# SEVENTH REGIONAL CONFERENCE ON MANAGEMENT OF NATIONAL METEOROLOGICAL AND HYDROLOGICAL SERVICES (RECO-7) IN REGIONAL ASSOCIATION II (ASIA)

**ABU DHABI, UNITED ARAB EMIRATES**

**10–11 FEBRUARY 2017**

## FINAL REPORT

**WORLD METEOROLOGICAL ORGANIZATION**


*Participants in the seventh Regional Conference on Management of National Meteorological and Hydrological Services in RA II (Abu Dhabi, UAE, 10–11 February 2017)*

## 1. OPENING

1.1 At the kind invitation of the Government of the United Arab Emirates, the seventh Regional Conference on Management of National Meteorological and Hydrological Services (NMHSs) in Regional Association II (Asia) was held in Abu Dhabi, United Arab Emirates, from 10 to 11 February 2017 in conjunction with the sixteenth session of Regional Association II (RA II-16) from 12 to 16 February 2017.

1.2 The opening statement was delivered by Mr Ali Al Gifri, Director of Administrative Support, on behalf of Mr Abdullah A. Al Mandoos, Executive Director, National Center of Meteorology and Seismology and Permanent Representative of the United Arab Emirates with WMO. In his statement, Mr Al Gifri extended a very warm welcome to all participants and wished them an enjoyable stay and fruitful deliberations. Noting that one of the objectives of this Conference is to address basic challenges of many meteorological services in the Region, he hoped that discussions shall echo the concerns of these services and shall seek solution to them. Mr Al Gifri further noted that a number of Members in RA II are still facing major and serious challenges that impede the pace of development and progress to its hydro-meteorological services. He was also pleased to note that, in the meantime, many NMHSs in the region are well developed and ranked as world-class services with access to innovation and technology.

1.3 Mr Abdulla Mohamed Al-Mannai, President of Regional Association II and Permanent Representative of Qatar with WMO welcomed the participants to the Conference and expressed his appreciation to the Government of the United Arab Emirates, the local staff and the WMO Secretariat for their efforts for the organization of the Conference. He recalled the earthquake in Nepal in 2015, devastating floods in China, India and Thailand and emphasized the improvement in early warning systems could potentially generate billions of dollars in benefits in terms of reduction of losses, particularly for weather sensitive sectors such as agriculture.

1.4 A welcoming address was delivered by Dr Wenjian Zhang, Assistant Secretary-General of the World Meteorological Organization.

## 2. OBJECTIVES OF THE CONFERENCE

2.1 The purpose of the Conference was to help NMHSs identify and address the emerging issues and challenges, strengthen regional cooperation and enhance partnerships for implementation of WMO and Regional priorities and to enhance the management skills of Directors and senior managers of NMHSs and improve and develop National Strategic Plans.

2.2 In order to achieve the above objectives, the programme was organized in the following areas: Session 1: Reports of WGs and Pilot Projects; Session 2: Global and Regional Partnerships for Implementation of WMO and Regional priorities; and Session 3: Entrepreneurial Skills in the Management of NMHSs. In Session 3, Members discussed the following topics:

- Sharing national experience in the management of NMHSs;
- Public-Private Partnership;
- Improving and developing National Strategic Plans; and
- Enhancing the management skills of senior managers of NMHSs in the context of societal needs.

2.3 The RECO-7 programme is attached as Annex I to this report and the presentations delivered by Members and the WMO Secretariat are published on the WMO website at http://meetings.wmo.int/RA-II-16/SitePages/RECO-7.aspx.

## 3. REPORTS OF WORKING GROUPS AND PILOT PROJECTS

3.1 A keynote presentation was given by the WMO Secretariat on the outcomes of the survey on the basic capability of NMHSs in RA II.

3.2 The chairpersons of RA II Working Groups reported on their major activities including the status of relevant pilot projects. The executive summary of the achievements of the Working Group and reports of the RA II pilot projects are attached in Annexes II and III, respectively. The full final reports of the Working Groups are given in Annex IV.

3.3 The Republic of Korea introduced a newly proposed pilot project on the impact-based forecasting.

3.4 The benefit of WIGOS project on Radar composite in Southeast Asia was reported by Japan as an example of successful implementation of the RA II WIGOS projects.

## 4. GLOBAL AND REGIONAL PARTNERSHIPS FOR IMPLEMENTATION OF WMO AND REGIONAL PRIORITIES

4.1 Presentations were given by Nepal, Viet Nam, Sri Lanka, Myanmar, Saudi Arabia, United Arab Emirates and India for outlining the global and regional challenges and opportunities as well as the sub-regional partnerships for the regional cooperation.

4.2 In the panel discussion on the challenges and successes on the strategic implementation of WMO and regional priorities, Members underscored the importance of cooperation in recognition of the followings:

- Key regional entities, such as ASEAN, GCC and LAS, and CIS which have committees for coordination of meteorological and hydrological activities and in some cases related Ministerial Forums. These coordination mechanisms are useful for NMHS to gain political support to enhance their services;
- The Government of India currently serves as chairman of RIMES Council and Maldives as RIMES Secretariat. RIMES facilitates the core regional observations & monitoring issues of early warnings to the end-users. It acts as an interface institution between NMHSs and climate sensitive user sectors and helps in enhancing the dialogues by organizing active monsoon forums.
- Active regional cooperation is also needed including data sharing across national borders;
- The weather, climate and water global enterprise is changing rapidly. WMO and NMHS will need to adapt at all levels, global, regional and national to their changing roles and changing and expanding demands for services;
- It is important to develop long term strategic business plans and also plans for capacity development including training of experts in NMHSs;
- In this rapidly changing operating environment the staff profile of NMHS will need to change and quite quickly as automatic systems are put in place. The current situations with a large but low-skilled staff will need to transition to lower numbers of highly skilled staff. This presents challenges in educations, recruitment and retention of staff, especially due to low salary scales in the public sector in most countries;
- It is important for NMHS to produce and deliver their information in a timely manner and to make it more accurate and more understandable to end users, in order to meet requirements of users, which will build trust between NMHSs and general public and stakeholders;
- To make information provided by NMHS more useful, understanding of meteorological and hydrological information by general public is necessary. NMHSs should make efforts to enhance their understanding with more communication between NMHS and general public such as open days and communications campaigns on weather and climate matters;
- Communication between meteorological experts and other experts related with meteorology is also important and both of them should discuss and work

together to solve a lot of challenges in regional aspects;

- Modernization of observation system and of utilization of observation data are urgently necessary for developing countries in terms of not only conventional observation station but also satellite. It is very important for NMHS to convince its government to provide investment for maintenance of instruments regularly after those implementation, in order to make services of NMHS sustainably;
- Sustainability is a critical factors. Upfront investment in infrastructure is becoming available but long term maintenance of operations is costly. Governments need to be persuade to increase funding to NMHS. The most effective way to do this is to argue the economic case for this investment, especially the reduction in economic losses that would accrue from effective early warning systems.

## 5. ENTREPRENEURIAL SKILLS IN THE MANAGEMENT OF NMHSs

5.1 The WMO Secretary-General gave a keynote presentation with a focus on the new governance of WMO and management of NMHSs.

5.2 Presentations were given by Japan, Mongolia, United Arab Emirates, Russian Federation, Maldives and Lao PDR on the sharing of national experience in the management of NMHSs and the development of and improvement in National Strategic Plans.

5.3 Presentations were also given by China and the Republic of Korea on Private-Public Partnership followed by discussions on the opportunities and challenges for private sector engagement in RA II followed by the panel discussion.

5.4 The Conference agreed to submit the recommendations on the Private Sector Engagement in RA II for consideration by the Secretary-General in the development of Policy Framework for Public-Private Sector Engagement as Annex to the draft Decision 6.1/1 (RA II-16). The summary and recommendations are given in Annex V.

5.5 Following the panel discussion on the enhancement of the management and communication skills of senior managers of NMHSs in the context of societal needs, the Conference agreed to submit the recommendations on management skills of Directors and senior officials as the Annex to the draft Decision 4.8(2)/1 (RA II-16). The summary and recommendations are given in Annex VI.

## 6. CLOSURE OF THE CONFERENCE

6.1 Mr Abdulla Mohamed Al-Mannai, President of Regional Association II, expressed his thanks and appreciation to the Government of the United Arab Emirates and Mr Abdullah A. Al Mandoos, Permanent Representative of the United Arab Emirates of WMO, for the warm hospitality. He also extended his gratitude to the WMO Secretariat and local staff for their excellent arrangements made for the Conference.

6.2 The Conference closed at 5.00 p.m. on 11 February 2017. The list of participants is attached as Annex VII to this report.

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**ANNEX I**

**Seventh Regional Conference on Management of National Meteorological and Hydrological Services (RECO-7) in Regional Association II**

**10–11 February 2017, Abu Dhabi, United Arab Emirates**

**PROGRAMME**

**DAY 1: 10 February 2017 (Friday)**

08:30-09:00 **Opening Ceremony**
- Opening statement – Representative of the Government of UAE
- Welcoming remarks – President of RA II
- Welcoming remarks – Representative of WMO Secretary-General

09:00-09:20 Group Photo & Refreshment

09:20-09:30 **Outcomes of the survey on the basic capability of NMHSs in RA II** - *L.S. LEE (R. YAMADA)*

09:30-11:30 **Session 1: Reports of WGs and Pilot Projects**
*(Chair: RA II President, Rapporteur: S. KIM)*
- Working Group on Weather Services - *B.L. CHOY*
- New pilot project: User Oriented Impact-based Forecasts - *S.B. KIM*
- Working Group on Climate Services - *A. SHIMPO*
- Working Group on Hydrological Services - *S. KIM*
- Working Group on WIGOS and WIS - *Y. CHEN*
- Benefit of WIGOS Project: Radar Composite in Southeast Asia - *Y. TANAKA*
- Discussion

11:30-14:00 Lunch
- *Side meeting: International Data Rescue portal (I-DARE) (11:30-12:30)*

**Session 2: Global and Regional Partnerships for Implementation of WMO and Regional priorities**

14:00-16:00 **2.1 Global and Regional Partnerships**
*(Chair: RA II Vice-President, Rapporteur: B.L. CHOY)*

- Global and regional challenges and opportunities
  - Outcomes of Donor Roundtable 2016- Principles for Donor Engagement - *M. POWER*
  - Modernization of National Meteo. and Hydro. Services in Nepal - *R.R. SHARMA (Nepal)*
  - Developing trend of National Hydro-Meteo. Service of S.R VIET NAM - *T.H. LE (Viet Nam)*
  - Meteorology in Sri Lanka – Challenges and Opportunities - *L. CHANDRAPALA (Sri Lanka)*
- Sub-regional partners for the regional cooperation
  - ASEAN - National Experiences in the Management of NMHSs - *K.M. OO (Myanmar)*
  - GCC - National implementation plan for GFCS - *A. GHULAM (Saudi Arabia)*
  - LAS - Regional cooperation through League of Arab States Mechanism - *J. RABADI (UAE)*
  - RIMES - Activities of India Meteorological Department (IMD) - *R.K. GIRI (India)*

16:00-16:20 *Refreshment*

16:20-17:30 **2.2 Panel Discussion: Challenges and Successes on the Strategic Implementation of WMO and Regional priorities**
*(Facilitator: RA II Vice-President, Rapporteur: A. SHIMPO)*
*Panelists: M. POWER/ A. GHULAM / R.K. GIRI / K.M. OO / L. CHANDRAPALA / J. RABADI*

**DAY 2: 11 February 2017 (Saturday)**

**Session 3: Entrepreneurial Skills in the Management of NMHSs**

09:00-09:30 **Keynote presentation:**
- Management issues and concern for NMHSs – *WMO Secretary-General*

09:30-10:30 **3.1 Sharing national experience in the management of NMHSs**
*(Chair: PR of Saudi Arabia, Rapporteur: Y. CHEN)*
- Modernization of Met Services in Japan over 60 years - *Y. SEKITA (Japan)*
- Management of Mongolian Meteorological Service - *E-O ERDENEBAT (Mongolia)*
- The UAE Research Program for Rain Enhancement Science - *A AlMAZROUI (UAE)*
- Roshydromet contribution to implement global and regional activities - *A. NURULLAEV (Russian Federation)*
- Management of Maldives Meteorological Service - *A.M. RAMIZ (Maldives)*
- Experience in the management of the Department of Meteorology and Hydrology in Lao PDR - *K. KHOUNPHONH (Lao PDR)*

10:30-10:50 Refreshment

10:50-12:30 **3.2 Public-Private Partnership**
*(Chair: PR of Saudi Arabia, Rapporteur: B.L. CHOY)*
- WMO Dialogue on the public-private engagement - *M. POWER*
- Private sector engagement in Asia
  - Public-private partnership in China- *X. XU (China)*
  - Public-private partnership in Korea- *H. YOO (Republic of Korea)*
- Recommendations on the Opportunities and Challenges for private sector engagement in RA II

*(Facilitator: PR of Saudi Arabia, Rapporteur: B.L. CHOY)*
*Panelists: M. POWER/ X. XU/ H. YOO/ E-O ERDENEBAT / L. CHANDRAPALA / K. KHOUNPHONH*

12:30-14:30 Lunch
- *Side meeting: Aviation services (12:30-13:30)*

14:30-15:30 **3.3 Improving and developing National Strategic Plans**
*(Chair: RA II President, Rapporteur: Y. TANAKA)*
- WMO Integrated Strategic Planning - *W. NYAKWADA*
- Discussion

15:30-16:00 Refreshment

16:00-17:30 **3.4 Panel Discussion: Enhancing the management and communication skills of senior managers of NMHSs in the context of societal needs**
*(Facilitator: RA II President, Rapporteur: R.K. GIRI)*
*Panelists: Y. ADEBAYO/ Y. SEKITA / K KHOUNPHONH / X. XU/ Wattana Kanbua*
- Media Communication - *C. NULLIS*

17:30-18:00 **Summary**

18:00 **Closure**

**ANNEX II**

## EXECUTIVE SUMMARY OF THE ACHIEVEMENTS OF THE RA II WORKING GROUPS DURING THE INTERSESSIONAL PERIOD 2013–2016

### 1. Working Group on Weather Services (WGWS)

### 1.1 Expert Group on Aeronautical Meteorological Services Delivery (EG-AeM)

Arrangements were being made to share information and best practices for the transition into ISO 9001:2015 which was published in Sep 2015. WMO Secretariat conducted fact finding visiting to those Members to identify the support, including possibility of twinning and/or mentoring, required.

ICAO APAC Regional Office conducted a survey in October 2015 on the implementation status of MET services for ATM. Related seminars were conducted and a capacity building RA II workshop for SIGMET was held in June 2016.

### 1.2 Expert Group on Operational Forecasting (EG-OF)

Regional Subproject Management Team of SWFDP in Southeast Asia decided to start its demonstration phase from January 2016. A new SWFDP – Central Asia is being developed. These activities are supported by Global Centres.

A questionnaire survey for non-registered members has conducted to find out their potential interest in ERA in 2014. A concise guidance for EER was provided to RA II Members in 2014.

A user request survey on the Emergency Response Activities (ERA) was conducted, and the results were reported to the coordinators of EG-OF by the Theme Leader in Emergency Response Activities.

The Regional Specialized Meteorological Centres in the region (RSMCs Beijing, Obninsk, and Tokyo) continued their efforts to maintain contact information for the registered members for the Environmental Emergency Response.

### 1.3 Expert Group on Public Weather Services Delivery (EG-PWS)

The work plan of EG-PWS for 2013-16 was formulated in 2013.

Two training workshops on public weather services were organized under the WMO/CBS Severe Weather Forecast Demonstration Projects (SWFDP). The first one was held in Macao, China from 15 to 19 April 2013 with participants from Cambodia, Lao, Thailand, Viet Nam, India, Maldives, Myanmar, Sri Lanka, Pakistan, Nepal, Bhutan, and others. The second one was held in Manila, Philippines from 9 to 13 June 2014 with participants from Cambodia, Laos, Thailand, Vietnam, and others.

In addition, a Voluntary Cooperation Programme (VCP) training workshop on “Effective Media Communication” was organized in Hong Kong, China in December 2013 for Bhutan, Cambodia, China, Islamic Republic of Iran, Republic of Kazakhstan, Republic of Korea, Thailand and The United Arab Emirates. The workshop covered media communication in different phases of significant weather events, through various channels including the traditional media like TV and radio as well as new media like the social media. There were practical sessions of weather presentation on TV and radio, which offered each participant hands-on experience together with expert feedback.

A meeting of the EG-PWS was held in Doha on 3 December 2014 and teleconferences were held among the Co-coordinators and Theme Leaders of the EG-PWS on 25 March 2015 and 25 June 2015 to discuss the organization of a training workshop for RA II

Members in 2015 on the enhancement of public weather service delivery.

With the joint effort of the China Meteorological Administration (CMA) Training Centre, the CMA Public Meteorological Service Centre and the EG-PWS, an International Training Workshop on Public Weather Service was held in Beijing, China from 16 to 20 November 2015. Experts from CMA, Hong Kong Observatory and Korea Meteorological Administration were invited to deliver lectures, which covered such topics as delivery of weather forecast and warning messages, disaster prevention and mitigation strategy, and experience in promoting stakeholder engagement. Nearly 40 participants from 11 countries, including China, Kazakhstan, Maldives and Thailand attended the workshop.

A meeting of the EG-PWS was held in Hong Kong, China on 10 and 11 December 2015. The meeting reviewed the 2013-2016 work plan of the EG-PWS and identified new tasks to be performed in 2016 including public education and outreach; socio-economic studies and evaluations; communication between RA II members and stakeholders; and quality management of service delivery.

Planning ahead, the meeting proposed organizing a workshop on socio-economic benefit study for Members in RA II or subregions in 2016-2019, with the assistance of WMO PWS Programme. Proposals of streamlining the Terms of Reference of EG-PWS and improvement of the structure of EG-PWS were also made for consideration in the next RA II session.

## 2. Working Group on Climate Services (WGCS)

### 2.1 Expert Group on Climate Services (EG-CS)

Currently, three WMO Regional Climate Centers (RCCs) have been operating in RA II such as BCC (China), TCC (Japan) and NEACC (Russian Federation). These RCCs have conducted a variety of RCC-related activities, including the dissemination of climate data/products and the organization of training workshops for capacity development in accordance with RCC mandatory functions.

It is noted that India began a demonstration phase as a candidate RCC in May 2013.Regional Climate Outlook Forums (RCOFs), such as FOCRAII, SASCOF, NEACOF, EASCOF and ASEANCOF, are convened regularly. These RCOFs provide some consensus outlook for next season and some of these RCOFs also provide opportunities to exchange of good practices and the sharing of experiences in the application of climate information among NMHSs and to strengthen user-provider interaction.

It is also noted that a pilot project on Information Sharing on Climate Services (Res.5 (RA II-15)) has been conducted by TCC and it has been operating the dedicated website since March 2014.

### 2.2 Expert Group on Agrometeorology (EG-AgM)

The meeting of RA II Expert Group on Agro-meteorology “Strengthening of agro-meteorological activity in RA II countries” was held in India (Pune) on 9–10 November 2015. The directions of the discussion on the meeting were (1) Weather and Climate Services for Agro-meteorology, (2) Agrometeorological products for Agro-meteorological Services, and (3) Capacity Building & Impact Assessment. International and national delegates participated and gave presentation on the topics.

Activities of EG-AgM are strongly linked with those of CAgM and co-coordinators of EG-AgM make their efforts to catch up with discussions and recommendations by CAgM Implementation Coordination Team (ICT).

In RA II, a variety of issues are reported by the co-coordinators of EG-AgM, such as the progress in Agricultural Meteorology Programme, Nations Drought Management Policies

for Asia-Pacific, Capacity development, Farmer Awareness Programme, dissemination of Agromet Advisories to the farmers, seasonal climate forecast and its application in agriculture for farmers at the national as well as district levels.

## 3. Working Group on Hydrological Services (WGHS)

The first session was held in Seoul, Republic of Korea, from 30 September to 2 October 2014, and Individual work programme was developed consisted of actions, activities, outputs, resources, milestones and linkages.

The second session was held in Gyeongju, Republic of Korea, from 14 to 16 April 2015. Progress of the work programme was reported, and the work programme was adjusted.

WGHS members with Dr Pilon (WMO) and Dr Liu (CHy) participated as speakers or panellists in the 7th World Water Forum session titled “Hydrological Services in Asia under Rapidly Changing Conditions”, Gyeongju, Republic of Korea, 15 April 2015 and organized by KICT, MLIT and WMO. Hydrological activities and issues were presented and discussed.

Water resources assessment tool was developed with support of MLIT of Republic of Korea in 2015. The developed tool is a public-domain SW with GUI and GIS interface, and can be used to analyse dynamics of water balance in consideration of climate and land use changes. Pilot test is scheduled in 2016 and the first version can be distributed to Members in 2017.

The third session of WGHS was held in Seoul, Republic of Korea from 25 to 27 October 2016. Participants reported on final progress achieved in this four-year intersessional period, and discussed a shaping of its future work plan for the period 2017–2020 and the decisions stemming from current and possibly future work for consideration of the RA II-16.

## 4. Working Group on WMO Integrated Global Observing System and WMO Information System (WG-WIGOS/WIS)

### 4.1 Expert Group on WIGOS

Regarding implementation of WIGOS, all seven projects have made progress. Most projects have successfully provided useful support to RA II members in implementation of WIGOS, especially Project No. IV - RA II WIGOS Project to Enhance the Availability and Quality Management Support for NMHSs in Surface, Climate and Upper-air Observations and Project No.VI - RA II WIGOS Project to Develop Support for NMHSs in Satellite Data, Products and Training.

The First session of the WMO RA II Expert Group on the WMO Integrated Global Observing System (EG-WIGOS-1) was held from 31 October to 1 November 2016 in Abu Dhabi, United Arab Emirates. EG-WIGOS-1 recommended that the Projects six of seven WIGOS projects should continue during the next intersessional period. A proposal for Regional WIGOS Centers in RA II in pilot mode is submitted to RA II MG meeting for consideration.

The updating structure and new TOR of EG-WIGOS for the next intersessional period is proposed. The term “Theme Leader” is recommended to be changed to “Project Leader”. The name of the Project Leaders is recommended to be identical to those listed in the R-WIP-II Projects.

Proposal for establishing a Task Team on developing the RBON in RA II by the RA-II-16 is developed, and the TOR with a roadmap for the implementation of RBON in RA II is also drafted and proposed to be submitted to RA II MG for consideration.

An updated R-WIP-II taking into account the Plan for the WIGOS pre-operational phase 2016-2019 is drafted and will be submitted to RA II MG for consideration.

A proposed RBSN/RBCN lists which has considered RBON concept, specifically the key attributes and criteria for the selection of stations/platforms into RBON is prepared and is proposed to be submitted to the 16th session of RA II for approval.

The Joint RA-II/RA-V Workshop on WIGOS for Disaster Risk Reduction was held in Jakarta, Indonesia, 12-14, October 2015, and decided to propose two joint projects, which were “Joint RA-II/RA-V WIGOS Satellite Data Project” and “Joint RA-II/RA-V WIGOS Radar Data Project”.

### 4.2 Expert Group on WIS (EG-WIS)

Regarding implementation of WIS, four GISCs became in operation since RA II-15. Now 6 out of 7 GISCs (including Moscow) in RA II are in operational status. Remaining GISC New Delhi is now pre-operational stage. As for the National Centre (NC), 35 out of 37 NCs in RA-II decided their principal GISC in RA-II-15 in 2012. After that remaining two NCs (Turkmenistan and DPRK) decided their principal GISC.

Creation and registration of WIS metadata for GTS bulletins in RA-II is showing a good progress in general. 31 RA-II Members (89%) out of 35 have registered at least one WIS metadata record to the catalogue. The community is waiting for GISC New Delhi to become operational and starting catalogue management for its area of responsibility. As of November 2016, Uzbekistan (its principal GISC is Seoul) has not registered its records to the catalogue yet.

The thirteenth session of RA II (Resolution 5 (2004)) added the GTS link between Thimphu and New Delhi to Regional Meteorological Telecommunication Network (RMTN). After 10-years, the NMC Thimphu (Bhutan) connected to the GTS, started receiving meteorological data through RTH New Delhi in July 2015 and issuing their surface observation data in BUFR format since March 2016. On the other hand, ten circuits in the Regional configuration plan are not in operation. Especially NMCs Baghdad (2 circuits) and Kabul (3 circuits) are still isolated from the GTS. Meanwhile, the NI circuit between Karachi and Tashkent has not been implemented yet, because there are difficulties to deploy telecommunication infrastructure for the area, and both RTHs requested to remove the link from RA II regional circuit plan.

According to the statistics collected every three months from January 2013 to July 2016, (1) notable progress has been seen with the migration of SYNOP data since October 2014, (2) number of BUFR TEMP report increased by about 50 in the first half of 2014, which is attributed to India’s BUFR TEMP reports, (3) As of November 2016, Four Members were reporting CLIMAT data in BUFR format, which is a major setback compared to the situation in 2014-2015..

In accordance with the decision of Cg-17, Volume II of WMO No. 386 (Manual on GTS) will be discontinued and replaced by web-based documentation. EG-WIS agreed to organize a Task Team (TT) to proceed and create the web-based document. Theme Leader in Data Communication Technics and Structure will lead the TT with Volunteer Experts of the Theme, and some experts would be invited. The EG-WIS will establish the TT with ToR and plans to submit the draft of web-based document to RA II Management Group.

**ANNEX III**

**Report on the RA II Pilot Projects**

**RA II Pilot Project (1)**

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|---|---|
| Project Name: | Pilot Project to Develop Support for National Meteorological and Hydrological Services in Numerical Weather Prediction |
| Acronym: | RAII-PP-NWP |
| Project Type: | Pilot |
| Project Status: | The Pilot Project has completed Phase 2, and will move to Phase 3 of implementation. |
| Project Overview: | This Project is established in accordance to Resolution 6 of RA II-14 and taken forward to Phase 2 under Resolution 14 of RA II-15 to develop support for NMHSs in numerical weather prediction (NWP). It is proposed to move into Phase 3 to setup resource and support on the techniques for post-processing EPS products. The web-based portal "Asian Consortium for NWP Forecasts (ACNF)" has become operational, and will be continuously enhanced. |
| Project Aims: | Short-term:<br>(1) To promote sharing of experience and expertise in post-processing of NWP products, modelling and data assimilation;<br>(2) To assist recipient Members in accessing and using NWP products<br>Long-term:<br>(1) To assist NMHSs in Region II in development and operation of NWP model and data assimilation systems;<br>(2) To promote exchange of knowledge and best practices between Members in different areas of NWP including data assimilation, modelling, post-processing and computational aspects |
| Partners/Participants: | Korea Meteorological Administration (KMA) (Co-coordinator)<br>Hong Kong Observatory (HKO) (Co-coordinator) |
| Project Cost: | Not applicable. |
| Funding Source(s): | This project will make optimum use of the expertise of members from the Coordinating Group. Financial support will be provided through voluntary contributions. |
| Project Timescale: | The project is expected to continue during the period 2016-19. |

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| Deliverables: | (1) Survey result on users' feedback on the usefulness of the ACNF website in NWP development and applications, possible enhancement of the website, and the future training needs<br>(2) Training workshops for RA II members (under the framework of WMO Voluntary Cooperation Programme) on more advanced NWP techniques in support of disaster risk reduction (DRR) *e.g.* targeted observation and data assimilation for tropical cyclones, post-processing of ensemble prediction systems output for probabilistic and extreme weather event forecast.<br>(3) Enhancement of ACNF to include resources and support on post-processing of NWP and ensemble prediction system |
| Project Links: | http://acnf.weather.gov.hk |
| Project Summary: | Completion of the project is expected to foster closer collaboration and technical exchange between NHMSs in Region II on NWP, contribute to enhancing weather services delivery, disaster risk reduction and capacity development efforts. |
| Date of Last Update: | 6 December 2016 |
| Contact Person 1:<br>Name:<br>Organization:<br>Address:<br>Telephone:<br>Fax:<br>E-mail:<br><br>Contact Person 2:<br>Name:<br>Organization:<br>Address:<br>Telephone:<br>Fax:<br>E-mail: | <br>Mr. Chan, Pak-wai<br>Hong Kong Observatory<br>134A Nathan Road, Tsim Sha Tsui, Kowloon, Hong Kong, China<br>+852 2926 8435<br>+852 2375 2645<br>pwchan@hko.gov.hk<br><br><br>Mr. SHIN Hyun Cheol<br>Korea Meteorological Administration<br>61 Yeoeuidaebang-ro 16-gil, Dongjak-gu Seoul 156-720, Korea<br>+82-2-2181-0544<br>+82-2-2181-0908<br>sinhyo@korea.kr |

**RA II Pilot Project (2)**

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|---|---|
| Project Name: | Pilot Project on Information Sharing on Climate Services |
| Acronym: | RAII-PP-ISCS |
| Project Type: | Pilot |
| Project Status: | Implemented (the dedicated website for this PP was launched in March 2014 and is kept updated.) |
| Project Overview: | This Project is established in accordance with Resolution 15 (RA II-15) for collecting and sharing information on climate services provided by NMHSs as well as activities related to the Global Framework for Climate Services (GFCS). |
| Project Aims: | Short-term:<br>(1) To share climate services by NMHSs and information on good practices in the application of climate information in various fields, such as agriculture, health and water management.<br><br>Long-term:<br>(1) To contribute to the successful implementation of GFCS by sharing information mentioned above;<br>(2) To support the consideration of future work to facilitate the utilization of climate information. |
| Partners/Participants: | Tokyo Climate Center (TCC) of the Japan Meteorological Agency (JMA) (Lead) |
| Project Cost: | Not applicable |
| Funding Source(s): | This project is based on the kind cooperation of RA II Members by providing information via questionnaires and keeping updated. The dedicated website is maintained by TCC. |
| Project Timescale: | The dedicated website for this PP has already been launched in March 2014 and will be kept updated. |
| Deliverables: | (1) Quick reference and access to climate services by NMHSs and information on good practices in the applications of climate information in various fields, such as agriculture, health and water management.<br>http://ds.data.jma.go.jp/tcc/pilot/ |
| Project Links: | http://ds.data.jma.go.jp/tcc/pilot/ |

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| Project Summary: | TCC plays a leading role in the implementation of the Project, and started collecting information from NMHSs via an email-based questionnaire in 2013. Based on the data received, TCC has developed a new dedicated website to support the sharing of information on climate services provided by NMHSs and on their Framework-related activities. The website was officially launched on 31 March 2014, and TCC keeps it updated by collecting pertinent information from NMHSs to be shared with Members. Furthermore, TCC has done the second questionnaire survey in summer 2015 in order to renew information and to add more information about the utilization of climate information, aiming to contribute to the activities of GFCS. The updated information is available on the website since December 2015. |
| Date of Last Update: | 18 December 2015 |
| Contact Person :<br>Name:<br>Organization:<br><br><br>Address:<br>Telephone:<br>Fax:<br>E-mail: | <br>Mr. Kiyotoshi Takahashi<br>Head, Tokyo Climate Center<br>Climate Prediction Division<br>Global Environment and Marine Department<br>Japan Meteorological Agency (JMA)<br>1-3-4 Otemachi, Chiyoda-ku, Tokyo 100-8122, Japan<br>+81 3 3211 8406<br>+81 3 3211 2032<br>tcc@met.kishou.go.jp |

**RA II Pilot Project (3)**

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| Project Name: | Pilot Project to Develop Support for National Meteorological and Hydrological Services in the Collection and Application of Aircraft Meteorological Data Relay Data |
| Acronym: | RAII-PP-AMDAR |
| Project Type: | Pilot |
| Project Status: | The Project has completed Phase 1 of implementation. |
| Project Overview: | This Project is established in accordance to Resolution 16 (RA II-15) to develop support for NMHSs in the collection and application of AMDAR data. |
| Project Aims: | Short-term:<br>(1) To share experience among NMHSs in setting up and operating AMDAR programme;<br>(2) To conduct best practice workshop(s) on the setting up of AMDAR programme;<br>(3) To share experience among NMHSs on the application of AMDAR data, including in aerodrome forecast and in forecast for the Terminal Area;<br>(4) To assist NMHSs in Region II, especially developing country Members, in establishing their own AMDAR programme;<br>(5) To assist NMHSs in Region II in decoding, processing and visualization of AMDAR data;<br>Long-term:<br>(1) To promote sharing of AMDAR data from different AMDAR programmes;<br>(2) To promote the application of AMDAR data in Terminal Area Forecast and Service<br>(3) To assist NMHSs in Region II in the assimilation of AMDAR data in NWP models, development of new products/applications from AMDAR data to enhance the provision of weather forecasting and warning services;<br>(4) To identify and explore means to optimize the collection of AMDAR data; |
| Partners/Participants: | China Meteorological Administration (CMA) (Co-coordinator)<br>Civil Aviation Administration of China(CAAC) (Co-coordinator)<br>Hong Kong Observatory (HKO) (Co-coordinator) |
| Project Cost: | Around EUR 20,000. |
| Funding Source(s): | This project will make optimum use of the expertise available from the CBS Expert Team on Aircraft-based Observing Systems (ET-ABO). Financial support will be provided through voluntary contributions by CMA, CAAC and HKO. |
| Project Timescale: | Will be completed by December 2016 |

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| Deliverables: | (4) Survey report on RA II Members' readiness to collect and apply AMDAR data<br>(5) RA II Workshop(s) on the establishment of a national AMDAR programme and application of AMDAR data to enhance weather forecasting and warning services<br>(6) Establishment of an on-line discussion forum to facilitate the sharing of experience in the collection and application of AMDAR data of RA II Members and an Internet webpage to showcase the benefit of AMDAR data in weather forecasting and warning service |
| Project Links: | To be announced. |
| Project Summary: | Best practice workshop(s) and on-line support will be provided to Members of RA II to assist them in setting up its own national AMDAR programmes and in the application of AMDAR data in weather forecasting and warning service. |
| Date of Last Update: | 7 December 2016 |
| Contact Person 1:<br>Name:<br>Organization:<br>Address:<br><br>Telephone:<br>Fax:<br>E-mail:<br><br>Contact Person2:<br>Name:<br>Organization:<br>Address:<br>Telephone:<br>Fax:<br>E-mail:<br><br>Contact Person3:<br>Name:<br>Organization:<br>Address:<br><br>Telephone:<br>Fax:<br>E-mail: | <br>Mr. Xu Jianliang<br>Civil Aviation Administration of China<br>Deyuanjiuhe Plaza , Hongyan Road , Chaoyang District, Beijing, China<br>8610-87922183<br>8610-87922084<br>xujl@atmb.net.cn<br><br><br>Mr. Zhang Qiang[1]<br>China Meteorological Administration, CMA<br>46 Zhongguancun Nandajie, Haidian District, Beijing, China<br>+86 10 68407032<br>+86 10 62173225<br>zhangq@cma.gov.cn<br><br><br>Mr. Choy Boon-leung<br>Hong Kong Observatory<br>134A Nathan Road, Tsim Sha Tsui, Kowloon, Hong Kong, China<br>+852 2926 8350<br>+852 2375 2645<br>blchoy@hko.gov.hk |

[1] There may be a change of co-coordinator from CMA. Details to be confirmed.

**RA II Pilot Project (4)**

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|---|---|
| Project Name: | Pilot Project to Sustain and Enhance the Capacity of National Meteorological and Hydrological Services (NMHSs) in the Provision of Official Weather Forecasts for Medium Range |
| Acronym: | RAII-PP-MWF |
| Project Type: | Pilot |
| Project Status: | Phase 1 of implementation is completed. |
| Project Overview: | This Project is established in accordance to Resolution 17 (RA II-15) to develop support for NMHSs in provision of official weather forecasts for medium range. |
| Project Aims: | Short-term:<br>(1) To identify the current capacity and limitations in NMHSs in providing medium range weather forecasts;<br>(2) To identify reliable sources of NWP products to support NMHSs in providing medium range weather forecasts;<br>(3) To explore and identify means on post-processing of NWP products to better support NMHSs in providing medium range weather forecasts;<br><br>Long-term:<br>(1) To assist NMHSs in applying NWP products and post-processing methods to generate medium range forecast, in compliance with the needs of NMHSs to be supported;<br>(2) To identify methods and assist NMHSs in verification and validation of NWP-based weather forecasts;<br>(3) To promote sharing of experience in NWP product application, post-processing techniques among RA II Members especially developing country Members;<br>(4) To synergize with other related RA II Project such as “Project on the Provision of City-Specific NWP Products to Developing Countries” in supporting this pilot project. |
| Partners/Participants: | Hong Kong Observatory (HKO) (Co-coordinator)<br>Korea Meteorological Administration (KMA) (Co-coordinator) |
| Project Cost: | Not applicable |
| Funding Source(s): | This project will make optimum use of the expertise on NWP model applications in Members of RA II. Funding support on the Project development will be through voluntary contributions. |
| Project Timescale: | Project implementation to continue in 2016-2019. |

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| Deliverables: | (1) Survey report on RA II Members' readiness to apply NWP products and post-processing methods in providing medium range weather forecasts;<br>(2) Where possible, training workshop on the application of NWP models and post-processing methods for medium range weather forecasts;<br>(3) On-line forum or knowledge-based portal to facilitate sharing of experience on NWP application and post-processing. |
| Project Links: | To be implemented. |
| Project Summary: | A survey was successfully conducted to collect the current status and requirements from the participating Members of RA II in using NWP model products for medium range weather forecasts. The survey results would be used to implement appropriate NWP forecast outputs and post-processed products.<br><br>A couple of training courses on NWP model and post-processing techniques were organized; provision of NWP products for Tajikistan was also implemented by KMA in 2016 such that a total of 302 cities of 21 Asian countries are being supported.<br><br>With the support from the Project, Members of RA II will enhance their knowledge and capacity in using NWP products and post-processing techniques for provision of medium range weather forecasts. The NWP-based forecast products will be disseminated to the public as official products on Internet such as through the World Weather Information Service (WWIS) website. |
| Date of Last Update: | 19 November 2016 |
| Contact Person 1:<br>Name:<br>Organization:<br>Address:<br><br>Telephone:<br>Fax:<br>E-mail:<br><br>Contact Person 2:<br>Name:<br>Organization:<br>Address:<br><br>Telephone:<br>Fax:<br>E-mail: | <br>Mr. WONG Wai Kin<br>Hong Kong Observatory<br>134A Nathan Road, Tsim Sha Tsui, Kowloon, Hong Kong, China<br>+852 2926 8416<br>+852 2375 2645<br>wkwong@hko.gov.hk<br><br><br>Mr. SHIN Hyun Cheol<br>Korea Meteorological Administration<br>61 Yeoeuidaebang-ro 16-gil, Dongjak-gu Seoul 156-720, Korea<br>+82-2-2181-0544<br>+82-2-2181-0908<br>sinhyo@korea.kr |

**RA II Pilot Project (5)**

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|---|---|
| Project Name: | Pilot Project to Enhance the Seamless Provision of Regional Severe Weather Warnings and Advisories |
| Acronym: | RAII-PP-WARNING |
| Project Type: | Pilot |
| Project Status: | The Pilot Project is currently under Phase 1 of implementation. |
| Project Overview: | This Project is established in accordance with Resolution 18 (RA II-15) to enhance the seamless provision of regional severe weather warnings and advisories. |
| Project Aims: | First phase:<br>(1) To share experiences in data formats for tropical cyclone warnings/advisories among RA II Members;<br>(2) To identify challenges to be solved for converting tropical cyclones warnings/advisories of RA II Members into a common data format;<br>(3) To seek potential benefits from using a common data format for tropical cyclone warnings/advisories;<br>Second phase after completing first phase:<br>(1) To access the feasibility of developing a common data format for severe weather warnings/advisories by RA II Members;<br>(2) To give the Coordinators of SWIC advice on its development of a consolidated and seamless provision of severe weather warnings/advisories through SWIC; |
| Partners/Participants: | Hong Kong Observatory (HKO) (Co-coordinator) |
| Project Cost: | Not applicable. |
| Funding Source(s): | This project will make optimum use of the expertise available from RA II members. Financial support will be provided through voluntary contributions by HKO. |
| Project Timescale: | Will be completed by December 2016 |
| Deliverables: | (1) Survey report on data format of tropical cyclone warnings/advisories currently in use by RA II Members<br>(2) Report on feasibility of converting RA II Members' tropical cyclone warnings/advisories into common data format |
| Project Links: | To be announced. |
| Project Summary: | With the completion of the Project, a common data format could be recommended for use by RA II Members for exchange and seamless provision of tropical cyclone warnings and advisories |
| Date of Last Update: | 4 November 2016 |
| Contact Person:<br>Name:<br>Organization:<br>Address:<br>Telephone:<br>Fax:<br>E-mail: | <br>Mr. Cheng Yuen-chung Armstrong<br>Hong Kong Observatory<br>134A Nathan Road, Tsim Sha Tsui, Kowloon, Hong Kong, China<br>+852 2926 8358<br>+852 2311 9448<br>yccheng@hko.gov.hk |

## FINAL REPORTS OF THE RA II WORKING GROUPS



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# Report of the RA II Working Group on Weather Services (WGWS)

**B.L. Choy, Hong Kong Observatory**

**Chairperson of the RA II Working Group on Weather Services**

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**B.L. Choy and Marina Petrova**
**Co-coordinators, Expert Group on Aeronautical Meteorological Services Delivery**

**Yuki Honda and Irina Zaytseva**
**Co-coordinators, Expert Group on Operational Forecasting**

**L.S. Lee, Muhammad Hanif and Evgeniy Vasilyev**
**Co-coordinators, Expert Group on Public Weather Services Delivery**

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## Report of the RA II Working Group on Weather Services (WGWS)

### 1. Introduction

This report summarizes major activities in association with the expert groups, viz Expert Group on Aeronautical Meteorological Services Delivery (EG-AeM), Expert Group on Operational Forecasting (EG-OF) and Expert Group on Public Weather Services Delivery (EG-PWS), during the period 2013-16.

### 2. Working Group Structure

The Working Group is composed of Expert Group on Aeronautical Meteorological Services Delivery (EG-AeM), Expert Group on Operational Forecasting (EG-OF) and Expert Group on Public Weather Services Delivery (EG-PWS). Each EG consists of two co-coordinators and several theme leaders.

### 3. Terms of Reference

The terms of reference of the Working Group on Weather Services (WGWS) are as follows:

(a) To coordinate and support the work of the expert teams in Aeronautical Meteorology in the Region in cooperation with the Commission for Aeronautical Meteorology;
(b) To coordinate all activities related to the GDPFS, including the Emergency Response Activities, and PWS in the Region in cooperation with the Commission for Basic System;

The terms of reference of EG-AeM are as follows:

(a) To coordinate and support the implementation and maintenance of an ISO 9000-based quality management system for the services to international air navigation, in particular to coordinate urgent assistance, for example, in the form of twinning/mentoring arrangements, to NMHSs not yet implementing a quality management system, given that following the deadline of 15 November 2012 the provisions of the International Civil Aviation Organization (ICAO) concerning the implementation of quality management for aeronautical meteorological services were upgraded from ICAO Recommended Practices to that of ICAO Standards;
(b) To coordinate and support the implementation of competency assessment for aeronautical meteorological personnel (forecasters and observers);
(c) To coordinate and support the development and implementation of meteorological services to air traffic management and SIGMET provision;

The terms of reference of EG-OF are as follows:

(a) To inform RA II Members of technical and scientific developments relating to the forecasting process, and to advise on the implementation of new techniques; and to coordinate organizational and planning aspects of the GDPFS including the requirements, procedures and practices for designating and maintaining GDPFS Centres in the Region;
(b) To monitor the performance of GDPFS in the Region and review compliance of GDPFS Centres against the designated criteria, which include, amongst others, standardized verification of numerical weather prediction (NWP) products, as part of the WMO Quality Management Framework;
(c) To coordinate existing and new requirements stated by RA II Members for GDPFS products, and for the production of analysed and forecast data by the RA II GDPFS Centres on all time scales, including on education and training materials;
(d) To promote the integrated use of Ensemble Prediction Systems, high-resolution NWP, radar and satellite-based products into core operational forecasting, and the exchange, use and interpretation of meteorological products;
(e) To coordinate within RA II the operational production of forecasts of sub-seasonal to longer-time scales, on the basis of the emerging requirements from Regional Climate

Centres, Regional Climate Outlook Forums and NMHSs, and in the context of the Climate Services Information System of the Global Framework for Climate Services;

(f) To monitor the provision of products and services by designated RA II GDPFS Centres within the framework of the Emergency Response Activities (ERA) Programme, and advise on evolving requirements for ERA operational systems and services;

(g) To coordinate, monitor and facilitate the implementation of the Severe Weather Forecasting Demonstration Project in RA II;

The terms of reference of EG-PWS are as follows:

(a) To coordinate all activities related to PWS in the Region in cooperation with the Commission for Basic Systems;

(b) To mainstream service delivery as contained in the WMO Strategy for Service Delivery and its Implementation Plan, as a main priority in the work of the PWS Programme and in guiding its future development in the Region;

(c) To facilitate the implementation of the Strategy to address specific aspects of PWS through activities such as conducting socio-economic studies and evaluations, improving media relations, and designing and implementing pilot and demonstration projects related to PWS delivery;

(d) To coordinate the contribution of PWS to such high-priority areas as the Global Framework for Climate Services with particular focus on the User Interface Platform; WIGOS and WIS; disaster reduction and mitigation; and capacity development;

(e) To assist NMHSs strengthen their capabilities to ensure efficient and effective preparation and delivery of warning services through the national PWS programmes and channels by embedding early warning systems within an operational end-to-end service delivery framework;

(f) To encourage stronger dialogue between NMHSs and development partners and users (for example, media, health, emergency management) in areas relevant to PWS;

(g) To encourage and provide guidance to Members to assert the authority of NMHSs as the sole providers of official high-impact weather warnings;

(h) To collaborate with development partners and other WMO entities to assist NMHSs in the identification and assessment of societal, economic and environmental impacts and benefits of hydrometeorological services;

(i) To promote and support the education and training of the public and other users of forecasts and warnings products and services on their use and interpretation, including uncertainty information;

(j) To inform Members of, and evaluate, technical and scientific developments relating to the formulation, content, presentation, and dissemination of weather information, as well as the inclusion of information on the impacts of weather phenomena and the corresponding advice, and coordinate the related recommendations for application by Members;

(k) To establish education and training requirements related to the PWS delivery, in accordance with the competency requirements established by the Commission for Basic Systems;

(l) To improve procedures for the exchange of severe weather warnings between neighbouring countries;

(m) To monitor progress on the implementation of the current WMO Strategic Plan on matters related to PWS in the Region;

**4. Membership (as at 2016)**

Expert Group on Aeronautical Meteorological Services Delivery (EG-AeM)

| **EG-AeM** | | |
|---|---|---|
| Co-Coordinators | Mr Boon-leung Choy | Hong Kong, China |
| | Ms Marina Petrova | Russian Federation |

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|---|---|---|
| Theme Leader in QMS Implementation and Maintenance | Ms Jie Shao | China |
| Theme Leader in Competency Assessment | Mr Manoj Kumar Bhatnagar | India |
| Theme Leader in Meteorological Support to Air Traffic Management and Provision of SIGMETs | Mr Jun Ryuzaki | Japan |

Expert Group on Operational Forecasting (EG-OF)

| **EG-OF** | | |
|---|---|---|
| Co-Coordinators | Mr Yuki Honda | Japan |
| | Ms Irina Zaytseva | Uzbekistan |
| Theme Leader in Operational Forecasting Process and Support | Ms Sunitha D. Santhamma | India |
| | Mr Vo Van Hoa | Viet Nam |
| Theme Leader in Operational Predictions from sub-seasonal to longer-time scale | Mr Suhee Park | Republic of Korea |
| Theme Leader in Emergency Response Activities | Mr Masami Sakamoto | Japan |

Expert Group on Public Weather Services Delivery (EG-PWS)

| **EG-PWS** | | |
|---|---|---|
| Co-Coordinators | Mr Lap-shun Lee | Hong Kong, China |
| | Dr Muhammad Hanif | Pakistan |
| | Dr Evgeniy Vasilyev | Russian Federation |
| Theme Leader in Socio-economic Benefits of Meteorological and Hydrological Services | Mr Jinjun Pan | China |
| Theme Leader in Delivery of Warning Services | Mr Chuanhai Qian | China |
| Theme Leader in Education and Public Outreach related to PWS | Mr Ikhyun Cho | Republic of Korea |

### 5. Expert Group on Aeronautical Meteorological Services Delivery (EG-AeM)

**2013-14**

A meeting of the expert group was held during 10-12 November 2014 in Hong Kong, China. Apart from the Co-coordinators and the Theme Leaders, three additional experts from other Members of RA II were invited to the meeting. Although two of the participants, including the Theme Leader in Competency Assessment (India) and an invited expert (Kazakhstan), were unable to attend the meeting in the end, the meeting still had a reasonable sub-regional representatives of RA II (China; Hong Kong, China; Japan; Kuwait; Russian Federation; Thailand).

Four major areas were discussed during the meeting, they were (i) Review of the outcome of the conjoint ICAO MET Divisional and WMO CAeM meeting in July 2014, (ii) Status of implementation of high priority items in RA II, (iii) Proposal for regional follow up actions and (iv) Coordination of regional aeronautical meteorological services delivery events. Generally speaking, the NMHSs in RA II had great discrepancies in capabilities; while some of them were working on exciting new developments, some of the others were still having deficiencies in the provision of METAR, TAF and SIGMET. This could be one of the reasons why the progress of implementing Quality Management and Competency Assessment Systems, each of these requiring considerable knowledge and skills for sustainable development, was below expectation for the region as a whole when compared with more advanced regions like RA VI. This may also impact the regional ability to face the upcoming challenges in the provision of aeronautical meteorological services for the future global air navigation system. One of the participants had showcased the positive outcome of twinning, arranged through bilateral agreement, in removing deficiencies of NMHS. The possibility of having more twining/mentoring activities in RA II would be further explored.

For more advanced NMHSs in RA II, activities to study and develop new technologies to support the future air navigation system had been started in close co-ordination with relevant Expert Teams of WMO Commissions and ICAO. They had also demonstrated their current abilities to provide new services including space weather and regional hazardous weather advisory services. At the same time, the participants were aware of the evolving requirements of users for the provision of sub-regional aviation meteorological services in a global sense, and the rise of the big data concept which made the value of data and value-added services diverge further. It was recognized that partnership among NMHSs through MOU or bilateral agreements may be able to extend the capabilities of individual NMHS to better serve the global needs of aviation users and worth further exploration.

The work plans of the Theme Leaders for 2013-16 were amended in accordance to the outcome of the meeting. The meeting also considered it essential to review the Terms of Reference of EG-AeM in response to the outcome of the conjoint WMO CAeM/ICAO MET Divisional meeting in July 2014..

**2014-15**

Subsequent to the expert group meeting in Hong Kong, follow up actions were taken and they were mostly completed. Highlights include the Secretariat had enhanced the CAeM website to make online guidelines and information on competency assessment more accessible, the Theme Leader on SIGMET had made good progress in preparing a SIGMET workshop in Q2 2016, CAeM ET-ETC had developed a flow-chart to guide Members on assessing the compliance with BIP-M and CBS TT-AvXML had invited CAeM ET-ETC to consider activities to support the introduction of IWXXM.

A number of sub-regional activities within the Commonwealth of Independent States (CIS) were also reported by Marina Petrova, the co-coordinator of the expert group. These include the holding of a conjoint CIS ICH WG-4/ICAO METG PT/EAST/15 meeting at Sochi from 31 March to 3 April 2015. Attended by 40 experts from 8 Members/States, including Azerbaijan, Belarus, Georgia, Kazakhstan, the Kyrgyz Republic, the Russian Federation, Tajikistan, Uzbekistan, and ICAO, Austro Control, RSHU, IRAM and other MET experts from CIS countries, vital issues on aeronautical meteorological services for aviation users in the airspace of CIS countries, interactions and coordination enhanced through regional cooperation, as well as prospects and trends of meteorological services to aviation were reviewed. The meeting, recognizing the importance of the delivery of safety-relevant services to civil aviation as a high-priority issue, appreciated the need to align aeronautical meteorological practices available in NMHSs with ICAO/WMO International Standards and to foster regional cooperation in the interests of ICAO/WMO States/Members. In terms of AMP competence assessment, more efforts were made to develop syllabi and methodology for distance learning of MET personnel in line with the WMO-No.1083 - Manual on the Implementation of Education and Training Standards in Meteorology and Hydrology, Vol. I. In addition, a survey on regional

peculiarities of GANG/ASBU implementation (CIS countries) is being done. The Russian Federation is making good progress in establishing the Regional Space Weather Centre (RSWXC) to be run by the Applied Geophysics Institute in the Russian Federation and Regional Hazardous Weather Advisory Centre (RHWAC) to support the issuance of SIGMET. A pilot project on transition towards XML data exchange will be initiated among the CIS countries. An international workshop – Oversight of Safety Management System in Aeronautical Meteorology Aspects – was held in St. Petersburg, the Russian Federation, from 29 September to 1 October, for the CIS countries, in which the representatives from ICAO, WMO and Austro Control had participated to share best practices among the Members of the sub-region.

**2015-16**

SIGMET workshop:

- A WMO/JMA SIGMET workshop, which was also in coordination with ICAO, was organized by the Japan Meteorological Agency (JMA) from 27 to 30 June 2016 in Tokyo, Japan.
- The four-day workshop provides training on the preparation and verification of Tropical Cyclone, Volcanic Ash and other SIGMET through the use of the latest satellite and other technologies
- 31 participants from 15 states/special administrative regions (Australia, Bangladesh, Cambodia, Hong Kong/China, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, Nepal, New Zealand, the Philippines, the Solomon Islands, Sri Lanka and Thailand) and two international organizations (the International Air Transport Association (IATA) and ICAO) attended the workshop
- The workshop also provided an outstanding opportunity for the development of collaborative relationships in the Asia/Pacific region and further enhancement of aviation weather services in the area

Pilot Project on SIGMET Coordination in Southeast Asia:

- A RA V pilot project involving five Meteorological Watch Offices (MWO) including Singapore, Malaysia and Indonesia to exercise a coordinated approach in the issuance of SIGMET for weather phenomena straddling FIR boundaries
- Both the Japan Meteorological Agency (JMA) and the Hong Kong Observatory (HKO) had participated in the project by providing tools to facilitate establishment of a consensus on the parameters of the phenomenon, including its extent, intensity, growth/decay rate, direction and rate of movement, prior to the issuance of SIGMETs across the boundaries

ATM Competency Assessment and Qualification Standard Implementation in the Russian Federation (RF):

- In order to perform WMO requirements the Additional Training Institution (ATI), which is a WMO Regional Training Center (WMO RTC) in RF, developed 2 distant-learning programs that include BIP-M components (physical meteorology, dynamics, climatology, synoptic and mesoscale meteorology):
  - o “Competency-oriented Additional Training for Aeronautical Forecasters” with an extra module containing essential BIP-M components for training those aeronautical forecasters who have higher education not concerning their profession, with 140 academic hours duration; and
  - o “Working Program on Additional Training for Aeronautical Forecasters including BIP-M components in accordance to WMO qualification standards”, with 250 academic hours duration.
- Specialists, who have higher education not concerning their profession, are sent to distant-learning courses based on modern technologies on a part-time basis and with minimal financial costs for education.
- As of August 2016, 63 aeronautical forecasters and 44 PT/EAST representatives (7 from Belarus, 10 from Kazakhstan, 14 from Kyrgyzstan and 13 from Georgia) have already passed or still continue to study at WMO RTC in RF.

- Collaboration work has started in universities of the Russian Federation in conjunction with PT/EAST countries national universities resources on the development of conjoint educational programs in the field of aviation meteorology.
- In 2015, scheduled AMP CA was conducted at 254 operational aviation meteorological subdivisions of RF. 2254 specialists, including 919 forecasters and 1335 meteorologists-technicians, were assessed as “competent”.
- Currently RF has started to implement WMO qualification requirements for aeronautical forecasters that become a standard beginning from 1 December 2016.
- As of August 2016, 959 aeronautical forecasters are working in RF, out of them:
  - 853 employees have higher professional education;
  - 85 employees have higher education, not concerning their profession;
  - 21 employees do not have higher education.
- Significant steps were made towards WMO qualification standard implementation in RF and PT/EAST States, which allows preparing timely all AMP stuff in compliance with WMO qualification requirements.
- WMO RTC in RF is ready to organize education for Aeronautical Forecasters from PT/EAST and other States with issuance of diplomas and certificates, as well as to provide methodological assistance on issues related to timely implementation of WMO qualification and competency standards for AMP

OPMET Data Exchange in the Russian Federation (RF):

- Aviation OPMET Databank of ROSHYDROMET provides PT/EAST States NOCs (Armenia, Georgia, Kazakhstan, Turkmenistan, Uzbekistan) with OPMET data, transferring via AFTN. Thus, establishing a gateway between two networks: ICAO (AFS) and WMO (GTS).
- Message and File Switching System (MSS/FSS) of ROSHYDROMET has a double connection both to RMDCN (Regional Meteorological Data Communication Network) and Internet; it collects and disseminates aeronautical OPMET data in the format of standard messages and files, including XML, minimizes the duplication of OPMET data, validates OPMET messages in a routine order as well as forms Aeronautical OPMET Databank with AFTN gateway.
- The existing procedure ensures operation of NOC Moscow as ROC Moscow de facto but doesn’t define de jure functions and obligations of the Russian Federation to ICAO and the neighbouring ICAO Member States.
- In view of SWIM implementation and transition to IWXXM, the following practical actions are taken in the Russian Federation to accommodate future requirements regarding OPMET data collection and dissemination:
  - NOC Moscow special software is developed and tested to convert TAC format into IWXXM format not only for the Russian Federation but for the number of PT/EAST countries which OPMET data bulletins are formed;
  - also special channels are conducted to collect and distribute OPMET data in the IWXXM format, for providing abovementioned countries;
  - assistance is rendered in transition to OPMET data exchange in the IWXXM format to the countries participating in data exchange through NOC Moscow;
  - representatives of the Russian Federation participate in the meetings of ICAO working groups – DMG, METG, EANPG, MIE METP.

QMS Implementation and Transition to ISO 9001:2015 Standard in the CIS Countries:

- Every month METAR/SPECI monitoring and TAF verification are made in the Aviation Forecasts Verification Centers, covering 213 aerodromes in the Russian Federation and 29 aerodromes of Azerbaijan, Armenia, Belarus, Tajikistan and Uzbekistan.
- The number of internal audits at aviation meteorological subdivisions is increasing, whereas the number of deficiencies identified is decreasing.
- Most of the nonconformities of the quality management system are associated with requirements to documentation management — 76%. Other nonconformities are related to responsibilities and authority (7%), infrastructure (5%) and competency and training (4%).
- Due to preparation for the transition to the new standard ISO 9001:2015 requirements the following actions are being undertaken:

- o training of internal auditors at specialized education centers in accordance with QMS programs compliant with the ISO 9001:2015 requirements;
- o alignment of documented procedures and Regulations on QMS with the ISO 9001:2015 requirements;
- o conduct of internal audits at subdivisions in order to control QMS AMS preparedness to ISO 9001:2015 and certification audits;
- o conduct of a QMS AMS certification audit in 2017 to confirm conformance of the QMS with ISO 9001:2015.

Pilot Project on SIGMET Coordination actions of MWOs between the Russian Federation and the Republic of Belarus:

- Aims at the determination of coordination mechanisms and actions between adjacent MWOs to achieve seamless SIGMETs production across the state and FIR borders regarding turbulence, icing and thunderstorm phenomena
- First phase of the Project (January – March, 2016) involved the Russian Federation (MWOs St. Petersburg, Murmansk, Arkhangelsk, Vologda, Moscow) and Republic of Belarus (MWO Minsk)
- A survey for all MWOs of RF and PT/EAST countries was carried out in August, 2016, concerning the participation in the project and the unified approach to SIGMET issue. As the result of it, the Project was expanded
- RF is open for further cooperation with all countries concerning SIGMET coordination, and also for organization and holding the SIGMET Training Workshop for the PT/EAST countries

Aviation Nowcasting Capacity Building Workshop:

- The three-day workshop was held back-to-back with the WMO WWRP 4th International Symposium on Nowcasting and Very-short-range Forecast 2016 (WSN16)
- It provided nowcasting and mesoscale technology training to interested Members in response to the need of the advancement of aviation meteorological services in the 0-6 hour nowcasting time frame
- 22 participants attended the workshop

## 6. Expert Group on Operational Forecasting (EG-OF)

**2013-14**

The main objectives of the activities of the Theme Leader in Emergency Response Activities (TL-ERA), who is a member of EG-OF, are

(a) Monitoring of the provision of products and services by designated RA-II GDPFS Centres within the framework of the Emergency Response Activities (ERA),
(b) Advising on evolving requirements for ERA operational systems and services.

An action plan for the 2013 – 2016 period was developed. The expected targets are:

- Improving the provision measures for the products and services by RSMCs for the registered members,
- Exploring of potential registration of non-registered member states,
- Providing better understanding of the standard products and the joint statement of ERA,
- Monitoring the user requests for ERA to improve the activity within the Region.

The WMO Expert Team on Emergency Response Activities (ET-ERA) was established under the Open Programme Area Group on Data-Processing and Forecasting System (OPAG-DPFS) at the 15th session of the Commission for Basic System (CBS), which was held in Jakarta in September 2012. ET-ERA had its first meeting in College Park, MD, USA, 21-25 October. The members of ET-ERA discussed many issues regarding ERA, and capacity development and outreach in each Region were one of the items on the agenda, where the provision of appropriate training courses and interpretation of their guidance and products are discussed.

Face-to-face training workshops require significant human and budgetary resources, and those may not reach a large audience. The meeting agreed that e-learning modules and web-based courses may be appropriate. RSMCs are encouraged to evaluate the existing materials and other possibilities, including the resources required to establish web-based training course. When such a web training course becomes available, operators in the RA-II member states would be encouraged to use it.

RSMCs in the Region developed Technical Memorandums in 2006 to coordinate operational procedures and roles among the centres. The memorandums were revised in 2010 (find Annex-II), and the centres initiated the email / fax tests in 2011. Each centre examines contact information once a year. Therefore three times a year the contact information for ERA is confirmed.

In other Regional Associations, about 40 – 50 % of registered member states are reachable. As a result of the efforts by RSMCs Beijing, Obninsk, and Tokyo, the reachability in RA-II became more than 95%, and nearly 80% of registered members specify their operational contact points appropriately. To maintain such a good result, RSMCs are encouraged to continue their efforts.

The current status of the member states in RA-II are:

(a) Registered and reachable members (27 members)
Bahrain, Bangladesh, China, Hong Kong, India, Islamic Rep. of Iran, Iraq, Japan, Kazakhstan, Kyrgyzstan, Macau, Mongolia, Myanmar, Oman, Pakistan, Qatar, Rep. of Korea, Russian Federation, Saudi Arabia, Sri Lanka, Tajikistan, Thailand, Turkmenistan, UAE, Uzbekistan, Vietnam, Yemen,

(b) Registered but not reachable member (one member)
DPRK,

(c) Not registered members (7 members)
Afghanistan, Bhutan, Cambodia, Kuwait, Lao, Maldives, Nepal

To explore of potential registration of non-registered member states, a questionnaire for non-registered RA-II members is planned. A concise guidance for ERA activities will be prepared to provide better understanding of the activities. The fax / email tests by RSMCs will continue.

**2014-15**

The EG-OF supports and promotes the implementation of subprojects of WMO Severe Weather Forecasting Demonstration Project (SWFDP) in 2015. Under the strong support from the WMO DPFS Secretariat and SWFDP Office, three subprojects of SWFDP are being developed for Southeast Asia (SWFDP-SeA), the Bay of Bengal (South Asia) (SWFDP-BoB) and Central Asia (SWFDP-CA) in RA II. As of 2015, 18 Members[2] out of 35 in RA II are involved in SWFDP.

(a) SWFDP-SeA has been developed since 2010. National Centre of Hydro-Meteorological Forecasting of Hydro-Meteorological Service of Viet Nam plays the key regional role as Regional Forecasting Support Centre in SWFDP-SeA and started to issue the Daily Severe Weather Forecasting Guidance in April 2015. At the second meeting of SWFDP-SeA Regional Subproject Management Team (RSMT) (11-14 August 2015, Ha Noi, Viet Nam) chaired by the Co-coordinator of EG-OF, the RSMT decided to start the demonstration phase from 1 January 2015. The two-week training workshop on Global Data Processing and Forecasting (GDPFS) and Public Weather Service (PWS) was organized as the joint event of SWFDP-SeA and –BoB in Bangkok, Thailand, in September 2015.

[2] (SWFDP-SeA) Cambodia, Lao PDR, Thailand, Viet Nam, India, Hong Kong, China; China, Japan, Korea (the Philippines)
(SWFDP-BoB) India, Bangladesh, Myanmar, Thailand, Sri-Lanka, Maldives, Japan
(SWFDP-CA) Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan, China, Korea, Japan, Russia

(b) SWFDP-BoB has been developed since 2012. RSMC New Delhi (India) plays the key regional role in SWFDP-BoB and, in September, opened a subproject website where all information necessary for severe weather forecasting are collected.

(c) SWFDP-CA is being developed since 2015. RSMC Tashkent (Uzbekistan) supposes to play the key regional role in SWFDP-CA. The technical workshop was organized at Almaty, Kazakhstan, in April 2015 and another SWFDP-CA workshop was organized at Moscow, Russian Federation, in July 2015.

The Theme Leader on Emergency Response Activities (TL-ERA) carried out a questionnaire survey for non-registered members to find out their potential interest in ERA in 2014 and provided a concise guidance to help Members interpret products from RSMC for nuclear ERA in 2014. In 2015, the Theme Leader conducted the email and fax communication test, which has been conducted annually since 2010, and confirmed that the service reachability of RSMC for nuclear ERA was improved to more than 95% as of 2015.

The Co-coordinator of EG-OF reviewed the available WMO Technical Progress Reports on GDPFS and NWP Research for 2001 to 2013 and found the number of reporting members were less than or equal to 10 in RA II. The Co-coordinator consulted with the Japan Delegation to Cg-17 about this issue and the Japan Delegation proposed to review the contents and reporting method of the Reports at Cg-17. The Congress decided to request CBS to conduct such review.

**2015-16**

General report on Global Data-processing and Forecasting System:

- In RA II, there are 18 Regional Specialized Meteorological Centres (RSMCs) and 3 Lead Centres as part of WMO Global Data-processing and Forecasting System. In addition to these Centres, the designation of two new RSMCs in RA II was approved by the Commission for Basic Systems at its 16th Session (China, Nov. 2016). One is RSMC Atmospheric Sand and Dust-storm Forecast (ASDF) Beijing, China and the other is Regional Climate Centre (RCC) Pune, India. Their formal designation will be endorsed at the 69th Session of the Executive Council (EC-69) (2017).
- The revised Manual on GDPFS (WMO-No.485) was also adopted by CBS at its 16th Session (CBS-16) (Guangzhou, China; Nov. 2016).
- Five Members (China; Hong Kong, China; Japan; Kazakhstan; Thailand) submitted the WMO Technical Progress Report on GDPFS and NWP Research for the year of 2014. Aiming to facilitate the Members' contribution to the Report, the content and reporting method will be reviewed by CBS.
- The discussion on the future Seamless GDPFS is ongoing under WMO. The vision for the Seamless GDPFS was endorsed at EC-68. The white paper and implementation plan is being developed by the EC Steering Group on the Seamless GDPFS. It is planned to conduct the Members' review next year. To facilitate the implantation plan, Members in RA II will be invited to identify national focal points on GDPFS next year.

Severe Weather Forecasting Demonstration Project:

- SWFDP regional subprojects in Southeast Asia, Bay of Bengal and Central Asia in RA II were started in 2010, 2012 and 2014, respectively. These three subprojects in RA II have shown steady progress during recent years.
- The SWFDP Southeast Asia (SWFDP-SeA) which involves five countries namely: Cambodia, Lao PDR, Philippines, Thailand and Viet Nam, entered into demonstration phase from 1 January 2016 after decision by its Regional Subproject Management Team (RSMT) which met in Ha Noi, Viet Nam in August 2015. Global NWP centres of ECMWF, CMA, JMA, KMA and DWD are contributing to SWFDP-Southeast Asia, while Viet Nam is providing support as lead Regional Forecast Support Centre, with support of RSMC Tokyo (for typhoon forecast support) and RSMC New Delhi (for tropical cyclone forecast support).

- The SWFDP-Bay of Bengal (SWFDP-BB) which initially involved six countries namely: Bangladesh, India, Maldives, Myanmar, Sri Lanka and Thailand, has been expanded in 2016 to benefit Bhutan, Nepal and Pakistan as well to involve all nine countries in South Asia. The SWFDP-Bay of Bengal is ready to start its demonstration phase subject to decision by the first meeting of its Regional Subproject Management Team (RSMT) which is likely to be held in 2017. ECMWF, UKMO and IMD are contributing as global NWP centres for SWFDP-Bay of Bengal with RSMC New Delhi as lead Regional Centre.
- The SWFDP-Central Asia (SWFDP-CA) involves four countries namely: Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan. The development planning of the subproject was started in 2014. The contributing global NWP centres include Roshydromet, ECMWF, CMA, JMA and KMA. RSMC Tashkent will serve as the lead Regional Centre. The project website which is in Russian language is currently maintained by Roshydromet.
- Regular specialized training workshops have been conducted for capacity development of participating NMHSs:
  - Two-week joint SWFDP-SeA and -BB Training Workshop in Macao, China during 8-19 April 2013
  - Two-week SWFDP-SeA Training Workshop in Quezon City, Metro Manila, Philippines during 2-13 June, 2014.
  - One-week SWFDP-Central Asia Workshop on Analysis and Interpretation of Numerical Weather Prediction (NWP) products was held in Moscow, Russian Federation, from 6 to 10 July 2015
  - Two-week joint SWFDP-SeA and -BB Training Workshop in Bangkok, Thailand during 14-25 September 2015.
  - SWFDP-CA Workshop on Forecasting and Public Weather Services (PWS) in Almaty, Kazakhstan, from 22 February to 4 March 2016

Emergency Response Activity:

- A user request survey on the Emergency Response Activities (ERA) in the Regional Association II (RA II) was conducted in 2016, and the results were reported to the coordinators of Expert Group on Operational Forecasting (EG-OF) by Theme Leader in Emergency Response Activities (TL-ERA). The survey questionnaire and the survey report are found in Annexes IV-1.1.1 and IV-1.1.2, respectively.
- The Regional Specialised Meteorological Centres in the region (RSMCs Beijing, Obninsk, and Tokyo) have continued their efforts to maintain contact information for the registered members for the Environmental Emergency Response (EER).

Training on Tropical Cyclone Forecasting – Report from RSMC Tokyo:

- The 16th ESCAP/WMO Typhoon Committee Attachment Training 2016 course was held at JMA Headquarters from 15 to 26 August 2016. Forecasters from the Panel on Tropical Cyclones (PTC) have also been invited since 2015 to enhance training collaboration between PTC and the Typhoon Committee. Participants were coming from Lao PDR, Philippines, Vietnam, Oman, Pakistan and Sri Lanka.
- The training focused on imparting practical knowledge and skills relating to operational tropical cyclone analysis and forecasting via lectures and exercises using the Satellite Analysis and Viewer Program (SATAID). The course covered a range of subjects including Dvorak analysis, interpretation of microwave data, quantitative precipitation estimation (QPE), quantitative precipitation forecasting (QPF) and storm surge forecasting. All attendees gave presentations to help JMA staff understand the current status of their meteorological and hydrological services. In 2016, two-day lectures on warning coordination were newly introduced. Lectures focused on how to determine warning thresholds using disaster statistics and meteorological datasets through a past tropical cyclone disaster event in Japan. The participants reported that in particular practical exercise using SATAID is effective to obtain operational skills of tropical cyclone analysis/forecasting. However, trainees also stressed their needs for lectures/exercises on analysis/forecast techniques for severe weather phenomena associated with tropical cyclones, such as radar-based heady rainfall estimates and storm surges.

Training on Tropical Cyclone Forecasting – Report from RSMC New Delhi:

- Tropical Cyclone Forecaster Training is conducted every year from 2005 onwards. This year this training was conducted during 19-30 September 2016. There were 19 participants including 3 from WMO/ESCAP Panel member countries viz. Bangladesh, Maldives and Pakistan, 11 from Area Cyclone Warning Centres (ACWCs) and Cyclone Warning Centres (CWCs) of IMD and 5 from National Weather Forecasting Centre & RSMC New Delhi.
- Regional Training Workshop for capacity development in coastal multi hazard early warning system was jointly organised by RSMC, New Delhi & Indian National Centre for Ocean Information Services (INCOIS), Hyderabad and sponsored by UN-ESCAP at Hyderabad during 19-23 September. 8 countries from WMO/ESCAP and WMO-Typhoon Committee participated in the training workshop.
- In 2015, an advanced training on TC forecasting was conducted by RSMC New Delhi during 03-14 August 2015. There were 16 International participants from WMO/ESCAP Panel and Typhoon Committee member countries. There were 41 national participants from IMD, National Centre for Medium Range Weather Forecasting (NCMRWF), Indian National Centre for Ocean Information Services (INCOIS), Indian Navy (IN) and Indian Air Force (IAF).

Sand and Dust storm Forecasts

- Cg-XIV endorsed launching of the Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) project with its mission to enhance the ability of WMO Members to deliver timely and quality sand and dust storm forecasts, observations, information and knowledge to users through an international partnership of research and operational communities. SDS-WAS is jointly coordinated by the WMO World Weather Research Programme (WWRP) and the Global Atmosphere Watch (GAW).
- In view of the demand of many National Meteorological Services and the good results obtained by the SDS-WAS, the WMO Executive Council endorsed to establish a new type of RSMC with activity specialization in Atmospheric Sand and Dust Forecast (RSMC-ASDF) in 2013.
- The meeting of the Regional Steering Group (RSG) of SDS-WAS Asia Node was organized in September 2016 in Jeju, Korea. The RSG reviewed the technical document and its annex submitted by China Meteorological Administrator.
- The designation of RSMC ASDF Beijing was approved by CBS at its 16th Session (Guangzhou, China; Nov. 2016). Their formal designation will be endorsed at the 69th Session of the Executive Council (EC-69) (2017).

## 7. Expert Group on Public Weather Services Delivery (EG-PWS)

**2013-14**

Communication among the Co-coordinators and Theme Leaders of the EG-PWS was mainly made through email exchange in 2013. A meeting of the EG-PWS was held in Doha on 3 December 2014 and a teleconference was held on 25 March 2015. In 2013, the work plan of EG-PWS for 2013-16 was formulated. Some of the proposed tasks were the development of guidelines on assessment of socio-economic benefits and communication with stakeholders. However, it was later found that similar guidelines were being prepared under other WMO programmes. Therefore, the EG-PWS would put more focus on the recommendations given in "The WMO Strategy for Service Delivery and its Implementation Plan" published by WMO in 2014. In this regard, the EG-PWS planned to organize a training workshop/seminar for RA II Members in 2015 on the enhancement of public weather service delivery.

Some of the activities on PWS carried out in this Region during 2013 and 2014 are summarized as follows. Two training workshops on public weather services were organized under the WMO/CBS Severe Weather Forecast Demonstration Projects (SWFDP). The first one was held in Macao, China from 15 to 19 April 2013 with participants from Cambodia, Lao, Thailand, Viet Nam, India, Maldives, Myanmar, Sri Lanka, Pakistan, Nepal, Bhutan, and others. The second one was held in Manila, Philippines from 9 to 13 June 2014 with participants from

Cambodia, Laos, Thailand, Vietnam, and others. In addition, a Voluntary Cooperation Programme (VCP) training workshop on "Effective Media Communication" was organized in Hong Kong, China in December 2013 for Bhutan, Cambodia, China, Islamic Republic of Iran, Republic of Kazakhstan, Republic of Korea, Thailand and The United Arab Emirates. The workshop covered media communication in different phases of significant weather events, through various channels including the traditional media like TV and radio as well as new media like the social media. There were practical sessions of weather presentation on TV and radio, which offered each participant hands-on experience together with expert feedback.

**2014-15**

A teleconference among the Co-coordinators and Theme Leaders of the EG-PWS was held on 25 June 2015 to discuss the organization of a training workshop for RA II Members in 2015 on the enhancement of public weather service delivery. With the joint effort of the China Meteorological Administration (CMA) Training Centre, the CMA Public Meteorological Service Centre and the EG-PWS, an International Training Workshop on Public Weather Service was held in Beijing, China from 16 to 20 November 2015. Experts from CMA, Hong Kong Observatory and Korea Meteorological Administration were invited to deliver lectures, which covered such topics as delivery of weather forecast and warning messages, disaster prevention and mitigation strategy, and experience in promoting stakeholder engagement. Nearly 40 participants from 11 countries, including China, Kazakhstan, Maldives and Thailand attended the workshop.

A meeting of the EG-PWS was held in Hong Kong, China on 10 and 11 December 2015. The meeting reviewed the 2013-2016 work plan of the EG-PWS and identified new tasks to be performed in 2016 including public education and outreach; socio-economic studies and evaluations; communication between RA II members and stakeholders; and quality management of service delivery. Planning ahead, the meeting proposed organizing a workshop on socio-economic benefit study for Members in RA II or subregions in 2016-2019, with the assistance of WMO PWS Programme. Proposals of streamlining the Terms of Reference of EG-PWS and improvement of the structure of EG-PWS were also made for consideration in the next RA II session.

**2015-16**

In the Working Group, Implementation and Coordination Team, and Task Team Chairs' Meeting on Strategic Planning in RA II, which was held in Qatar from 15 to 17 December 2015, the draft RA II OP 2016–2019 for EG-PWS was further improved. It was confirmed that the focus should be placed on the consistency with other existing implementation plans and work plans in the Region, and that the deliverables and activities should be specific, feasible and measureable.

A survey for RA II Members was conducted online from October to November 2016 to gather information on the basic capability of NMHSs in the Region. 32 responses out of 35 Members were received. In the aspect of PWS, it was found that 89% of Members operated a website for real-time weather forecasts and warnings, which was quite similar compared with 90% in the previous survey in 2011. Percentage of Members operating automatic telephone answering system had increased from 65% to 74%. However, percentage of Members operating a TV weather forecast programme slightly reduced from 40% to 37%. The survey also revealed that cooperation with other service providers in the provision of specific weather services or advice might need more enhancements.

The survey also showed that 78% of the Members contributed operational weather information to WMO's on-line World Weather Information Service (WWIS), with the total number of cities for which weather forecasts are on WWIS being 420. 39% of Members supported the exchange of official warnings of severe weather by contributing to WMO's on-line Severe Weather Information Centre (SWIC).

The EG-PWS has been following up with the WMO Secretariat to update the list of PWS focal point. It would also continue to explore the list of PWS technical contact from Members.

An SWFDP Workshop on Forecasting and Public Weather Services for Forecasters and Users from Central Asia was held in Kazakhstan from 22 February to 4 March 2016. It aimed at enhancing the capability of Central Asian countries in forecasting high-impact weather and disseminating relevant information, as well as strengthening communication and collaboration between meteorological services and disaster emergency management units. More than 30 meteorologists and staff of emergency response, water and electricity power supply units from Kazakhstan, Kyrgyz, Tajikistan and Uzbekistan attended the workshop. The workshop provided a platform for participants to learn from the experts and to share their own experiences in delivering weather forecasts and warning messages. Through the interactive activities and simulated exercise sessions, they were also able to try out approaches and methods from different perspectives in meeting the challenges they faced.

A meeting of CBS PWS Expert Teams was held in Shanghai, China from 27 June to 1 July 2016, with experts from China; Hong Kong, China; other countries and WMO Secretariat. The meeting identified and discussed in depth a number of topics or issues for the development of implementation plan to the "WMO Guidelines on Multi-hazard Forecast and Warning Services". The meeting agreed that a key element in the success of impact-based forecasts was the engagement of stakeholders to ensure that their requirements were clearly expressed, understood and recorded so that action could be taken on them. The meeting also supported the engagement of social scientists in the work related to multi-hazard impact-based forecast and warning services.

A meeting of another CBS PWS Expert Team on services and products innovation and improvement was held from 11 to 15 July 2016, with participants from Hong Kong, China; Japan, Russian Federation, other countries and WMO Secretariat. The meeting agreed that although the Big Data issue dealt with many different kinds of data, of particular interest to PWS was crowdsourced data. It decided to establish a Task Team on Big Data to investigate the utilization of Big Data for monitoring, impact assessment, and forecasting and to collect and share examples of different approaches to crowdsourced data.

A Common Alerting Protocol (CAP) Implementation Workshop was held in Thailand from 23 to 24 August 2016, with WMO being one of the workshop sponsors. The workshop focused on emergency alerting as enabled by the CAP standard. It was a technical meeting for information sharing among experts from NMHSs and other organizations. Common issues and how best to expand the adoption of CAP were discussed.

A Workshop on the Implementation of New NWP and Impact-based Forecast and Warning Techniques was held at the Department of Meteorology and Hydrology, Myanmar from 6 to 9 September 2016. Representatives from various NMHSs and international organizations participated in the workshop, which discussed various issues such as the developments of colour-coded warnings, impact-based products, NWP and nowcasting system. The meeting further coordinated technical supports to be provided by various parties, and prepared an action plan with timelines for Myanmar.

A Stakeholder Workshop to Implement an Impact-based Forecast and Warning Service in Maldives was held from 26 to 28 September 2016 in Maldives. It provided guidance and assistance to Maldives Meteorological Service and national stakeholders on the implementation of a pilot project on impact-based forecasting for Maldives. In the workshop, a number of presentations were on the current status of operational warning systems for meteorological, hydrological and geophysical hazards, the challenges posed by those systems, and the disaster reduction activities.

A WMO Voluntary Cooperation Programme (VCP) Training Workshop on Use and Interpretation of Mesoscale NWP for High-impact Weather Forecasting was held in Hong Kong, China from 5 to 9 December 2016. The workshop focussed on both application and theoretical aspects of high-impact weather forecasting using mesoscale NWP models.

## 8. Other Activities

A Webex session was conducted on 14 Dec 2015 among the expert group co-coordinators to discuss the works of each expert group so far, draft RA II Operating Plan 2016-19, roles and responsibilities of working group chairs, expert group coordinators and theme leaders, challenges of each group in aligning activities in RA II and ways to make activity management more effective by reviewing working/expert group structures and their terms of references. Participants were generally of the view that communication was the major hindrance in collecting status information, alignment of activities and promulgation of the challenges and priorities to RA II Members. It was considered essential for the Secretariat to maintain a list of focal points and also interested parties for each Member on individual theme to facilitate communication. To assess the latest status of individual Member on specific topic, one may want to make use of the WMO country profile instead of separate surveys which could only give a snapshot of the situation which may not be useful for year-to-year comparison. The organization and terms of reference of the groups were also discussed and proposals made. An idea brought up was the proposed coordination of RA II pilot projects through expert group coordinators of the respective theme. With regard to the current and future SOPs, participants were of the view that the RA II MG should also consider not only the ER/KO/KPI but other items found important to RA II, like ERA under EG-OF.

## 9. Conclusion

After some deliberation, WGWS activities have eventually gained momentum and progress of associated works have moved into high gear in 2015-16. Some refinements to the working arrangements, including the Terms of Reference of the Expert Teams, may be required to allow more effective outcomes in a rapidly changing environment and these would be proposed for consideration of RA II-16.

## Expert Group on Operational Forecasting (EG-OF)

Y. Honda
Japan Meteorological Agency

### 1. Introduction

This report summarizes major activities in association with Expert Group on Operational Forecasting (EG-OF) during the period 2015-2016.

### 2. Expert Group Structure

The EG-OF is composed of two co-coordinators and three theme leaders.

### 3. Terms of Reference

The terms of reference of the Working Group on Weather Services (WGWS), which the EG-OF belongs to, are as follows:

(a) To coordinate and support the work of the expert teams in Aeronautical Meteorology in the Region in cooperation with the Commission for Aeronautical Meteorology;

(b) To coordinate all activities related to the GDPFS, including the Emergency Response Activities, and PWS in the Region in cooperation with the Commission for Basic System;

### 4. Membership

Expert Group on Operational Forecasting (EG-OF)

| **EG-OF** | | |
|---|---|---|
| Co-Coordinators | Mr Yuki Honda | Japan |
| | Ms Irina Zaytseva | Uzbekistan |
| Theme Leader in Operational Forecasting Process and Support | Ms Sunitha D. Santhamma | India |
| | Mr Vo Van Hoa | Viet Nam |
| Theme Leader in Operational Predictions from sub-seasonal to longer-time scale | Mr Suhee Park | Republic of Korea |
| Theme Leader in Emergency Response Activities | Mr Masami Sakamoto | Japan |

### 5. Highlights of EG-OF activities

- The revised Manual on Global Data-processing and Forecasting System (WMO-No.485) was approved by CBS at its 16th Session (CBS-16) (Guangzhou, China; Nov. 2016).
- There are three regional subprojects of Severe Weather Forecasting Demonstration Project (SWFDP) in RA II. Regional Subproject Management Team of SWFDP in Southeast Asia decided to start its demonstration phase from January 2016. The SWFDP in the Bay of Bengal (South Asia) is moving to the demonstration phase. A new SWFDP in Central Asia is being developed. These activities are supported by Global and Regional Centres.
- A questionnaire survey for non-registered members has conducted to find out their potential interest in ERA in 2014. A concise guidance for EER was provided to RA II Members in 2014. A user request survey on ERA was conducted in 2016 to find needs and queries regarding the activities within the region. User requests and opinions will be conveyed to relevant entities of WMO.
- The 16th ESCAP/WMO Typhoon Committee Attachment Training 2016 course was held at JMA Headquarters from 15 to 26 August 2016. In 2016, two-day lectures on warning coordination were newly introduced.
- Tropical Cyclone Forecaster Training was conducted in 2016. There were 19 participants

including 3 from WMO/ESCAP Panel member countries. Regional Training Workshop for capacity development in coastal multi hazard early warning system was also organised in 2016 and trainees from 8 countries from WMO/ESCAP and WMO-Typhoon Committee participated.

- The Commission for Basic Systems approved the designation of China Meteorological Administrator (CMA, Beijing) as RSMC for Atmospheric Sand and Dust storm Forecasts at its 16th Session in 2016.

**6. Expert Group on Operational Forecasting (EG-OF)**

General report on Global Data-processing and Forecasting System

- ✓ In RA II, there are 18 Regional Specialized Meteorological Centres (RSMCs) and 3 Lead Centres as part of WMO Global Data-processing and Forecasting System. In addition to these Centres, the designation of two new RSMCs in RA II was approved by the Commission for Basic Systems at its 16th Session (China, Nov. 2016). One is RSMC Atmospheric Sand and Dust-storm Forecast (ASDF) Beijing, China and the other is Regional Climate Centre (RCC) Pune, India. Their formal designation will be endorsed at the 69th Session of the Executive Council (EC-69) (2017).
- ✓ The revised Manual on GDPFS (WMO-No.485) was also adopted by CBS at its 16th Session (CBS-16) (Guangzhou, China; Nov. 2016). The approved Manual can be found as the approved documents of CBS-16:
  - http://meetings.wmo.int/CBS-16/English/2.%20PROVISIONAL%20REPORT%20(Approved%20documents)/CBS-16-d03-6(1)-REVISED-MANUAL-GDPFS-approved_en.docx?Web=1
  - http://meetings.wmo.int/CBS-16/English/2.%20PROVISIONAL%20REPORT%20(Approved%20documents)/CBS-16-d03-6(2)-NEW-TYPE-CENTRES-REVISED-MANUAL-GDPFS-approved-en.docx?Web=1
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Severe Weather Forecasting Demonstration Project

- ✓ SWFDP regional subprojects in Southeast Asia, Bay of Bengal and Central Asia in RA II were started in 2010, 2012 and 2014, respectively. These three subprojects in RA II have shown steady progress during recent years.
- ✓ The SWFDP Southeast Asia (SWFDP-SeA) which involves five countries namely: Cambodia, Lao PDR, Philippines, Thailand and Viet Nam, entered into demonstration phase from 1 January 2016 after decision by its Regional Subproject Management Team (RSMT) which met in Ha Noi, Viet Nam in August 2015. Global NWP centres of ECMWF, CMA, JMA, KMA and DWD are contributing to SWFDP-Southeast Asia, while Viet Nam is providing support as lead Regional Forecast Support Centre, with support of RSMC Tokyo (for typhoon forecast support) and RSMC New Delhi (for tropical cyclone forecast support).
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- ✓ The SWFDP-Central Asia (SWFDP-CA) involves four countries namely: Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan. The development planning of the subproject was started in 2014. The contributing global NWP centres include Roshydromet, ECMWF, CMA, JMA and KMA. RSMC Tashkent will serve as the lead Regional Centre. The project website which is in Russian language is currently maintained by Roshydromet.

- ✓ Regular specialized training workshops have been conducted for capacity development of participating NMHSsl.
  - Two-week joint SWFDP-SeA and -BB Training Workshop in Macao, China during 8-19 April 2013
  - Two-week SWFDP-SeA Training Workshop in Quezon City, Metro Manila, Philippines during 2-13 June, 2014.
  - One-week SWFDP-Central Asia Workshop on Analysis and Interpretation of Numerical Weather Prediction (NWP) products was held in Moscow, Russian Federation, from 6 to 10 July 2015
  - Two-week joint SWFDP-SeA and -BB Training Workshop in Bangkok, Thailand during 14-25 September 2015.
  - SWFDP-CA Workshop on Forecasting and Public Weather Services (PWS) in Almaty, Kazakhstan, from 22 February to 4 March 2016

Emergency Response Activity

- ✓ A user request survey on the Emergency Response Activities (ERA) in the Regional Association II (RA II) was conducted in 2016, and the results were reported to the coordinators of Expert Group on Operational Forecasting (EG-OF) by Theme Leader in Emergency Response Activities (TL-ERA). The survey questionnaire and the survey report are found in Annexes IV-1.1.1 and IV-1.1.2, respectively.
- ✓ The Regional Specialised Meteorological Centres in the region (RSMCs Beijing, Obninsk, and Tokyo) have continued their efforts to maintain contact information for the registered members for the Environmental Emergency Response (EER).
- ✓ Annual activity report in 2016 submitted by TL-ERA is found in Annex IV-1.1.3.

Training on Tropical Cyclone Forecasting: Report from RSMC Tokyo

- ✓ The 16th ESCAP/WMO Typhoon Committee Attachment Training 2016 course was held at JMA Headquarters from 15 to 26 August 2016. Forecasters from the Panel on Tropical Cyclones (PTC) have also been invited since 2015 to enhance training collaboration between PTC and the Typhoon Committee. The 2016 attendees were Mr. Thatsana Chanvilay from Lao PDR, Ms. Shelly Jo Igpuara Ignacio from the Philippines, Ms. Ton Thi Thao from Vietnam, Mr. Nasser Said Abdullah Al Ismaili from Oman, Mr. Habib Rehmat from Pakistan, and Mr. Ponna Handi Chaminda De Silva from Sri Lanka.
- ✓ The training focused on imparting practical knowledge and skills relating to operational tropical cyclone analysis and forecasting via lectures and exercises using the Satellite Analysis and Viewer Program (SATAID). The course covered a range of subjects including Dvorak analysis, interpretation of microwave data, quantitative precipitation estimation (QPE), quantitative precipitation forecasting (QPF) and storm surge forecasting. All attendees gave presentations to help JMA staff understand the current status of their meteorological and hydrological services. In 2016, two-day lectures on warning coordination were newly introduced. Lectures focused on how to determine warning thresholds using disaster statistics and meteorological datasets through a past tropical cyclone disaster event in Japan. The participants reported that in particular practical exercise using SATAID is effective to obtain operational skills of tropical cyclone analysis/forecasting. However, trainees also stressed their needs for lectures/exercises on analysis/forecast techniques for severe weather phenomena associated with tropical cyclones, such as radar-based heady rainfall estimates and storm surges.
- ✓ Annual report on activities of the RSMC Tokyo – Typhoon Centre can be found in the following website: http://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/annualreport.html

Training on Tropical Cyclone Forecasting: Report from RSMC New Delhi

- ✓ Tropical Cyclone Forecaster Training is conducted every year from 2005 onwards. This year this training was conducted during 19-30 September 2016. There were 19 participants including 3 from WMO/ESCAP Panel member countries viz. Bangladesh, Maldives and Pakistan, 11 from Area Cyclone Warning Centres (ACWCs) and Cyclone Warning Centres (CWCs) of IMD and 5 from National Weather Forecasting Centre & RSMC New Delhi.

- ✓ Regional Training Workshop for capacity development in coastal multi hazard early warning system was jointly organised by RSMC, New Delhi & Indian National Centre for Ocean Information Services (INCOIS), Hyderabad and sponsored by UN-ESCAP at Hyderabad during 19-23 September. 8 countries from WMO/ESCAP and WMO-Typhoon Ccommittee participated in the training workshop.
- ✓ In 2015, an advanced training on TC forecasting was conducted by RSMC New Delhi during 03-14 August 2015. There were 16 International participants from WMO/ESCAP Panel and Typhoon Committee member countries. There were 41 national participants from IMD, National Centre for Medium Range Weather Forecasting (NCMRWF), Indian National Centre for Ocean Information Services (INCOIS), Indian Navy (IN) and Indian Air Force (IAF).

Sand and Dust storm Forecasts

- ✓ Cg-XIV endorsed launching of the Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) project with its mission to enhance the ability of WMO Members to deliver timely and quality sand and dust storm forecasts, observations, information and knowledge to users through an international partnership of research and operational communities. SDS-WAS is jointly coordinated by the WMO World Weather Research Programme (WWRP) and the Global Atmosphere Watch (GAW).
- ✓ In view of the demand of many National Meteorological Services and the good results obtained by the SDS-WAS, the WMO Executive Council endorsed to establish a new type of RSMC with activity specialization in Atmospheric Sand and Dust Forecast (RSMC-ASDF) in 2013.
- ✓ The meeting of the Regional Steering Group (RSG) of SDS-WAS Asia Node was organized in September 2016 in Jeju, Korea. The RSG reviewed the technical document and its annex submitted by China Meteorological Administrator. These reports are obtained from the following links:
  http://www.wmo.int/pages/prog/arep/wwrp/new/documents/technique_report_on_asian_RC_final_2015.pdf
  http://www.wmo.int/pages/prog/arep/wwrp/new/documents/technique_report_on_asian_RC_final_annex_2015.pdf
- ✓ The designation of RSMC ASDF Beijing was approved by CBS at its 16th Session (Guangzhou, China; Nov. 2016). Their formal designation will be endorsed at the 69th Session of the Executive Council (EC-69) (2017).

**Annexes**

Annex IV-1.1.1: Survey Questionnaire on Emergency Response Activities
Annex IV-1.1.2: Survey Report on User Request on the Emergency Response Activities (ERA) in Regional Association II (Asia)
Annex IV-1.1.3: Report by the Theme Leader in Emergency Response Activities for 2016

# Brief Introduction on the WMO ERA

*for the Emergency Response Activities (ERA) in Reginal Association II (Asia)*

*Masami SAKAMOTO*

*(Japan Meteorological Agency,*

*Theme Leader in Emergency Response Activities / Expert Group on Operational Forecasting)*

## 1. Introduction

After the Chernobyl nuclear power plant (NPP) accident in April 1986, the Commission for Basic Systems (CBS) of the World Meteorological Organization (WMO) had a series of discussions and decided to launch an atmospheric transport and dispersion modelling (ATDM) service to meet the broad interest in the atmospheric diffusion of toxic radiological materials. The environmental emergency response (EER) services started in 1989. The 49th session of WMO executive council in 1997 approved three Regional Specialized Meteorological Centres (RSMCs) for EER in Regional Association II (Asia) [see Table 1]. In 2011, the three RSMCs provided ATDM forecasts and joint statements in response to the Fukushima Daiichi NPP accident, and this was the first real operational service since the EER service started. The 16th World Meteorological Congress (Cg-16) in May 2011 noted the contributions by the RSMCs, and a representative of the International Atomic Energy Agency (IAEA) offered an appreciation.

**Table 1.** WMO RSMCs for EER in Regional Association II (Asia)

| | Hosting Organization (Nation / State) |
|---|---|
| RSMC Beijing | China Meteorological Administration (China) |
| RSMC Obninsk | Russian Federal Service for Hydrometeorology and Environmental Monitoring (Russian Federation) |
| RSMC Tokyo | Japan Meteorological Agency (Japan) |

The Emergency Response Activities (ERA) programme is primarily designed to provide ATDM service as part of the World Weather Watch (WWW). The CBS Expert Team on ERA (ET-ERA), which was set up under the CBS Open Programme Area Group on Data-processing and Forecasting Systems (OPAG-DPFS) in 2012, discusses ERA related issues and defines the processes and procedures for the provision of ERA products and services.

## 2. Operational Services and Exercises

The RSMCs provide users with the ATDM charts and a joint statement on weather and ATDM forecasts over the influenced area. Descriptions on the ATDM charts at each centre are found in Annex 4 of WMO technical document 778:
http://www.wmo.int/pages/prog/www/DPS/WMOTDNO778/Annex4.html

WMO and IAEA conduct quarterly regular exercises to prepare the nuclear and radiological emergencies on third Tuesdays in February, May, August, and November. The schedule and target regions for the regular exercises are decided by the beginning of the year. Other than the quarterly exercises, IAEA conducts international exercises named ConvEx, and WMO has been participating in ConvEx-2d and ConvEx-3. [Exercises planned this year (2016) are listed in Table 2.] For all exercises described above, RTH-Offenbach (hosted by the German Weather Service) broadcasts exercise information using the header "WNXX01 IAEA" through the Global Telecommunication System (GTS).

**Table 2.** Planned EER exercises in 2016

| Date | Exercise Type | Target Region |
|---|---|---|
| 18 February | Quarterly Test | RA I (Africa) and RA VI (Europe) |
| 17 May | Quarterly Test | RA II (Asia) |
| 16 August | Quarterly Test | RA III (South America) and RA IV (North and Central America) |
| 5 October | ConvEx-2d | Primary Target: RA VI (Europe) |
| 15 November | Quarterly Test | RA V (Southwest Pacific) |

## 3. Expert Team Activities on ERA

ET-ERA meets once every two years to discuss issues related to ERA. The team consists of experts from RSMCs, RTH-Offenbach, international organizations ( IAEA, ICAO, CTBTO and WHO), and some national weather services.

ET-ERA has been working on the migration from fax service delivery to the service through the Internet (email and web). The implementation of the migration has been a challenge, and the team discussed whether or not the facsimile transmission should be discontinued. The team concluded at the meeting in December 2015 that the facsimile transmission system is still needed to reach some of the NMHSs with limited capabilities and it can also serve as backup to e-mail, in case of Internet failure.

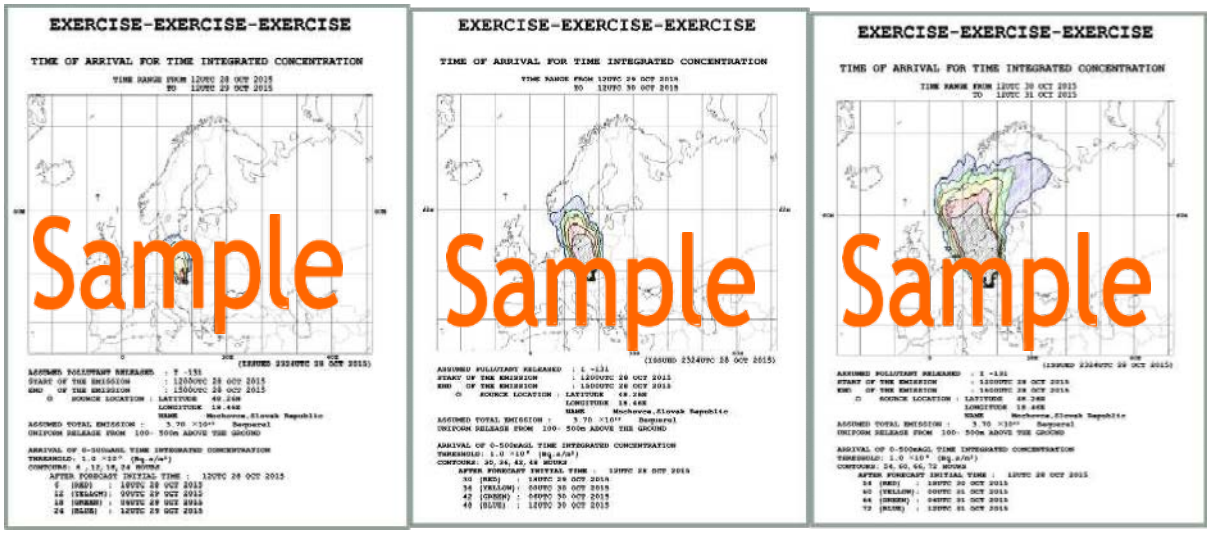
ET-ERA is discussing new types of products to provide to users in the future, and continues experiments to meet user requirements. Experimental products to be provided in the near future are described below.

3 a) Time of Arrival (ToA)

This is the product designed to indicate arrival times of a specific (instantaneous or time-integrated) atmospheric concentration level over geographic areas. ET-ERA conducted ToA product experiments in June and October 2015, and decided to continue effort in further developing of this product. Details of the product are undecided yet, but currently 6 hourly colored hatched arrival time areas are planned to be indicated in 24 hourly forecast charts.

Figure 1. Samples of the time of arrival products (time-integrated concentration).

3 b)




Fixed Legends

Currently forecasts for the time-integrated air concentration and total deposition are presented using different legends among three time zones up to 24, 48, and 72 hours after the NWP forecast initial time at each centre [according to the appendix II-7 of WMO No. 485]. A representative of IAEA at ET-ERA meeting in 2015 requested RSMCs to provide fixed legend charts for three time zones. An experiment will be done using the legends specified by IAEA in the near future.

### 3 c) the Transfer Coefficient Matrix (TCM) technique with the ATDM model ensemble

The 17th World Meteorological Congress (Cg-17) in 2015 noted two types of techniques to be developed for the ATMD services. These were the Transfer Coefficient Matrix (TCM) technique and Ensemble approach to ATDM [see 4.1.47 and 4.1.48 of WMO (2015)].

In most cases of accidental releases of radioactive materials, the release rates are unknown, only time series of radiological monitoring can be available. Unfortunately results of ATDM forecasts and analyses are heavily dependent on the release rates. With the TCM technique, a posterior analysis of toxic material dispersion can be estimated changing and adjusting release rates at a site [see Draxler and Rolph (2012)]. On the other hand, dispersion forecast results are also very dependent on NWP models and ATDMs at forecasting centres. There must be ambiguity stemming from differences of weather and ATDM forecasts. To identify the variations among centres, ET-ERA plans to have a joint experiment for TCM techniques with an ATDM multi-centre model ensemble. The model ensemble comparison is planned using the web application at the Joint Research Centre of the European Commission (JRC-EC).

## 4. Summaries

EER services started in 1989. The activities for the Fukushima Daiichi NPP accident were highly appreciated at Cg-16 in 2011. The CBS ET-ERA is discussing future ATDM services. Opinions and suggestions on the activities from Members will be appreciated.

## References


Draxler R. R., and G. D. Rolph 2012: Evaluation of the Transfer Coefficient Matrix (TCM) approach to model the atmospheric radionuclide air concentrations from Fukushima. *J. Geophy. Res*., **VOL. 117**, D05107, doi:10.1029 / 2011JD017205, 2012.

WMO 2010 (final update in 2015): Manual on the Global Data-processing and Forecasting System Volume I – Global Aspects (WMO-No.485)

WMO 2015: Seventeenth World Meteorological Congress, Geneva, 25 May–12 June 2015, abridged final report with resolutions (WMO-No.1157)

# SURVEY QUESTIONS

*Regarding Emergency Response Activities (ERA) in Reginal Association II (Asia)*

## 1. Respondent

Name of County/Territory: _____

Name of Organization: _____

Name of Respondent: _____

Title: _____

Email: _____

Phone:_____Facsimile: _____

## 2. User satisfaction

2 a) Does your organization have specific operations using the environmental emergency response (EER) service by RSMCs? (Please check one of below and describe the usage of the EER service in your operations if you have)

1. yes ☐ / 2. no ☐

Your operational usage:

_____

_____

_____

2 b) What is your overall satisfaction rating with regards to the current ERA service? (Please check one of below and provide us your opinions if you have)

1. excellent ☐ / 2. good ☐ / 3. fair ☐ / 4. not good ☐ / 5. poor ☐

_____

_____

_____

_____

2 c) What does your organization think regarding the current exercises on the EER service? (Please check one of below and provide us your opinions if you have)

1. too many (frequent) ☐ / 2. appropriate ☐ / 3. too few (need more) ☐

## 3. Contents of the Service

3 a) What does your organization think regarding products listed below? (Please refer to sec. 3 of the attached document "Brief Introduction of WMO ERA" and check one option for each)

3.a.i)Time of Arrival products

1. favorable ☐ / 2. no idea (need more explanation) ☐ / 3. unessential ☐

3.a.ii)Fixed legend products

1. favorable ☐ / 2. no idea (need more explanation) ☐ / 3. unessential ☐

3.a.iii)Transfer Matrix Coefficient analysis with the ATDM model ensemble

1. favorable ☐ / 2. no idea (need more explanation) ☐ / 3. unessential ☐

3 b) Does your organization have specific requests on the contents of the EER service? (If you have, please provide us with your opinions)

## 4. Service Provision Measures

4 a) Does your organization have specific purposes to require continuation of the fax service for EER? (Please check one of below and describe your necessity when appropriate)

1. no ☐ / 2. yes ☐

Your necessity for the fax-service continuation:

4 b) What is your overall satisfaction rating with regards to the service through RSMCs' common web pages1? (Please check one of below.)

1. excellent ☐ / 2. good ☐ / 3. fair ☐ / 4. not good ☐ / 5. poor ☐

## 5. Requests (or questions) for the Activities

5) Could you inform us of your request regarding the atmospheric transport and dispersion modelling (ATDM) services within WMO ERA?
(You may ask any questions regarding ERA.)

END

Thank you very much for completing this questionnaire. Please reply the form (this file) to the contact point below by the end of September (Friday, 30 September 2016).

[ Theme Leader in Emergency Response Activities (Mr. Masami SAKAMOTO):
Fax: +81 3 3211 2032, email: masami.sakamot-a@met.kishou.go.jp ]

[1] RSMCs' common webs are maintained to provide users with ATDM forecast results on-line. RSMCs currently send users emails and faxes, in which URLs of the common webs are included with a relevant user ID and a pass word.

Answers by NMHSs (2. User satisfaction 1/2)

| Country/ State | 2 a) | |
|---|---|---|
| China | 1.yes | We provide the government with the support of the nuclear emergency response and provide the public with nuclear accident atmospheric dispersion forecasts. For example, during Japan's Fukushima nuclear accident, we provided decision-making reference to the government and provided explanation to the public. |
| Hong Kong, China | 1.yes | To help assess the potential environmental impact of nuclear accidents. |
| Iran, Islamic Republic of | 1.yes | IN case of Request from users or having the required release information from internal or external sites |
| Japan | 2.no | The Japanese government is not using the EER service, because it has its own atmospheric dispersion models available for the purpose. Therefore the questions below are not applicable. |
| Korea, Republic of | 1.yes | For reference materials |
| Kyrgyzstan | 1.yes | |
| Macao, China | 1.yes | We will request the atmospheric transport and dispersion modelling products from three RSMCs for internal analysis, and also test the internal notification systems. |
| Mongolia | 1.yes | |
| Myanmar | 1.yes | Department of Meteorology and Hydrology (DMH) is operating the usage of the EER service in hydro-meteorological disasters and geological disasters (Earthquake, Land slide, and Tsunami). |
| Pakistan | 1.yes | |
| Russian Federation | 1.yes | Informational support of a national bogies (Ministry of emergency and other) responsible for decision making in case of emergencies lead to environmental contamination |
| Saudi Arabia | 2.no | |
| Thailand | 2.no | |
| Turkmenistan | N/A | |
| United Arab Emirates | 1.yes | |
| Uzbekistan, Republic of | 2.no | Does not guide |
| VIET NAM | 1.yes | We use the website "http://ra2-nwp.kishou.go.jp/cityfc/VietNam/VietNam.html" with an account that RSMCs Tokyo provided. |

Answers by NMHSs (2. User satisfaction 2/2)

| Country/State | 2 b) | | 2 c) | |
|---|---|---|---|---|
| China | 2.good | | 2.appropriate | Exercise and offered sufficient information for analysis and processing. |
| Hong Kong, China | 2.good | | 2.appropriate | |
| Iran, Islamic Republic of | 2.good | It is almost new compared to other WMO activities and in the future will be enhanced with more training and development | 2.appropriate | |
| Japan | N/A | | N/A | |
| Korea, Republic of | 2.good | | 2.appropriate | |
| Kyrgyzstan | 2.good | | 2.appropriate | |
| Macao, China | 2.good | | 2.appropriate | |
| Mongolia | 2.good | | 1.too many | |
| Myanmar | 2.good | | 2.appropriate | |
| Pakistan | 1.excellent | | 2.appropriate | |
| Russian Federation | 2.good | | 2.appropriate | |
| Saudi Arabia | 1.excellent | | 3.too few | We would like to propose to increase EER exercises in RA II at biannual basis. |
| Thailand | N/A | The ATDM service is good but the service from ERA in not covered, especially the products and the right time that meet the requirement of each country for further data use planning. | 2.too many | The current exercises are appropriate but TMD has not yet involved in the exercise. |
| Turkmenistan | N/A | | N/A | |
| United Arab Emirates | 1.excellent | | 2.appropriate | |
| Uzbekistan, Republic of | 2.good | | 3.too few | Exercise and offered sufficient information for analysis and processing. |
| VIET NAM | 2.good | | 2.appropriate | |

Answers by NMHSs (3. Contents of the Service 1/1)

| Country/State | 3 a.i) | 3 a.ii) | 3 a.iii) | 3 b) |
|---|---|---|---|---|
| China | 1.favorable | 3.unfavorable | 1.favorable | It will be better to provide the ensemble ATDM products. RSMC Beijing can provide these products, which have 15 members and are generated from the ensemble T639 and GRAPES_MESO systems. |
| Hong Kong, China | 1.favorable | 1.favorable | 1.favorable | It would be highly desirable to have some tailored products to help assess potential radiological impact to aviation, such as maximum activity concentration / dose rate in air, 3-dimensional grid point values of the model output that can cover flight levels, etc. |
| Iran, Islamic Republic of | 1.favorable | 2.no idea | 1.favorable | Not more than available for the time being and may be in the future. |
| Japan | N/A | N/A | N/A | |
| Korea, Republic of | 1.favorable | 1.favorable | 2.no idea | |
| Kyrgyzstan | 1.favorable | 1.favorable | 1.favorable | No |
| Macao, China | 1.favorable | 1.favorable | 2.no idea | |
| Mongolia | 1.favorable | 2.no idea | 1.favorable | No |
| Myanmar | 1.favorable | 2.no idea | 2.no idea | DMH have specific requests on the Cyclone warning, Tsunami Warning and Landslide warning of the EER service. DMH needs timely warning during the |
| Pakistan | 1.favorable | 1.favorable | 1.favorable | No |
| Russian Federation | N/A | 2.no idea | 2.no idea | |
| Saudi Arabia | 1.favorable | 1.favorable | 2.no idea | No |
| Thailand | 2.no idea | 1.favorable | 1.favorable | TMD requires the atmospheric transport products in various levels ranging from surface to 500hPa or above including particle dispersion. |
| Turkmenistan | N/A | N/A | N/A | |
| United Arab Emirates | 1.favorable | 1.favorable | 1.favorable | None |
| Uzbekistan, Republic of | 1.favorable | 1.favorable | 2.no idea | No |
| VIET NAM | 1.favorable | 1.favorable | 1.favorable | We need to send our people to join in EER training courses, conferences and seminars. |

Answers by NMHSs (4 Service Provision Measures 1/1)

| Country /State | 4a) | | 4b) | |
|---|---|---|---|---|
| China | 2.yes | We hope to continue with the fax service, because the e-mails are sometimes blocked. Meanwhile we also need to receive the important/particular information through fax in some special cases. | 1.excellent / 4. not good | This enables to analyze the situation online and sharing the experiences of other participants. |
| Hong Kong, China | 1.No | While it is not a strict necessity, it would be desirable to maintain the fax service as a backup channel for communication, as well as to receive notifications and products. | 2.good | Based on the experience in the past couple of exercises, the web pages are found to be rather useful for accessing the products. |
| Iran, Islamic Republic of | 1.No | No Necessity | 2.good | |
| Japan | N/A | | N/A | |
| Korea, Republic of | 2.yes | Fax transmission system is necessary as backup to e-mail and it is better to recognize Environmental emergency situation. | 2.good | |
| Kyrgyzstan | 1.No | | 2.good | |
| Macao, China | 2.yes | We recommend that the facsimile transmission system is still needed to be continued, in case of Internet service failure. | 2.good | |
| Mongolia | 1.No | | 2.good | |
| Myanmar | 2.yes | DMH necessitate the fax-service continuation because internet communication system is problem in Myanmar to open the URLs and use the web pages/emails. | 2.good | |
| Pakistan | 1.No | | 2.good | |
| Russian Federation | 1.No | | 2.good | |
| Saudi Arabia | 1.No | | 1.excellent | |
| Thailand | 2.yes | Facsimile transmission system is still necessary for backup system. | N/A | |
| Turkmenistan | N/A | | N/A | |
| United Arab Emirates | 2.yes | We support it as a back up means of delivery of the Service. | 2.good | |
| Uzbekistan, Republic of | 2.yes | Enhance of readiness for emergency situations and to strengthen monitoring of atmospheric air. | 1.excellent | This enables to analyze the situation online and sharing the experiences of other participants. |
| VIETNAM | 1.No | | 2.good | We usually use the seasonal and monthly outlook from these webpages. |

Answers by NMHSs (5 Requests (or questions) for the Activities 1/1)

| Country / State | 5) |
|---|---|
| China | If the new Transfer Matrix Coefficient analysis products are provided in future, could WMO provide the product standards and the TCM coefficient and programs? |
| Hong Kong, China | (a) It would be highly desirable to have 3-dimensional grid point values of the model output that can cover flight levels (e.g. in GRIB or other digital data format) for facilitating further analysis and post-processing of the products.<br>(b) It would be desirable to have more detailed information / procedure regarding request for non-nuclear environmental emergency response ATDM service. |
| Iran, Islamic Republic of | In the future with more exercise and working on the matter as a new task in our met service, we will come across with some technical and scientific issues and we should contact to make better services |
| Japan | |
| Korea, Republic of | |
| Kyrgyzstan | |
| Macao, China | Making the booklets or leaflet to provide a sample to introduce what is the standard procedure for respond the EER warning / exercise. |
| Mongolia | No |
| Myanmar | |
| Pakistan | 1. Why the products are not posted on a special ERA website?<br>2. How local data can be ingested |
| Russian Federation | |
| Saudi Arabia | Support and assist member states in RA II for the provision of products and services, in accordance with their responsibilities, at national level. RSMCs in RA II can play a major role in capacity development of members in RA II. |
| Thailand | 1. To distribute more products to members for utilizing in their works extensively.<br>2.To train members for having understanding of the products appropriately.<br>3.To present the products consistently in both usual and emergency situations.<br>4.ATDM forecast should be longer than 72 hours or above and running the model at least twice a day would be good. |
| Turkmenistan | The National Committee of Hydrometeorology under the Cabinet of Ministers of Turkmenistan does not study and does not monitor the spread of toxic radioactive materials. The function of our Committee include monitoring the weather and weather forecasting.[1] |
| United Arab Emirates | We just would like to thank you and acknowledge your efforts. |
| Uzbekistan, Republic of | Sending information not just through fax and e-mail too. |
| VIET NAM | -Ask the ERA to train our people to get use of the ATDM model<br>-Explore the capacity of setup and running a ATDM model in Viet Nam |

[1] The National Committee of Hydrometeorology under the Cabinet of Ministers of Turkmenistan replied this by an email message, not in the form

**ANNEX IV-1.1.2**

**Survey Report**

# User Request Survey on the Emergency Response Activities (ERA) in Regional Association II (Asia)

Theme Leader in Emergency Response Activities
/ Expert Group on Operational Forecasting
Under Working Group on Weather Services

## 1. Introduction

Results from the 15th Session of Regional Association II (RA II-15, Doha, 13 – 19 December 2012) included a decision to handle Emergency Response Activities (ERA) as part of work by the Expert Group on Operational Forecasting (EG-OF).

ERA was initiated in 1989 as the Environmental Emergency Response (EER) service launched by the Commission for Basic Systems (CBS) to meet broad interest in the atmospheric dispersion of toxic radiological materials following the Chernobyl Nuclear Power Plant accident in April 1986. The Regional Specialized Meteorological Centres (RSMCs) in Beijing (China), Obninsk (Russian Federation) and Tokyo (Japan) were designated at the 49th session of the WMO executive council in 1997, and began operation on 1 July of the same year. The three RA II RSMCs have committed to their respective contributions in the field.

The first time the International Atomic Energy Agency (IAEA) requested ERA support for an actual event was for the Fukushima Daiichi Nuclear Power Plant accident in March 2011. The three RSMCs in RA II provided Atmospheric Transport, Dispersion, and Deposition Modelling (ATDM) predictions to IAEA and WMO Members within their region of responsibility from March to May 2011. The 16th World Meteorological Congress (Cg-16) in 2011 noted the series of operational services and asked CBS to enhance such products and assistance for National Meteorological and Hydrological Services (NMHSs) [WMO No. 1077; Sixteenth World Meteorological Congress 3.1.3.23].

To enable the provision of better assistance to NMHSs, it is necessary to clarify their needs and how they can apply support from WMO ERA to their domestic services. Against such a background, EG-OF planned a user request survey on ERA in consideration of its usefulness not only to Members within their region but also to those in other Regional Associations, as RA II was only one of the regions that experienced the series of real-time operational services associated with the Fukushima Nuclear Power Plant accident. The 17th World Meteorological Congress (Cg-17) held in May and June 2015 noted the user request survey on ERA in RA II and encouraged Members to actively respond [WMO No.1157; Seventeenth World Meteorological Congress 4.1.46].

Before the user request survey, a concise explanatory material on EER was distributed and a questionnaire survey for non-registered Members was conducted within RA II in October 2014. This work coincided with invitation issuance and checking of contact point information for EER via a letter from the WMO Secretary General sent out on 19 September 2014 [ref. WDS/DPFS-ERA/2014]. One additional member in RA II responded with contact information and joined the

EER service framework. As a result of these consolidation efforts, the number of registered Members for EER in RA II rose to 29 of 35. The user request survey of 2016 incorporated these 29 registered Members.

## 2. Results

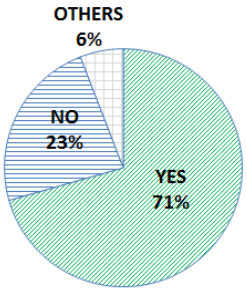
### 2.1 Survey results summary

The theme Leader in Emergency Response Activities (TL-ERA; a member of EG-OF) drafted a survey questionnaire and a brief introduction to ERA. The documents were reviewed by experts from the CBS Expert Team on ERA (ET-ERA), those in RA II, EG-OF coordinators, and the chair of the Working Group on Weather Services (WGWS). On 15 June 2016, the Regional Office for Asia and the South-West Pacific (RAP) of the WMO Development and Regional Activities (DRA) department distributed the brief introduction (Appendix I) to all 35 Members of RA II. RAP asked the 29 registered Members to complete the questionnaire (Appendix II) and return it to the designated EG-OF contact point. A total of 17 responses had been received by November 2016 (Appendix III).

The results of each question are summarized in 2.2 below, and brief remarks and comments on the requests along with questions from Members are noted in 2.3.

### 2.2 Results

This section presents responses to questionnaire survey. Two Members (Turkmenistan and Japan) did not answer the majority of the questions. When no appropriate answer was given, a response of "Others" was recorded. The item numbers for the questions below (underlined) correspond to those in Appendix II.

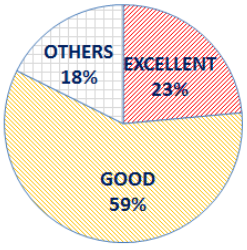



2 a) Does your organization have specific operations using the environmental emergency response (EER) service by RSMCs?

2.2.1 User satisfaction

2 a) Does your organization have specific operations using the environmental emergency response (EER) service by RSMCs?

A total of 12 Members (71%) reported "yes" to this question. Some of such Members planned to use the services in the future, while others indicated specific current usage in their domestic coordination. Four Members (23%) reported not using RSMC products.




2 b) What is your overall satisfaction rating with regards to the current ERA service?

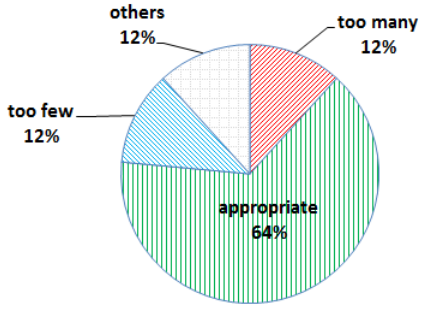
2 b) What is your overall satisfaction rating with regards to the current ERA service?

A total of 10 Members (59%) rated the current ERA service as good, and 4 (23%) rated it as excellent. No ratings of fair, not good, or poor were given. Accordingly, the overall level of satisfaction with the current service can be taken as good or higher. It should be noted that negative answers from respondents not

specifying any of the options presented are included in *others*.

2 c) What does your organization think regarding the current exercises on the EER service?

A total of 11 Members (64%) answered that the number was appropriate, 2 (12%) answered that there were too many, and 2 (12%) indicated that there were too few. It should be noted that 3 of the 4 answering too many or too few did not use the EER service in domestic coordination. The data suggest that the majority of current service users believe the current exercise frequency is generally appropriate.



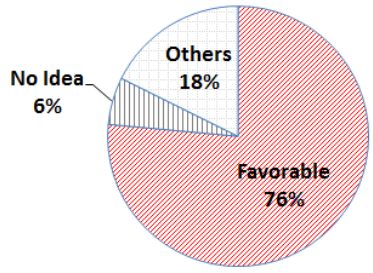

2 c) What does your organization think regarding the current exercises on the EER service?

2.2.2 Contents of the Service

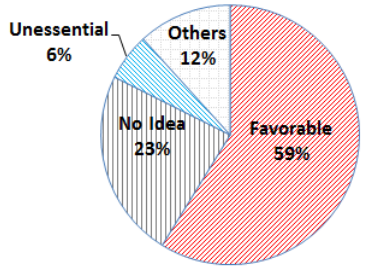
3 a) What does your organization think regarding products listed below?

This question probed interest in and the necessity of products currently evaluated by the ET-ERA. More than half of respondents indicated that such products are useful. The Time of Arrival (ToA) product proved to be the easiest to understand and the most favorable of the three.

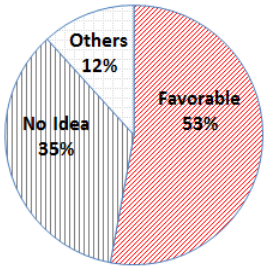
More than a third of respondents had no idea on the usage and/or usefulness of Transfer Coefficient Matrix (TCM) analysis with the ATDM model ensemble, which can be attributed to its status as a very new and unfamiliar technique. Some respondents also chose “no idea” for other candidates. Additional information is provided in 2.3.




3.a.i) Time of Arrival products




3.a.ii) Fixed legend products




3.a.iii) Transfer Coefficient Matrix analysis with the ATDM model ensemble

3 b) Does your organization have specific requests on the contents of the EER service?

The question invited specific Member requests regarding the service. Requests and questions from a total of five Members included three-dimensional ATDM results (and various representations thereof) and ensemble ATDM based on ensemble NWP forecasts from individual NWP centres.

2.2.3 Service Provision Measures

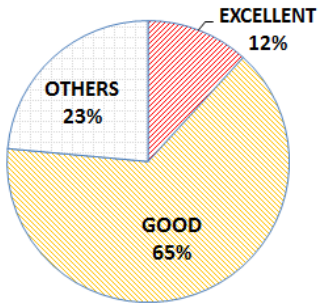
4 a) Does your organization have specific purposes to require continuation of the fax service for EER?

CBS has focused on a gradual migration from facsimile transmission to email and web based services for ATDM prediction. This question probed user preferences regarding service provision measures. A total of 8 Members (47%) reported no longer needing facsimile transmission, while 7 respondents (41%) indicated their necessity of the fax service continuity. The fax service appears to be used as backup for email and web provision. It should be noted that some Members rely exclusively on facsimile transmission based on the

results of email and fax transmission tests conducted by the three RSMCs.

4 b) What is your overall satisfaction rating with regards to the service through RSMCs' common web pages?

A total of 11 Members (65%) responded that the service through the common – mirrored web pages is good, with 2 (12%) giving a rating of "excellent." Overall satisfaction with the current web service appeared high. It should be noted that one of the respondents opted for two alternative options, and was included in the *Others* category.




4 b) What is your overall satisfaction rating with regards to the service through RSMCs' common web pages?

2.2.4 Requests/Questions Regarding Activities

This open question inviting requests and queries from Members drew a number of responses as outlined in 2.3 below.

## 2.3 Commentary on and Responses to User Questions

As some respondents chose "no idea (need more explanation)" in response to questions from 3 a i) to 3 a iii), additional information on ToA, fixed legend products, and TCM with the ATDM model ensemble are included. Comments and remarks on the user questions are following.

2.3.1 Time of Arrival (ToA)

Current products for EER consist of (Appendix II-7 of WMO 2010):

1. Three-dimensional trajectories starting at 500, 1500 and 3000 m above the ground, with particle locations at six-hour intervals (main synoptic hours up to the end of the dispersion model forecast);
2. Time-integrated airborne concentrations within the layer 500 m above the ground, in Bq s $m^{-3}$ for each of the three forecast periods;
3. Total deposition (wet + dry) in Bq $m^{-2}$ from the release time to the end of the three forecast periods.

ToA presents a different perspective, and is designed to predict the earliest arrival time of a specific air concentration. Details of the product are as yet undecided (e.g., whether concentration should be instantaneous or time-integrated concentration). Presentation of six-hour colored hatched arrival time areas on 24 hourly charts is currently planned as shown in 3 a) of Appendix I.

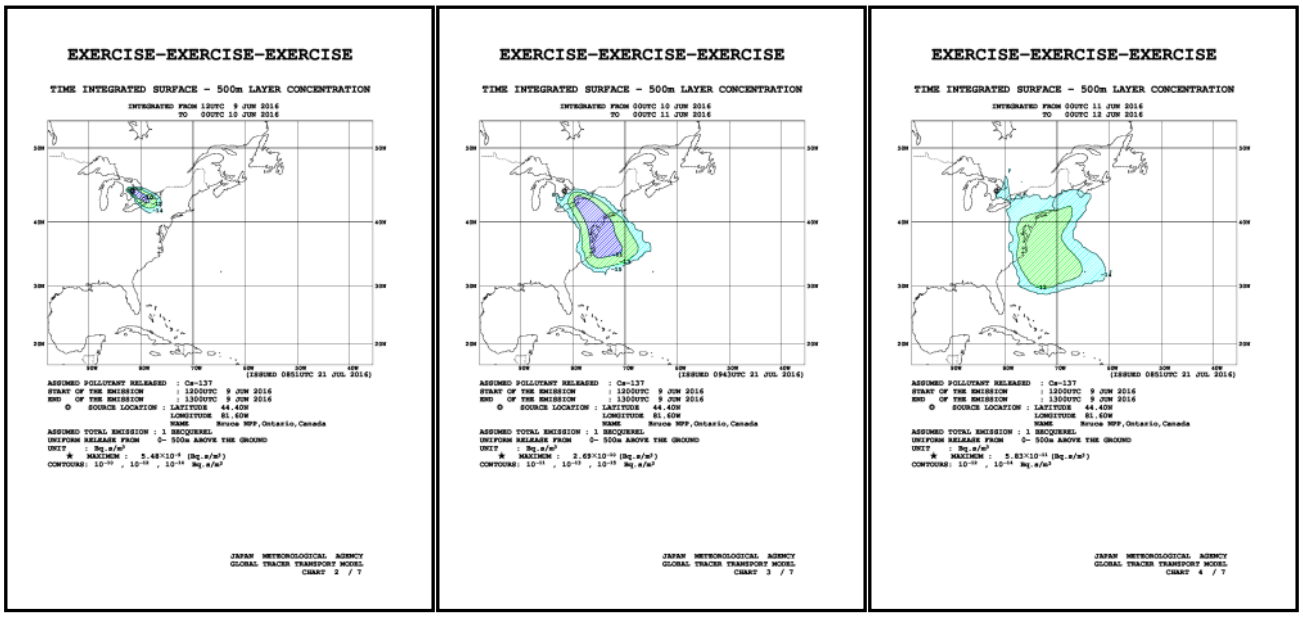
2.3.2 Fixed legend products

Appendix II-7 of WMO (2010) describes:

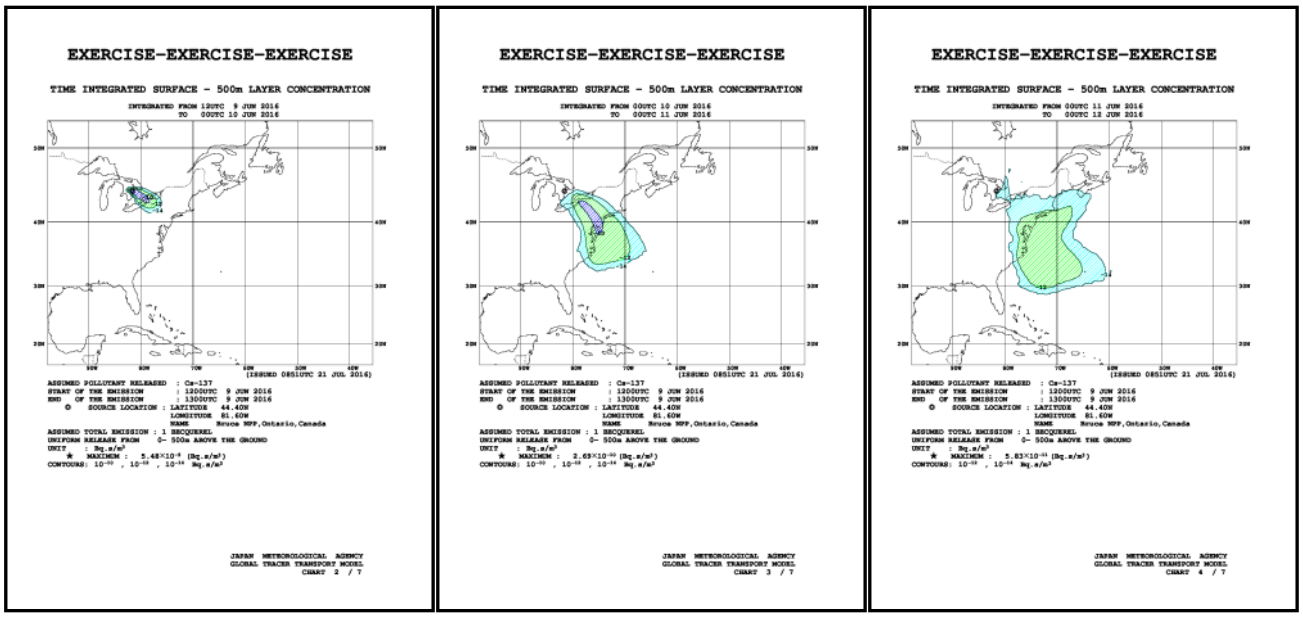
"(ii) Contour values may change from chart to chart".

Accordingly, contour values for time-integrated airborne concentrations and total depositions may differ among individual forecast periods (up to 24, 48, and 72 hours from the NWP forecast initial time). By way of example, RSMCs may present airborne concentrations using different contour values from chart to chart (as seen in the upper panels below) in accordance with WMO standards (2010). Users may misinterpret inter-map changes in contouring as sudden spreading of radioactive cloud (as seen in the upper-middle chart) following rapid dilution up to 72 hours

from the NWP initial time. The adoption of corresponding contour values facilitates intuitive understanding of charts, as seen in the lower panels.




Time-integrated airborne concentrations up to 24 hours (left), up to 48 hours (middle), and up to 72 hours (right) after the NWP initial time. The contours indicated are $10^{-10}$, $10^{-12}$, $10^{-14}$ Bq s/m$^3$ for the left and right panels, but $10^{-11}$, $10^{-13}$, and $10^{-15}$ Bq s/m$^3$ for the middle one.




The same figures but the all panels use the same contour values of $10^{-10}$, $10^{-12}$, and $10^{-14}$ Bq s/m$^3$

### 2.3.3 Transfer Coefficient Matrix (TCM) analysis with the ATDM model ensemble

In the early stages of accidental toxic material release, exact amount and release time are usually unknown. However, the accuracy of such information has a dominant impact on the results of ATDM forecasts. When the results of related isotope monitoring become available, ATDMs can be useful in the estimation and quantification of data on release at the source. One

such technique, known as TCM (transfer coefficient matrix) evaluation, was developed by Draxler and Rolph (2012).

ATDM forecasts are also influenced by NWP forecast quality and modeling techniques in ATDMs. The results of estimation regarding release times and amounts are also significantly dependent on these variables (WMO 2013). Accordingly, evaluation of the impacts and influence of different NWPs and ATDMs on transport and dispersion modeling results is important. ET-ERA plans to conduct an experiment on TCM analysis with an ATDM model ensemble in the near future.

2.3.4 Responses to user requests and questions

"Making the booklets or leaflet to provide a sample to introduce what is the standard procedure for respond the EER warning / exercise." (Macao, China)

Concise examples are presented in a leaflet titled "The Environmental Emergency Response for WMO Members in Regional Association II (Asia)" distributed to RA II Members by RAP in October 2014.

Related information is available in WMO Technical Document 778 (TD778) titled "Documentation on RSMC Support for Environmental Emergency Response" at http://www.wmo.int/pages/prog/www/DPFSERA/td778.html.

"ATDM forecast should be longer than 72 hours or above and running the model at least twice a day would be good." (Thailand)

Longer ATDM forecasts have been discussed by ET-ERA and its predecessors. However, the accuracy of NWPs used for ATDMs decreases with longer forecast times.

As for the frequency of the service, there was a description regarding a 12-hourly update of ATMD forecasts in TD778, but this was withdrawn in March 2011 in line with a suggestion by WMO DPFS.

"If the new Transfer Matrix Coefficient analysis products are provided in future, could WMO provide the product standards and the TCM coefficient and programs?" (China)

The TCM system is being evaluated by ET-ERA (including product standards). An example of how a web-based TCM system may look is provided on the NOAA Air Resource Laboratory (ARL) website at https://ready.arl.noaa.gov/READY_fdnpp.php.

We have no idea regarding if ARL can make available their programs for others.

"How local data can be ingested" (Pakistan)

There is currently no formal procedure for the adoption of local monitoring data. Application to post analysis (as per TCM) may be implemented in the future.

"We would like to propose to increase EER exercises in RA II at biannual basis." (Saudi Arabia)

RA II RSMCs participate in one of the WMO quarterly EER exercises (conducted in February, May, August and November) in each year. As IAEA did not ask the RSMCs to distribute ATDM charts to Members during the exercises (i.e., the quarterly test in May and Convex-2d in October 2016), no ATDM forecast distribution was seen in RA II for this year.

"Support and assist member states in RA II for the provision of products and services, in accordance with their responsibilities, at national level. RSMCs in RA II can play a major role in capacity development of members in RA II." (Saudi Arabia)

This was recognized at the 15th session of CBS [4.4.37, WMO 2012]. The issue was also discussed at the ET-ERA meeting in 2013, resulting in the note, "Face-to-face training workshops

require significant human and budgetary resources, and that may not reach a large audience, the meeting agreed that elearning modules and webbased courses may be more appropriate." Web-based materials are currently available as per Technical Document 778 at http://www.wmo.int/pages/prog/www/DPFSERA/td778.html

### 3. Concluding Remarks on the Survey

EG-OF sincerely appreciates the Member responses. This survey was the first attempt, and the results have helped to clarify matters regarding user satisfaction, impressions of service content and opinions on related provision measures as well as associated requests and questions. The positive evaluation provided by the majority of respondents is truly encouraging, and the suggestions/opinions on current and potential future activities are very much appreciated.

The results can be summarized as follows:

- ✓ Most respondents indicated a need for ERA products for their activities, and reported relatively high levels of satisfaction with the current service.
- ✓ User impressions of ET-ERA's candidate products were relatively positive.
- ✓ Nearly half of all respondents requested ongoing fax service. Impressions of the current web service were relatively good.

Opinions and suggestions from Members will be conveyed to the relevant entities of WMO. Such feedback is invited to support the improvement of future WMO ERA activities.

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## Report by the Theme Leader in Emergency Response Activities for 2016

Masami SAKAMOTO, Japan Meteorological Agency

### Executive Summary

A user request survey on the Emergency Response Activities (ERA) in the Regional Association II (RA II) was conducted, and the results were reported to the coordinators of Expert Group on Operational Forecasting (EG-OF) by Theme Leader in Emergency Response Activities (TL-ERA).

The Regional Specialised Meteorological Centres in the region (RSMCs Beijing, Obninsk, and Tokyo) have continued their efforts to maintain contact information for the registered members for the Environmental Emergency Response (EER).

### 1. Background

This report summarizes the activities in 2016 by the Theme Leader in Emergency Response Activities (TL-ERA), who is responsible for the Emergency Response Activities (ERA) in the Regional Association II (RA II: Asia) as a member of the Expert Group on Operational Forecasting (EG-OF). The main objectives of the activities by TL-ERA are;

1) monitoring of the provision of products and services by the designated global data-processing and forecasting system (GDPFS) centres within the framework of ERA,

2) advising on evolving requirements for ERA operational systems and services.

### 2. A User Request Survey on ERA

According to the action plan of EG-OF, TL-ERA drafted a survey questionnaire and a brief introductive material regarding ERA. The documents were reviewed by experts in CBS Expert Team on ERA (ET-ERA) and relevant experts in RA II (Mr. W. M. Ma of Hong Kong Observatory and Dr. S. Kim of NIMR/KMA). The coordinators of EG-OF and the chair of the Working Group on Weather Services (WGWS) also reviewed and gave advices on them.

On 15 June 2016, the Regional Office for Asia and the South-West Pacific (RAP) in the WMO Development and Regional Activities (DRA) department distributed the brief introduction to all 35 Members in RA II. RAP asked 29 registered Members to fill in the questionnaire form, and to send it back to TL-ERA. For Members who did not reply by the initial deadline of the first day of July, TL-ERA asked the contact points of the Members for the Environmental Emergency Response (EER) service to respond to the survey. 17 out of 29 registered Members have responded by November.

The report of the survey was drafted by TL-ERA, and then the documents were reviewed by the exports of ET-ERA and RA II. The report was submitted to the coordinators of EG-OF in November. It should be noted that the seventeenth World Meteorological Congress (Cg-17) in 2015 noted this user request survey in RA II, and encouraged Members to actively respond [WMO No.1157 4.1.46].

### 3. Email / Fax Tests

RSMCs in RA II continue the effort to confirm the email and fax communication for EER service since 2010. As a result of the efforts by RSMCs Beijing, Obninsk, and Tokyo, the

reachability to the registered NMHSs in RA-II is 100%, and more than 85% of the registered members specify their operational contact points appropriately. To maintain such a good connectivity, RSMCs are encouraged to continue their efforts.

The current (as of 24 November 2016) statuses of the members are;

i. Registered and reachable members (29 members)

i.a) with the operational contact point information specified (25 members):

Bahrain, Bangladesh, China, Hong Kong, India, Islamic Rep. of Iran, Japan, Kazakhstan, Kyrgyzstan, Macau, Mongolia, Myanmar, Oman, Pakistan, Rep. of Korea, Rep. of Uzbekistan, Rep. of Yemen, Russian Federation, Saudi Arabia, Sri Lanka, State of Kuwait, Tajikistan, Turkmenistan, Thailand, United Arab Emirates,

i.b) without the operational contact point information specified (4 members):

Iraq, State of Qatar, Socialist Rep. of Viet Nam, Democratic People's Rep. of Korea

ii. Registered but not reachable member (zero member):

iii. Non-registered members (6 members):

Afghanistan, Bhutan, Cambodia, Lao, Maldives, Nepal.

## 4. Other Business

A quarterly test of the Environmental Emergency Response (EER) for RA II was conducted on 17 May, but the Incident Emergency Centre (IEC) of the International Atomic Energy Agency (IAEA) made a private request, which asked RSMCs to provide services only to the requestor. The message of the Early Notification of a Nuclear Accident (EMERCON / WNXX01 IAEA) was delivered thought the Global Telecommunication System (GTS) at the exercise.

An international exercise ConvEx-2d was conducted by IAEA on 5 October. IAEA sent no message to WMO, while the manual of IAEA [EPR-IEComm 2012] describes the participation of WMO to the exercise as is shown below,

"This exercise is conducted once every four years on a specified announced date and lasts no more than 8 hours (elapsed time). In advance of this exercise, the IEC invites all Contact Points to participate. This exercise is conducted jointly with the WMO and is expected to involve national meteorological services."

# Report of the RA II Working Group on Climate Services (WGCS)

**Akihiko Shimpo, Japan Meteorological Agency**

**Chairperson of the RA II Working Group on Climate Services**

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**Ghulam Rasul, Ryuji Yamada and Akihiko Shimpo**
**Co-coordinators, Expert Group on Climate Services**

**Nabansu Chattopadhyay and Alexander Kleschenko**
**Co-coordinators, Expert Group on Agrometeorology**

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## Report of the RA II Working Group on Climate Services (WGCS)

### 1 Introduction

The WMO RA II Working Group on Climate Services (WGCS) was established considering that the Regional Association II (RA II) should continue to play an important and active role in the implementation of WMO regional activities in the field of climate services including agrometeorological services, with particular attention to matters relevant to implementation of the Global Framework for Climate Services in the Region. WGCS will work on climate and agrometeorological issues laid out in the terms of references in close cooperation with WMO's Technical Commissions, in particular, the Commission for Climatology (CCl) and the Commission for Agrometeorology (CAgM).

### 2 Working Group Structure

The Working Group is composed of Expert Groups for Climate Services (EG-CS) and Expert Group for Agrometeorology (EG-AgM). Both EG-CS and EG-AgM consist of two co-coordinators and five theme leaders. In addition, a number of volunteer experts who are expected to assist the tasks of each Expert Team have also been registered.

### 3 Terms of Reference

(a) To provide assistance and advice to the president of Regional Association II on all matters pertaining to the regional aspects of the relevant components of the World Climate Programme and the Agricultural Meteorology Programme and, in particular, to assist and advise the president of RA II on matters relevant to implementation of the Global Framework for Climate Services in the Region;
(b) To cooperate with the Commission for Climatology and the Commission for Agricultural Meteorology and other WMO bodies on activities related to climate services;
(c) To undertake and to coordinate activities relating to climate services as listed in the EG-CS and EG-AgM, respectively;
(d) To report, through the chair of the WGCS, to the president of RA II on an annual basis on activities relative to the above terms of reference.

## 4 Membership of Working Group

### Expert Group on Climate Services (EG-CS)

| EG-CS | Name | Country |
|---|---|---|
| Co-Coordinators | (~2014) Mr Ryuji Yamada<br>(2015~) Mr Akihiko Shimpo | Japan |
| | Dr Ghulam Rasul | Pakistan |
| Theme Leader in User Liaison and Applications of Climate Information and Products for Climate Risk Management and Adaptation to Climate Change | Dr Ali Karem Kadhum | Iraq |
| Theme Leader in QMS Implementation and Operation of Regional Climate Centres | Mr Peiqun Zhang | China |
| Theme Leader in Operational Regional and National Climate Outlook Forums | Dr A. K. Srivastava | India |
| Theme Leader in Climate Monitoring and Climate Watch | Ms Yuliya Plotnitskaya | Uzbekistan |
| Theme Leader in Climate Research for Development | Ms Yuping Yan | China |

### Expert Group on Agrometeorology (EG-AgM)

| EG-AgM | Name | Country |
|---|---|---|
| Co-Coordinators | Dr N. Chattopadhyay | India |
| | Dr Alexander Kleshchenko | Russian Federation |
| Theme Leader in Agrometeorological Training Needs | Ms Feruza Rakhmanova | Uzbekistan |
| Theme Leader in Soil Moisture Monitoring | Ms Xuefen Zhang | China |
| Theme Leader in Drought Preparedness and Management Strategies | Mr Mir Hazrat | Pakistan |
| Theme Leader in Seasonal Climate Forecast Applications for Agriculture | Mr Liuxi Mao | China |
| Theme Leader in Socio-economic Impact of Agrometeorological Information | Mr Kamalesh Kumar Singh | India |

## 5 Development of Work Plan

A work plan for the WG-CS was developed by co-coordinators of Expert Group on Climate Services and Expert Group on Agrometeorology, with the help of theme leaders and the WMO secretariat. The work plans for the WG-CS were submitted to the WMO Secretariat in December 2013 for 2013-2016 and August 2016 for 2016-2017.

The work plans were developed mainly based on the deliverables outlined in the RA II Strategic Operating Plan, terms of reference of the Expert Groups. The plan consists of: (1) Tasks; (2) Key deliverables; (3) Activities; (4) Timelines and (5) Responsible Theme Leaders/Co-coordinators.

Tasks for EG-CS and EG-AgM were established in the work plans and each task includes several relevant activities. Theme leaders of EG-CS and EG-AgM are expected to take a role in the said activities with the support of, and coordination with, co-coordinators.

## 6 Expert Group on Climate Services

A report of activities on EG-CS is available in ANNEX IV-2.1. Its contents are following.

(i) Implementation and development of Regional Climate Centers (RCCs)

(ii) Progress in the implementation of Regional Climate Outlook Forums (RCOFs)

(iii) User interface for climate services

(iv) Pilot Project on Information Sharing on Climate Services

(v) Capacity development activities for climate services

(vi) Commission for Climatology (CCl) and RA II activity

## 7 Expert Group on Agrometeorology

A report of activities on EG-AgM is available in ANNEX IV-2.2. Its contents are following.

(i) Introduction

(ii) Operational Agromet Advisory Services

(iii) Agromet products under Agromet Services

(iv) Capacity Building Programs

(v) Agrometorology under Global Framework for Climate Services (GFCS)

(vi) Drought Preparedness and Management Strategies

(vii) Economic Impact of Agromet Advisory Services

# Report of the RA II Expert Group on Climate Services (EG-CS)

## 1 Implementation and development of Regional Climate Centers (RCCs)

Three WMO Regional Climate Centers (RCCs) have been operating in RA II. The Beijing Climate Center (BCC) of the China Meteorological Administration (CMA) and the Tokyo Climate Center (TCC) of the Japan Meteorological Agency (JMA) were formally designated as WMO RCCs in RA II in 2009, and the North Eurasia Climate Centre (NEACC) coordinated by ROSHYDROMET, Russian Federation was also formally designated as WMO RCC in RA II in 2013. These RCCs have conducted a variety of RCC-related activities, including the dissemination of climate data/products and the organization of training workshops for capacity development in accordance with RCC mandatory functions. A portal site regarding RCCs in RA II is available (http://www.rccra2.org/).

To be a new RCC in RA II, the National Climate Centre of India Meteorological Department (IMD), Pune, began a demonstration phase as a candidate RCC in May 2013. After the success of its demonstration phase, IMD Pune was recommended to the formal designation as a new RCC in RA II, namely RCC Pune, at the sixteenth session of the Commission for Basic Systems (CBS) held in November 2016. Based on this recommendation by CBS, IMD Pune is expected to be formally designated and to start its operational activity as an RCC in 2017. It is noted that the experts of EG-CS reviewed the activities conducted by IMD Pune during its demonstration phase and supported the President of RA II for the designation process of RCC.

It is noted that Iran and Saudi Arabia have expressed interest in hosting WMO RCCs.

## 2 Progress in the implementation of Regional Climate Outlook Forums (RCOFs)

In RA II, Regional Climate Outlook Forums (RCOFs) are convened regularly. These include:

- the Regional Climate Monitoring, Assessment and Prediction for Regional Association II (FOCRA II) coordinated by China since 2005,
- the South Asian Climate Outlook Forum (SASCOF) coordinated by India since 2010,
- the North Eurasian Climate Outlook Forum (NEACOF) coordinated by NEACC since 2011,
- the East Asia winter Climate Outlook Forum (EASCOF) coordinated by Japan, Mongolia and Republic of Korea since 2013, and
- ASEAN Climate Outlook Forum (ASEANCOF; including some RA V Members) since 2013.

RCOFs in RA II held between 2014 and 2016 are listed in Annex IV-2.1.1. RCOF is mainly conducted to produce a consensus statement on seasonal forecast for each targeted region. In addition to this purpose, it is emphasized that RCOF is a good opportunity for experts from RA II Members to communicate each other and exchange their knowledge and experiences for climate services.

## 3 User interface for climate services

There is a recognized need to encourage the exchange of good practices and the sharing of experiences in the application of climate information among NMHSs and to strengthen user-provider interaction. Some RCOFs including FOCRAII and SASCOF have provided such opportunities by inviting experts from user sectors, such as agriculture and health, to the meeting and by listening to their needs for climate information.

## 4 Pilot Project on Information Sharing on Climate Services

For the successful implementation of GFCS, it is important to share good practices and lessons learned, including experienced project management capabilities, to develop projects and improve climate services by NMHSs as well as to avoid duplication and minimize the risk of failure. The WMO RA II's fifteenth session decided to establish a pilot project on information sharing on climate services. The project aims at sharing information on climate services and best practices of climate information among NMHSs in the region for the successful implementation of GFCS. TCC has been designated as Lead for the project to establish and maintain a dedicated website.

TCC has operated the dedicated website launched in March 2014 (http://ds.data.jma.go.jp/tcc/pilot/) and carried out the second questionnaire survey in August 2015, aiming to update on the website and to enhance the information about the concrete examples or good practices of the utilization of climate information. The updated information is available on the website since December 2015.

## 5 Capacity development activities for climate services

A number of capacity development activities, such as training events and expert visits have been conducted in the region organized by WMO Regional Training Centres, RCCs (BCC, NEACC and TCC) and some NMHSs. Such events have also been held in conjunction with RCOFs including FOCRAII, SASCOF and NEACOF. Many of these events have been conducted on a practical basis so that trainees could apply what they learnt to their operational climate services soon after returning to home countries.

Capacity development activities (training events) conducted between 2014 and 2016 are listed in Annex IV-2.1.2.

In addition to the activities listed in Annex IV-2.1.2, it is noted that the Regional Consultation meeting on climate services in the North-Eurasian countries was held in Sochi, Russian Federation on 19-20 October 2015. This regional consultation meeting aimed to integrate efforts of experts from NMHSs in the region with users of climate information from the priority areas of the GFCS for the purpose defining priorities for more effective production and use of global, regional and national climate and forecasting information by all interested parties in climate-sensitive sectors in all North-Eurasian countries. It resulted in: (i) enhanced understanding of the needs for climate services in different user sectors; (ii) clear understanding of capacity development needs to implement the GFCS at regional and national levels; (iii) strategic guidance on institutional arrangements, partnerships and processes required to operationalize the GFCS at the regional and national level.

## 6 Commission for Climatology (CCl) and RA II activity

The Management Group of the WMO Commission for Climatology (CCl-MG) invited the representatives of the working group on climate or climate issues in RAs to the second meeting (October 2015) and the third meeting (September 2016) of the CCl-MG, so that the Chair of WGCS in RA II participated in the meeting. At the meetings, it is recognized that sharing information among CCl and the working groups on climate or climate issues in RAs are important to enhance activities at the regional level.

## Regional Climate Outlook Forums (RCOFs) in RA II between 2014 and 2016

<2014>

| Name | Dates | Venue | Participants |
|---|---|---|---|
| SASCOF-5 | 22-23 April | Pune, India | Experts of NHMSs from 8 South Asian countries and international experts |
| FOCRAII-10 | 23-25 April | Beijing, China | More than 80 experts from 19 WMO Members including 12 RA II Members (China, DPRK, Hong Kong, Japan, Korea, Macao, Laos, Maldives, Mongolia, Pakistan, Russia, Thailand, Yemen) |
| NEACOF-6 | End of May | (via Internet) | Experts of NHMSs from CIS countries |
| ASEANCOF-2 | 29 May | (via Internet) | Experts of NHMS from ASEAN countries and international experts |
| EASCOF-2 | 29-31 October | Tokyo, Japan | More than 30 experts from China, Japan, Republic of Korea and Mongolia |
| ASEANCOF-3 | 17-19 November | Singapore | Experts of NHMS from ASEAN countries and international experts |

<2015>

| Name | Dates | Venue | Participants |
|---|---|---|---|
| SASCOF-6 | 21-22, April | Dhaka, Bangladesh | Experts of NMHSs from South Asian countries and international experts |
| FOCRAII-11 | 11-13, May | Beijing, China | More than 90 experts from 20 WMO Members including 14 RA II Members (China; DPR of Korea; Hong Kong, China; Japan; Kazakhstan; Lao PDR; Macao China; Maldives; Mauritius; Mongolia; Pakistan; Republic of Korea; Russian Federation; Thailand) |
| ASEANCOF-4 | 21-22, May | Jakarta, Indonesia | Experts of NMHS from ASEAN countries and international experts |
| SASCOF-7 (WinSASCOF) | 14-16, October | Chennai, India | Experts of NMHSs from South Asian countries and international experts |
| EASCOF-3 | 3-5, November | Seoul, Republic of Korea | More than 50 experts from China, Japan, Mongolia and Republic of Korea |
| NEACOF-9 | 10-12, November | Moscow, Russian Federation | 45 experts from 9 NMHSs of CIS countries (Armenia; Azerbaijan; Belarus; Kazakhstan; Kyrgyzstan; Moldova; Russian Federation; Tajikistan; Uzbekistan) |
| ASEANCOF-5 | 18-19, November | Singapore | Experts of NMHS from ASEAN countries and international experts |

<2016>

| Name | Dates | Venue | Participants |
|---|---|---|---|
| FOCRAII-12 | 7-9, April | Guangzhou, China | Experts of NMHS in RA II Members and international experts |
| SASCOF-8 | 25-26, April | Colombo, Sri Lanka | Experts of NMHS from South Asian countries and international experts |
| NEACOF-10 | May | (via internet) | Experts of NMHS from CIS countries |
| ASEANCOF-6 | May | (via internet) | Experts of NMHS from ASEAN countries and |

| | | | |
|---|---|---|---|
| | | | international experts |
| SASCOF-9 | 27-28, September | Nay Pyi Taw, Myanmar. | Experts of NMHS from South Asian countries and international experts |
| EASCOF-4 | 8-9, November | Ulaanbaatar, Mongolia | Experts from China, Japan, Mongolia and Republic of Korea |
| ASEANCOF-7 | 17-18, November | Manila, Philippines | Experts of NMHS from ASEAN countries and international experts |

(Reference)
ASEANCOF: http://asmc.asean.org/asmc_asean_cof_about/
EASCOF: http://ds.data.jma.go.jp/tcc/tcc/library/EASCOF/
FOCRAII: http://bcc.cma.gov.cn/channel.php?channelId=70
NEACOF: http://neacc.meteoinfo.ru/neacc/north-eurasian-climate-outlook-forum/
SASCOF: http://www.imdpune.gov.in/Clim_RCC_LRF/Events.html

## Capacity development activities (training events) conducted in RA II between 2014 and 2016

(2014)

| Events/Activities | Dates | Venue | Organ-izer | Participants |
|---|---|---|---|---|
| Capacity Building Training Workshop on Seasonal Prediction (followed by SASCOF-5) | 14-21 April | Pune, India | IMD | Experts of NHMSs from 8 South Asian countries (Afghanistan, Bangladesh, Bhutan, Maldives, Myanmar, Nepal, India and Sri Lanka) and international experts |
| International Training Course on Short-term Climate Prediction Methods (followed by FOCRAII) | 14-25 April | Beijing, China | RTC Beijing | 18 experts of 14 NMHSs including those from 9 Members in RA II (DPRK, Hong Kong, Laos, Maldives, Mongolia, Pakistan, Russia, Thailand and Yemen) |
| Training for Central Asian NMHS specialists in area of Long-range forecasting | 26-30 May | Almaty, Kazakhstan | NEACC | 9 experts from NHMS of Central Asia countries |
| Expert visit on the generation of guidance for seasonal forecasts using the statistical downscaling technique | 24-26 June | Nay Pyi Taw, Myanmar | TCC | 15 experts of the Department of Meteorology and Hydrology |
| Eleventh International Seminar on Climate System and Climate Change | 14-25 July | Beijing, China | BCC | More than 100 experts from 14 WMO Members including 5 RA II Members (Kazakhstan, Pakistan, Myanmar, Mongolia, Hong Kong) |
| International Training Course on Climate Monitoring, Prediction and Application | 20-31 Oct. | Beijing, China | RTC Beijing | 16 experts of 10 WMO Members including 6 RA II Members (Republic of Korea, Hong Kong, Myanmar, DPRK, Oman, Pakistan) |
| Training Seminar for NMHS specialists from Tajikistan | 5-7 Nov. | Moscow, Russia | NEACC | Two experts from NHMS of Tajikistan |

(2015)

| Events/Activities | Dates | Venue | Organ-izer | Participants |
|---|---|---|---|---|
| TCC Training Seminar on Global Warming Projection Information | 26-30, January | Tokyo, Japan | TCC | 13 experts from NMHSs of Asia-Pacific region |
| Expert visit on the generation of global warming prediction information | 25-27, March | Bangkok, Thailand | TCC | 12 experts of the Thai Meteorological Department |
| Capacity Building Training Workshop on Seasonal Prediction | 19-20, April | Dhaka, Bangladesh | IMD | Experts of NHMSs from South Asian countries |

| | | | | |
|---|---|---|---|---|
| (followed by SASCOF-6) | | | | |
| International Training Course on Short-term Climate Prediction Methods (followed by FOCRAII-11) | 14-22, May | Beijing, China | RTC Beijing | 25 experts of 18 NMHSs including those from 9 Members in RA II (DPR of Korea; Hong Kong, China; Lao PDR; Macao, China; Maldives; Mauritius; Mongolia; Pakistan; Thailand) |
| Expert visit on the generation of global warming prediction information | 23-26, June | Sri Lanka, Colombo | TCC | 12 experts of the Department of Meteorology of Sri Lanka |
| Twelfth International Seminar on Climate System and Climate Change | 20-31, July | Lanzhou, China | BCC | More than 100 experts from 10 WMO Members including 5 RA II Members (Kyrgystan; Mauritius; Myanmar; Pakistan; Thailand) |
| TCC Training Seminar on One-month Forecast | 16-20, November | Tokyo, Japan | TCC | 15 experts from NMHSs of Asia-Pacific region |

(2016)

| Events/Activities | Dates | Venue | Organ-izer | Participants |
|---|---|---|---|---|
| Expert visit on One-month Forecast | 5-7, April | Hanoi, Viet Nam | TCC | 18 experts of the National Center for Hydro-Meteorological Forecasting of Viet Nam |
| The Climate service training course | 5-15, April | Beijing, China | BCC | 29 participants from 10 WMO members including 2 RAII members (Thailand and the kingdom of Bhutan) |
| Thirteenth International Seminar on Climate System and Climate Change | 11-22, July | Chengdu, China | BCC | 165 participants from 12 WMO members including 4 RA II members (Pakistan, Thailand, Myanmar, Mauritius) |
| Expert visit on One-month Forecast | 2-4, August | Phnom Penh, Cambodia | TCC | 10 experts of the Department of Meteorology of Cambodia |
| TCC Training Seminar on Primary Modes of Global Climate Variability and Regional Climate | 14-18, November | Tokyo, Japan | TCC | 14 experts from NMHSs of Asia-Pacific region |

**Report of the RA II Expert Group on Agrometeorology (EG-AgM)**

**TABLE OF CONTENTS**

## Introduction

Increased frequency of climate extremes is another face of climate change confronted by humans, resulting in catastrophic losses in agriculture. While climate extremes take place on many scales, impacts are experienced locally and mitigation tools are a function of local conditions. To address this, agrometeorological advisories along with early warning systems must be place and location based, incorporating the climate, crop and land attributes at the appropriate scale. Existing services in RA II region often lack site-specific information on adverse weather and countermeasures relevant to farming activities. Warnings on chronic long term effects of adverse weather or combined effects of two or more weather elements are seldom provided, either. At present in RA-II countries agrometeorological activities are conducted within the Ministry of Agriculture or jointly by the Ministry of Agriculture and the meteorological organizations. The Republic of Kazakhstan is the first country in RA II that initiated agrometeorological operations in 1922. Later on, India, China and Viet Nam joined this area of activity in 1945, 1953 and 1960, respectively. Bangladesh was the last country to begin agrometeorological operations in 1986. The Operational Agrometeorological Services in RA-II region have been divided into different categories like status of issuance of Agromet Bulletins, Agromet Products, Climate Services, Capacity building and Economic Analysis etc. Numbers of on-going and new activities in recent past are summarized below.

## Operational Agromet Advisory Services

Agromet bulletins are prepared in different forms in various countries because of independent observational methods. Out of 34 Member counties in RA II, 14 countries (Bangladesh, Qatar, Japan, Nepal, Viet Nam, South Korea, Uzbekistan, Kazakhstan, Mongolia, India, Thailand, China, Laos, and Iran) informed that they were furnished with an agrometeorological service, which issued agrometeorological bulletins. Such activities in the 11 counties were conducted within their National Meteorological Services (NMSs). In Qatar, agrometeorological activities are conducted within the Ministry of Agriculture. In Japan and Viet Nam, such operations are managed jointly by the Ministry of Agriculture and the Meteorological Organization. In Uzbekistan, Cambodia, weekly bulletins are provided during the cultivating period to identify the best time for crop management. In Nepal, weekly bulletins just represent climate information. In Iran, weekly, monthly and seasonal bulletins include climate as well as soil and canopy information. Ten-day bulletins are regularly prepared in all countries except Qatar, Nepal, Thailand, India and Laos, and include different types of information. In Bangladesh, Srilanka, Thailand, Malaysia, and Japan only climate information is provided, while in the other countries, including Bahrain, Viet Nam, South Russia, Korea, Uzbekistan, Kazakhstan, Iran, China and Mongolia climate, soil and canopy parameters are observed and included in 10-day bulletins. In Mongolia, in addition to the above mentioned types of information, pasture and animal husbandry related matters are also contained in 10-day bulletins.

In Bangladesh, Qatar, Japan, Kazakhstan, Thailand and Laos no monthly bulletins are prepared, while in other countries monthly bulletins with information on soil, climate and canopy are given to users. In addition to weekly, 10-day , fortnightly bulletins and monthly bulletins, other kinds of publications, such as seasonal bulletins are prepared for each product based on observed climate, soil and canopy parameters in Bangladesh, Viet Nam, Uzbekistan Pakistan and Iran. In particular, in Viet Nam special reports are prepared for climate related impacts on vegetation, forest, farming and other agricultural sectors.

The agrometeorological weather forecast is one of the most important items focused on in these bulletins. In this context, short- and long-term forecasts bear particular importance in each bulletin, and users widely apply their information. All the countries in the region have agrometeorological databanks, including phenological observations for different cultivated plants, and data for soil and climate Data quality controls based on standards are regularly accomplished.

In most countries of the region, news and information are broadcasted through the mass media in critical situations, particularly to farmers. In India Hon'ble Union Minister of Agriculture launched the Nowcast-Extreme Weather Alert Services to farmers on 18th June, 2015 for providing localised Extreme Weather Warnings to more than 1 core farmers registered on mKisan portal of Ministry of Agriculture. These Nowcast alerts are based on DWR data and are issued few hours before the event to alert the farming community about the occurrence of the adverse weather.

On the picture 1 data is presented obtained from International Bank of Reconstruction and Development – it shows the distribution of losses due weather among sectors of Russian economy. You see that agriculture is on the first place. Therefore, Russia pays great attention to the agrometeorological service of agriculture at various levels.

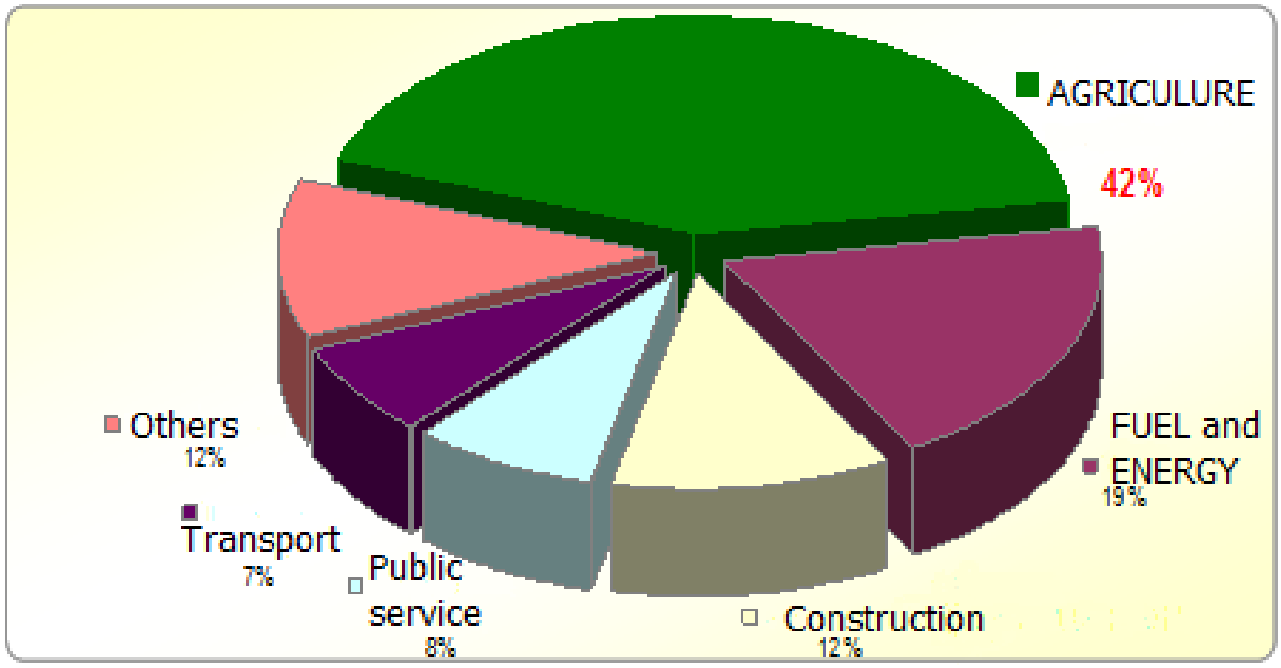



**Figure 1 - Distribution of losses from weather**

On the picture 2 shows the scheme of agro-meteorological support on the federal level of country. The total chain is shown – from receiving information, through processing to submitting results to end users. The output documents could be divided on three groups – bulletins, forecasts and others, such as reviews, analytical reports, etc. The start of the bulletins issued is 1921.

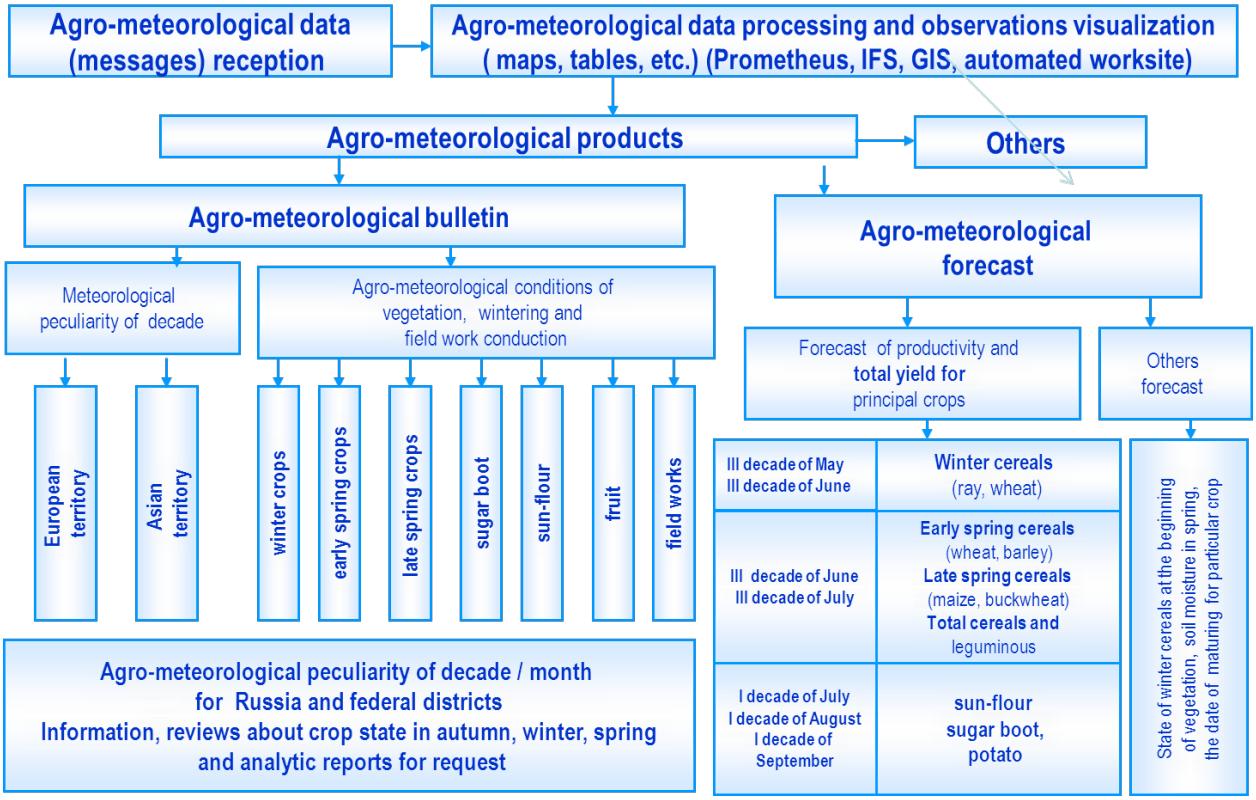



**Figure 2 - Agro-meteorological support of Russian agriculture on federal level**

Bulletin content is::
Weather on the territory in the period (details with real data, especially temperature)
Precipitation (real and norm percent), soil moisture and state
For main cultivated crops (winter and spring cereals, potato, beat, sunflower, etc):
Phases, density, expected productivity, conditions (favorable or bad) for the past and for the future
The most important forecasts are shown there. The regional level characterizes the territory restriction and it conducts by the regional agro-meteorological bodies. At the local level a station provide information to local agricultural enterprise.
The very important aspect is the visualization. The several packages or systems were developed and use at various levels. The one example of corresponding software is shown on the Figure 3.
It is necessary underline that all activities of this system are worked without human interference. The people need to select crop, period, type of result, etc.

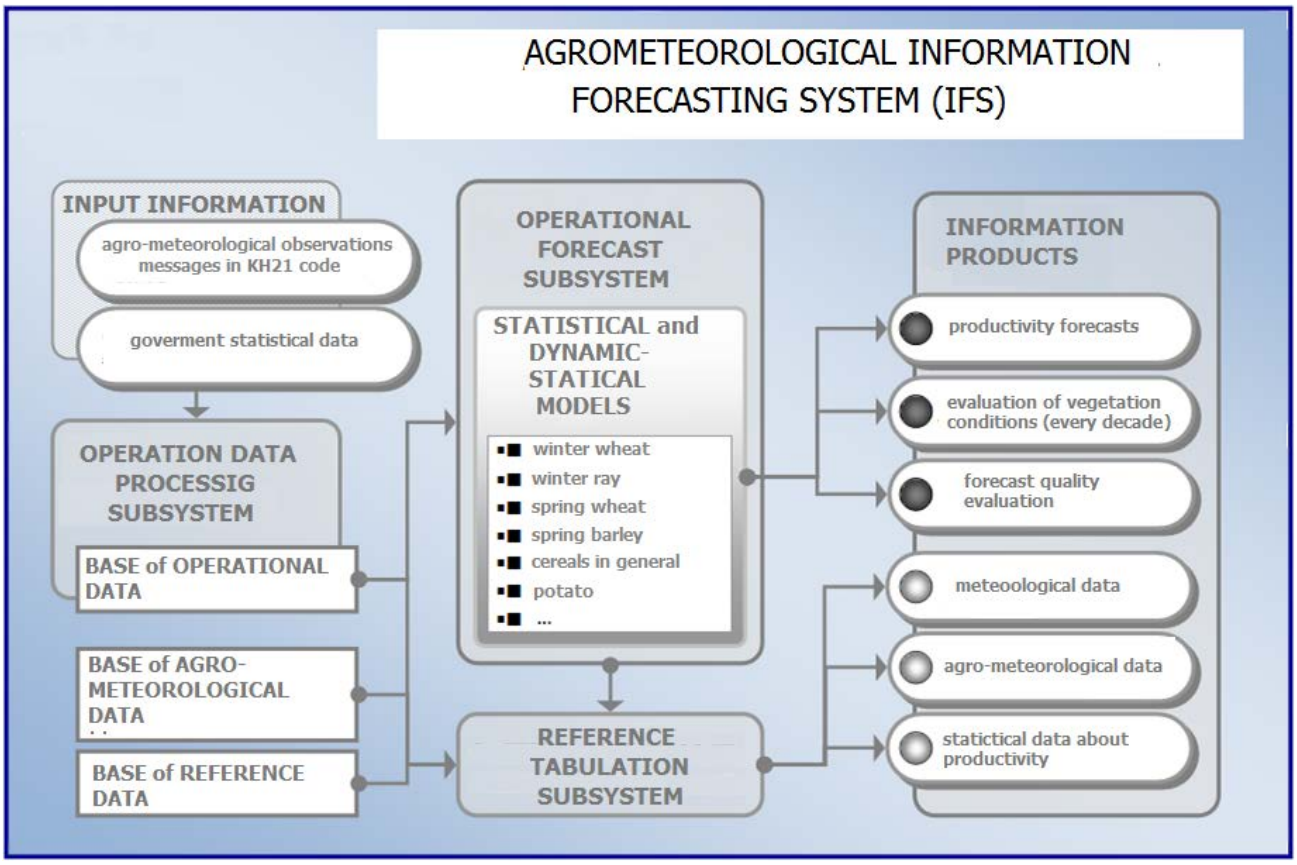



**Figure 3 – Agrometeorological information forecasting system (IFS)**

This Crop Watch bulletin in China presents a global overview of crop stage and condition between April 1 and July 31 2016—in this report referred to as the "April-July" period. It is the 102th bulletin produced by the Crop Watch group at the Institute of Remote Sensing and Digital Earth (RADI) at the Chinese Academy of Sciences, Beijing.

Crop Watch analyses are based mostly on several standard as well as new ground-based and remote sensing indicators, following a hierarchical approach. The analyses cover large global zones; major producing countries of maize, rice, wheat, and soybean; and detailed assessments of Chinese regions. In parallel to an increasing spatial precision of the analyses, indicators become more focused on agriculture as the analyses zoom in to smaller spatial units.

Crop Watch uses two sets of indicators: (i) agroclimatic indicators—RAIN, TEMP, and RADPAR, which describe weather factors; and (ii) agronomic indicators—BIOMSS, VHIn, CALF, and VCIx, describing crop condition and development. The indicators RAIN, TEMP, RADPAR and BIOMSS do not directly describe the weather variables rain, temperature, radiation, or biomass, but rather they are spatial averages over agricultural areas, which are weighted according to the local crop production potential. For more details on the CropWatch indicators and spatial units used for the analysis, please see the quick reference guide online resources and publications posted at www.cropwatch.com.cn.

The network of agro-meteorology stations belonging to the department in Sri Lanka consist of 39 nos. and at these stations, in addition to the general meteorological observations, soil temperature at different depths, minimum observed temperature on grass, evaporation rates and hours of sunshine are measured and the observations are made at these stations twice a day at 08.30 am and 03.30 pm. These data received by the Agro meteorological division at the headquarters , are quality controlled and supplied to interested parties. During the year 2015, a total amount of Rs. 542,000.00 has been collected by supplying agro-meteorological data to outside parties. In the year 2015,it was initiated to issue " a publication of meteorological

information" having analyzed and mapped the information obtained and other meteorological data, along with the expecting meteorological changes and agro meteorological information. This is disseminated via internet each week.

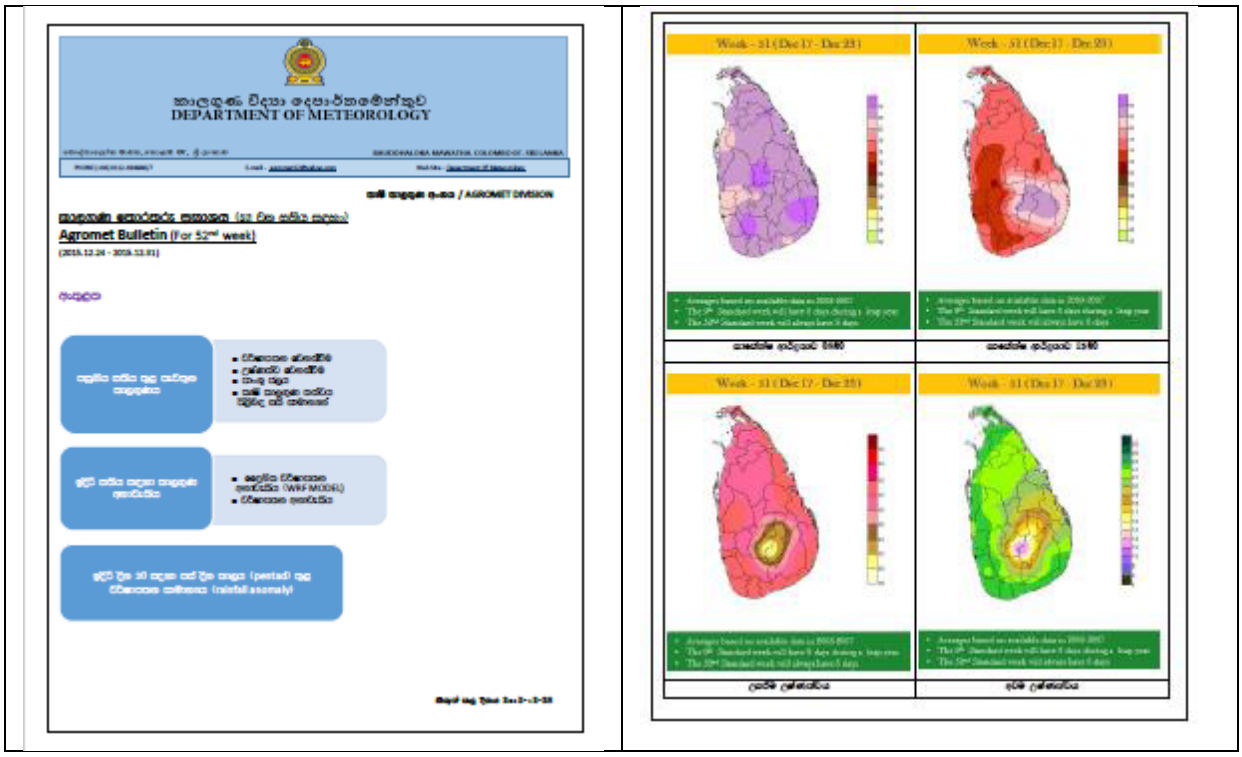



**Figure 4. Agro meteorological information in Sri Lanka**

The following recommendations are made to strengthen operational agrometeorological Services in Regional Association II:

• Developing agrometeorological forecasting centers;
• Developing forest meteorology, predicting yield/biomass before planting;
• Studying sand movement or desertification elements;
• Using AMS for measuring climatic elements and soil moisture;
• Measuring evapotranspiration;
• Establishing the domestic infrastructure of a flux measurement network;
• Developing agrometeorological models for crop growth and development and evaluate agromet environment using agromet advice model "AMBER";
• Integrating agrometeorological information services;
• Collaborating with the World Agrometeorological Information System (WAMIS);
• Cooperating with the International Society of Agricultural Meteorology (INSAM);
• Strengthening agrometeorology networks including station density, fine equipment, and capacity building;
• Providing more detailed agrometeorology information; and,
• Developing the infrastructure of the information network to transfer agrometeorological information to farmers more easily and faster.

## Agromet products under Agromet Services

While climate extremes take place on many scales, impacts are experienced locally and mitigation tools are a function of local conditions. To address this, agrometeorological early warning systems must be place and location based, incorporating the climate, crop and land attributes at the appropriate scale. The 12 parameters, which are among the most important for agriculture are solar radiation, sunshine hours, air temperature, dew point, atmospheric pressure, soil moisture, and rainfall,. The climatic data contribute to determining the exact water requirement of specific crops, helping farmers to irrigate more efficiently and effectively. Different agromet products being generated in the RA II region are listed here.

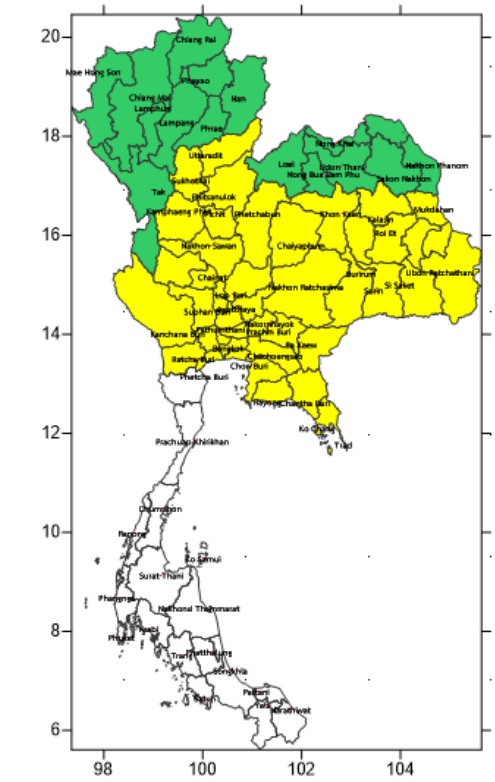
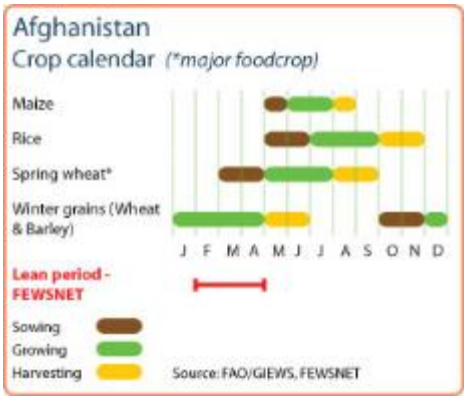
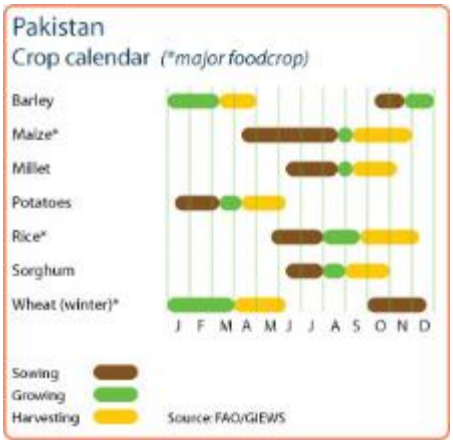
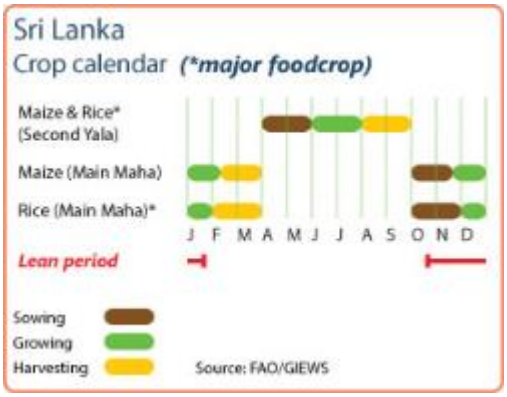



**Figure 5:Map for possible areas for cold air in Thailand In December 2016 – January 2017 (Seasonal Forecast)**



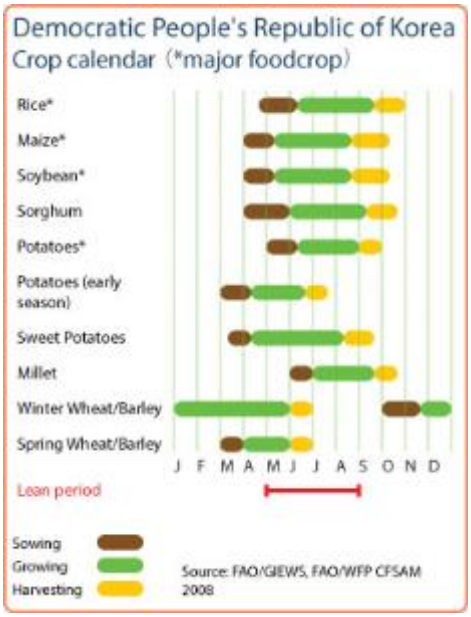
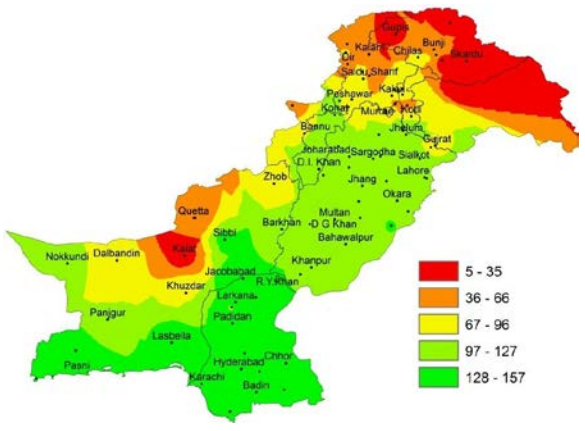




**Figure 6: Crop Weather Calenders**



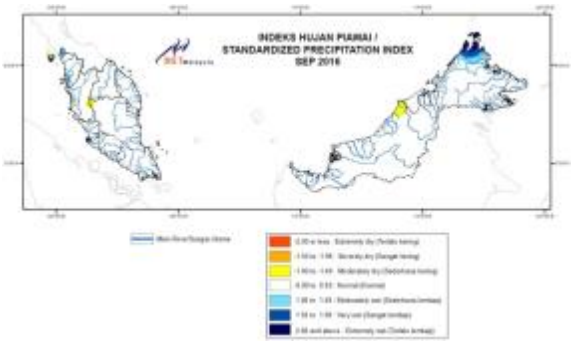




**Figure 7. Total Growing Degree Days accumulated Map Used in Pakistan**

**Figure 8. Standard Precipitation Index used in Malaysia**

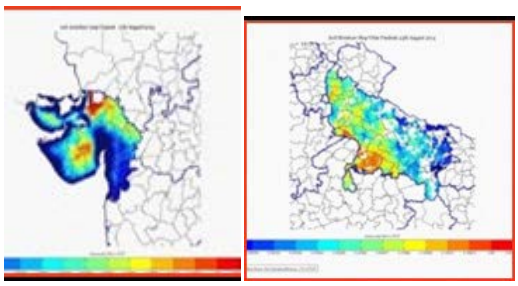


**Figure 9: Satellite based Soil Moisture**

India Meteorological Department (IMD) in collaboration with International Centre for Radio Science (ICRS), Jodhpur has started preparation of soil moisture maps for the States of Gujarat, Madhya Pradesh and Uttar Pradesh. These maps have been generated in near real time using satellite data viz. NDVI and brightness temperature data received from SMOS and MODIS.

For the integrated assessment of climate the National Agro-meteorological Institute (NRIAM) in Russia developed a special indicator - bioclimatic potential (BCP). It represents the total yield of the agro-ecosystem for the warm season.

Remote sensing data could be used for atmospheredrought monitoring as well as ground data territory Russia and some countries of central Asia. Remote sensing data are used in Russia agro-meteorology and agriculture for estimate crop state in different periods on the big territories. The digital data from AVHRR and MODIS as well as NDVI calculated on the base of those data were used. The special software was developed to process remote sensing date to produce such pictures (the country, federal districts, one or several regions). On the picture 4 is presented the cereals state on the territory of Russia. The green points are crops in the good state; yellow means satisfactory, red is for bad state. The other colours correspond to water, forests and not agriculture lands. The ground resolution is quite enough to have the general impression of the phenomenon distribution through the territory. The similar pictures are prepared every 10 days during the vegetation period.

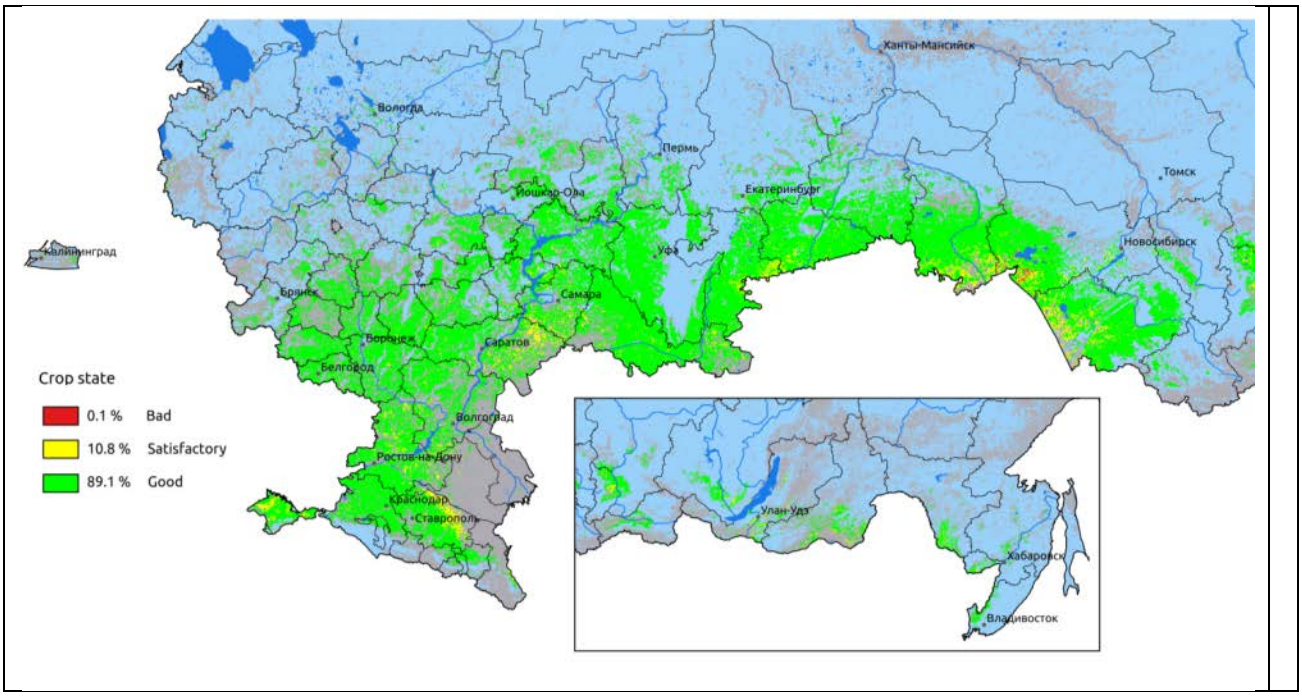



**Figure 10 – Crop state at the mid of June 2016**

On the picture 5 is the same result but only for one region of Russia. Such every 10 days the pictures for every region of Russia and general country would be transferred to the Hydro-

meteorological center, to the Ministry of Agriculture and regional agricultural organizations at various levels.

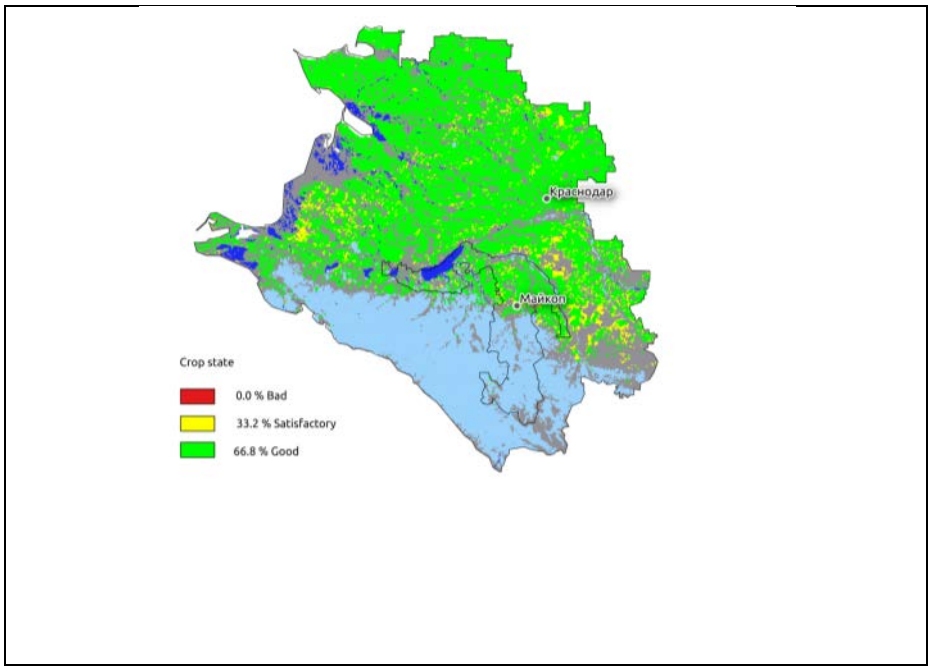



**Figure 11 – Crop state at the beginning of June 2016(Krasnodar Krai)**

In China Crop Watch agroclimatic indicators (CWAIs) are prepared for rainfall (RAIN), temperature (TEMP), and radiation (RADPAR), along with the agronomic indicator for potential biomass (BIOMSS) for sixty-five global Monitoring and Reporting Units (MRU). Rainfall, temperature, and radiation indicators are compared to their average value for the same period over the last fifteen years (called the "average"), while BIOMSS is compared to the indicator's average of the recent five years.

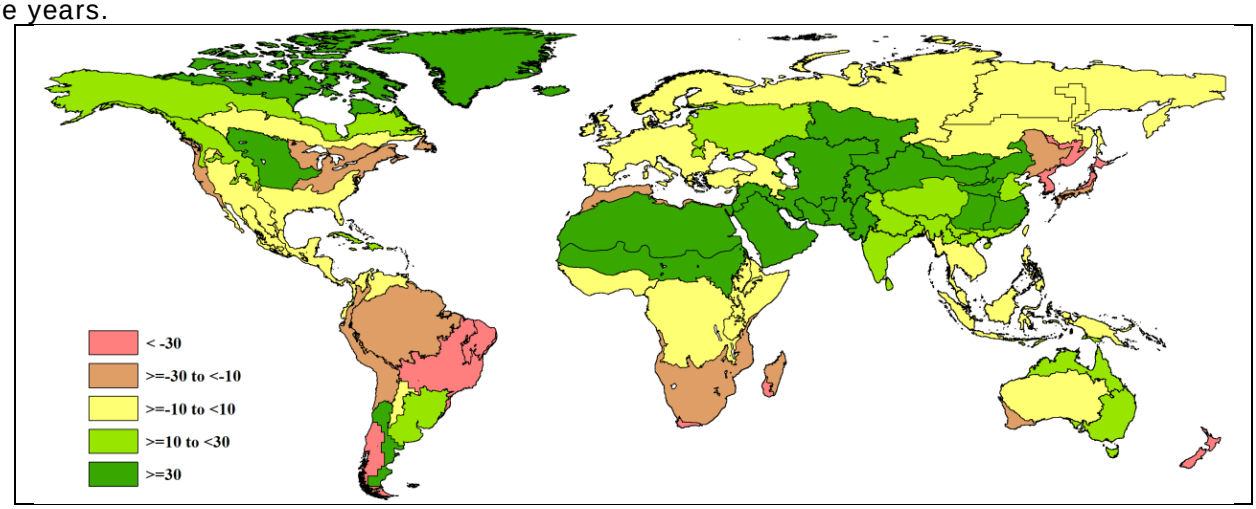



**Figure 12 Global map of April-July 2016 rainfall anomaly (as indicated by the RAIN indicator) by MRU, departure from 15YA (percentage)**

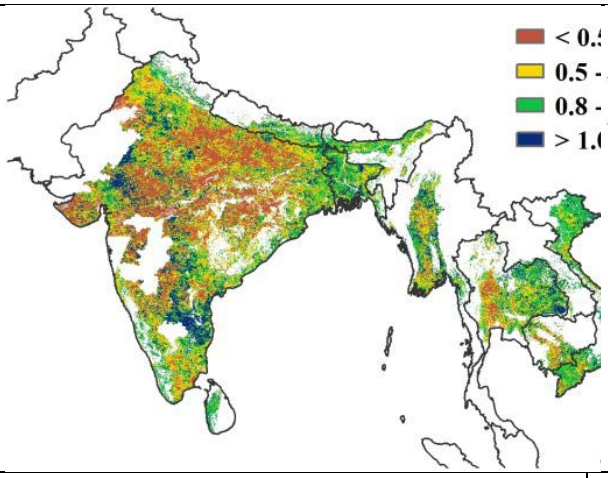



**Figure 13. Spatial distribution of rainfall profiles vegetation condition index**

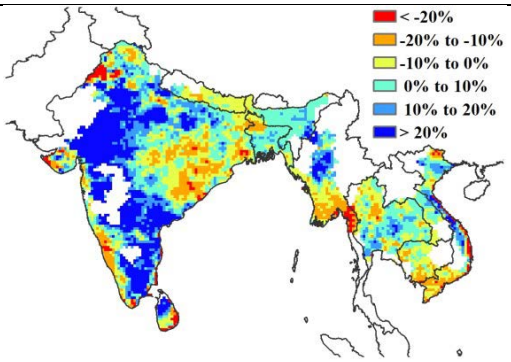



**Figure 14. Biomass accumulation potential departure**

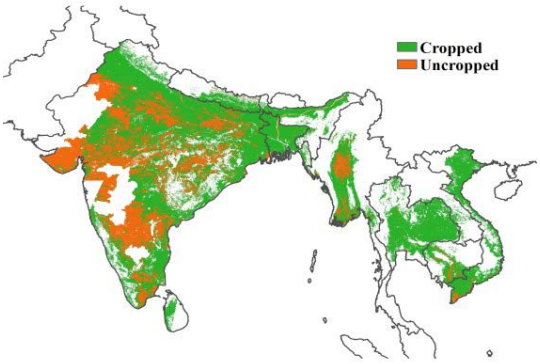



**Figure 15.Cropped arable land**

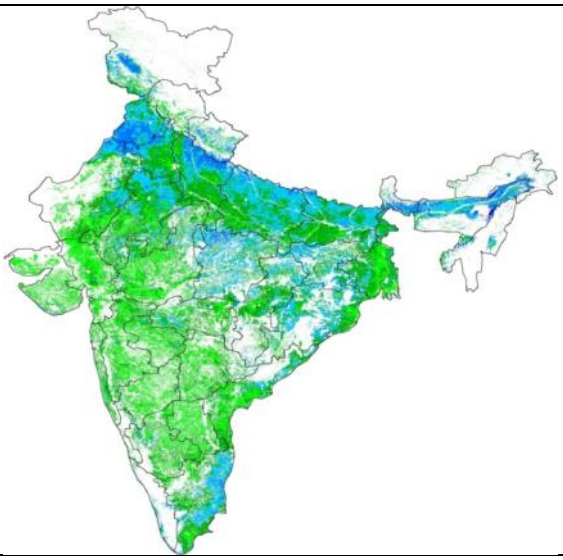


**Figure 16.he operational products of NDVI (Normalised Difference Vegetation Index) at 0700 GMT at 1 km spatial resolution from NOOA/AVHRR used in India**

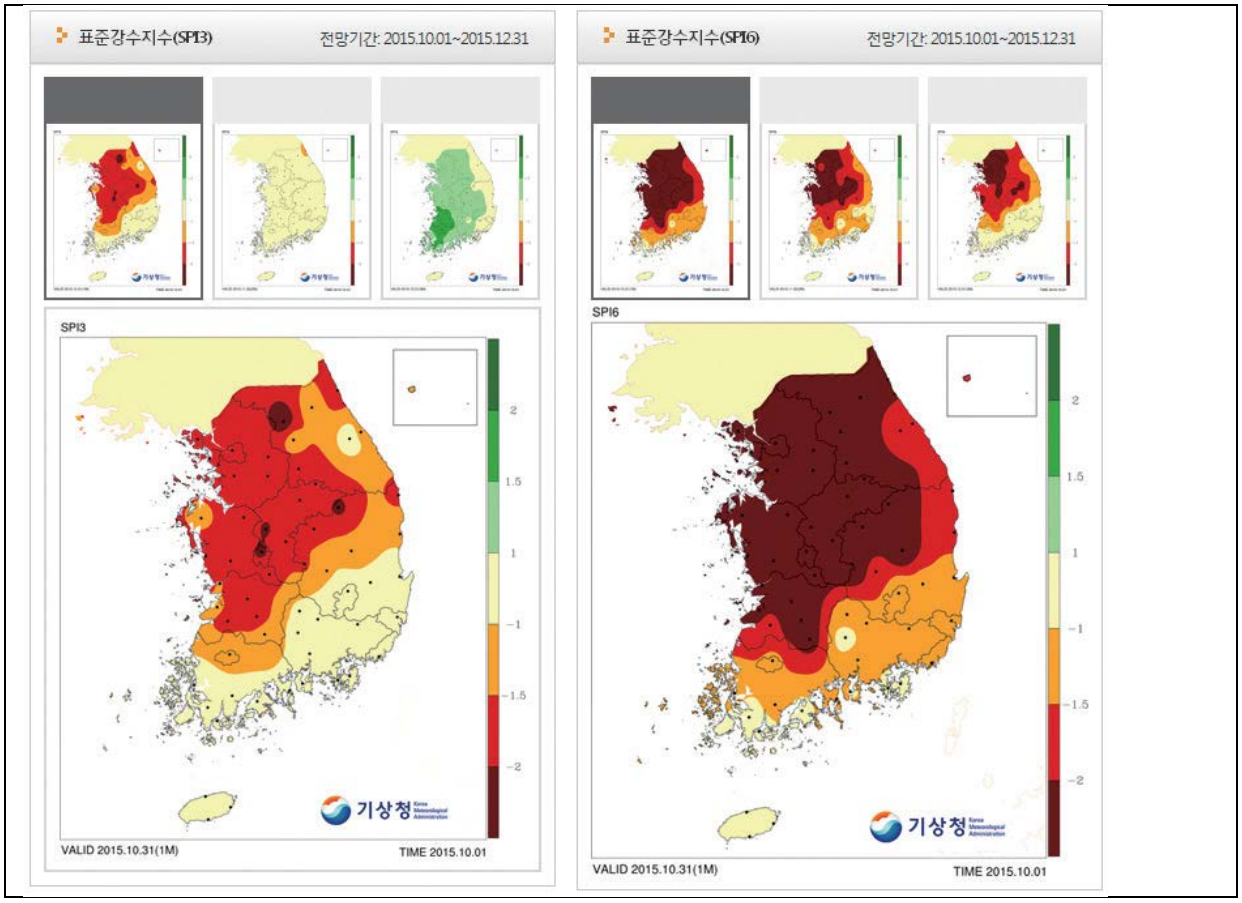



**Figure 17.1-month and 3-month Draught Outlooks of Republic of Korea**

## Capacity Building Programs

Various capacity building programs have been organized in different countries like
1. Short term courses
2. Training Courses at WMO Regional Training Centre
3. Participation in International Seminars, Scientific conferences etc.

For the first time Russian State Agrarian University – Moscow Timiryazev Agricultural Academy was produced the first graduate of agrometeorologist in Russia in 2016.Training is carried out at Uzbekistan. Tashkent Hydrometeorological Professional College, National University of mid-level for the national Hydrometeorological Service of Uzbekistan Central Asian educational institution for training. Training of highly qualified specialists in the field of hydrometeorology is provided by the National University of Uzbekistan named after MirzoUlugbek, as well as Uzhydromet trough postgraduate specialties

### Agrometeorological training in Uzbekistan

#### 1. General provisions

Uzgidromet is a government body, specially authorized to solve problems in the field of hydrometeorology in Uzbekistan. Agrometeorological training intended for the continuous improvement of professional skills of specialists of agrometeorologia.

#### 2. Training of personnel

Training is carried out at: Tashkent Hydrometeorological Professional College, National University of Uzbekistan.

Tashkent Hydrometeorological Professional College (TGMPC) is the only Central Asian educational institution for training of mid-level for the national Hydrometeorological Service of Uzbekistan.
Training of highly qualified specialists in the field of hydrometeorology is provided by the National University of Uzbekistan named after Mirzo Ulugbek, as well as Uzhydromet trough postgraduate specialties: 11.00.07. surface hydrology, water resources, hudrochemistry and 11.00.09. meteorology, climatology, agricultural meteorology.

### 3. Improving the skills of workers

The main purpose of training employees is to provide high-potential staff in the field of hydrometeorology by forming and fixing the practice of professional knowledge and skills derived from the theoretical training. The main objectives of training are:
- maintenance and improvement of the professional level of all employees in accordance with modern requirements for hydrometeorological sector;
-update and deepen knowledge in the field of theory and methodology of teaching, management activities on the basis of modern achievements of science, advanced technologies and best practices;
-development of innovative technologies, forms and methods of teaching aids and progressive use at domestic and foreign experience;
-provision of scientific and methodological support for full self-realization of individual creative ideas of employees.

### 4. The basic methodological principles

The basic methodological principles when conducting agrometeorological training to improve the professional level of specialists agrometeorologia:
- constant monitoring of the quality of training and retraining of workers, the degree of integration in the workflow of new technologies;
- regular informing of the employees about the achievements of advanced hydrometeorological science and practice;
- commitment to continuous professional growth;
- expansion of opportunities for training and retraining employees by using personnel resources and technical base of the Tashkent hydrometeorological professional College (TGMC), Scientific-research hydrometeorological Institute (nigmi), National University of Uzbekistan, regional training centres, WMO

### 5. Forms of training

- short courses;
- training and courses at the WMO Regional Training Centres;
- participation in international seminars and scientific conference, competitions of professional skill;
- the organization of individual work on self-education.
A number of training Agromet Advisory Services: programs have to be organized in Nepal for those who are directly and indirectly involved in the agroadvisories and these include:

1. Weather forecast based Agro advisory services to Technical Officers
2. Crop/ P&D models and Decision Support System
3. NWP based local weather forecast techniques
4. Use of Remote Sensing and GIS in agro advisory
5. Outreach Program
6. Provision of adequate training for the end-use

India Meteorological Department (IMD), in collaboration with the World Meteorological Organization (WMO) has organised two weeks training programme from 28th January to 9th February 2013 at National Training Institute, Pashan, Pune on ‚Operational Agrometeorology for serving end users requirement' for capacity building in the agri-culture sector of the Global Framework for Climate Services (GFCS). The training was specially designed for the professional in East African (Burundi, Ethiopia, Kenya, Rwanda, Tanzania, Asian participants (Bangladesh,

Maldives, Myanmar, Sri Lanka, and Thailand). those scientists working in operational Agro-Meteorological Advisory Services and those provide climate/ weather information products and services, preferably professional staff of National Meteorological and Agrometeorological Services and a range of professionals working on farm management and design issues where weather and climate data is relevant

Improvement in District level Weather Forecast organized by IMD for its personnel was organized **on** 28th and 29th September 2015

Use of Remote Sensing and GIS crop for Crop Growth Monitoring and Yeild prediction was organized at Indian Institute of Remote Sensing (IIRS), Dehradun during 31st August 2015 to 20th September 2015 at IIRS, Dehradun which mainly focussed on new approaches of GIS based inputs to Agromet Advisory Services.

Short duration course on “Agrometeorology” for foreign trainees was conducted at Agrimet Division, Pune during 9-20 May 2016, Pune. Mr. UgyenChophel and Mr. SonamRabten from Bhutan attended the training

Pune component of WMO RTC India and Agricultural Meteorology Division, IMD, Pune organised a three weeks training programme from 26th November to 16th December 2013 on “Operational Agrometeorology”, through Agricultural Meteorology Division, India Meteorological Department (IMD), Ministry of Earth Sciences, Government of India. The training is specially designed for professional working in AgrometeorologicalOrganisations/Institutes/Universities in India and other countries. The training would be conducted at Meteorological Training Institute, India Meteorological Department, Dr. HomiBhabha Road, Pashan, Pune, Maharashtra, India. Ideally, the training would draw upon those scientists working in operational Agrometeorological Advisory Services and those, providing climate/ weather information products and services, preferably professional staff of National Meteorological and Agrometeorological Services and a range of professionals

Two-weeks training programme on “Use of Multiple Crop Models and Decision Support System in Agrometeorological Advisory Services” was organized during 7-18 October, 2014 at Agro Climate Research Centre, Agricultural Research Institute, ANGR Agricultural University, Rajendranagar, Hyderabad. Training was imparted to 30 scientists and Senior Research Fellows (SRFs) of IMD on DSSAT, INFOCROP and APSIM crop simulation models for better delivery of weather based Agro advisories and crop yield forecasting at district level in different crops across the country.


Some of the recommendations of the different meetings on agromet products are:
Holding of further training workshops and consideration given to short courses in Agricultural Meteorology.

· Exchange of data and Agricultural Meteorological knowledge between member countries and also the Inter-Regional exchange of these materials.
· Exchanges of experts between member countries as a necessary way to improve the knowledge of Agricultural Meteorology.
· Use of Meteorological forecasts and short- and long-term Agricultural Meteorological recommendations should be included in specialized bulletins for further notice.
· Performance of joint research between member countries to solve common problems considering Agricultural Meteorological affairs.
· Use of GIS and Modeling of Joint Training should be considered

The following four programmes were conducted in Nepal during the year 2015 for the meteorological officers under the Continuous Education and Training (CET) Program

1. Preliminary Course for Statistical meteorological forecasts
2. Analysis of climatic data
3. Training on Meteorological equipment
4. Advanced Course on Agro meteorology

In addition to the meteorological officers , meteorologists and research assistants were made to participate in the higher course on Agro meteorology. Accordingly, the officers trained of these 4 programmes are as follows.


**Figure 18. Status of Trained officers**

## Dissemination

In India IMD (India Meteorological Department) in collaboration with Agromet Field Units (AMFUs) disseminates weather forecast and Agromet Advisories to the farming community in the country in both regional and English languages through Ministry of agriculture portal i.e. farmers' portal (http://farmer.gov.in/advs/login.aspx).Weather forecast and alerts now enable farmers in planning farming operations effectively and taking the best suited action to deal with adverse weather conditions.

Department of Agriculture in Cambodia is issues bulletin based on the climate and seasonal weather forecast of the area or province. They also advice the farmers on the type of crop/variety to plant based on the forecast (drought, floods, delayed/early rainy season, etc.). In case of pests/insects that destroy crops, wind data is important for early preparation.

In order to increase the number of farmers in the data base, a system has been developed by India Meteorological Department and Ministry of Agriculture to provide weather based Agromet advisories to the farming community through free SMS. To avail this service, farmers are requested to register their names and mobile numbers along with the crops. Once registered, the farmers will receive SMS for their specific crops twice in a week on day to day basis as well as during extreme weather events. In Nepal Agro-climatic and weather information is delivered to farmers and farming community via Information and Communication Technology such as web portals and radio, television and mobile phones under early warning system. The agrometeorological extension system in China in most cases a "cascade" system, from Provincial Level to Sub-Provincial Level to County Level and Township Level to Village Level. At the lower levels, extension officers and village technicians must play an important role.

In Mongolia the advices are spread by reports to the government, connections with other departments (Agronomy, Engineering/Machinery etc.) and field meetings at various levels that include extension officers and farmers, in the same "cascade" system already mentioned. Broadcasting of sowing advices is via television programmes received here mostly by cable, rural radio, rural community radio, and SMS messages that are becoming more and more popular. In some places in China, apart from radio and TV as well as SMS messages on mobile phones, there is other dissemination of weather and climate information. This is done through visits, through telephone by using special numbers, through printed leaflets of some of the information or via the internet with separate weather and agricultural sites.

Agromet advisories in India are being communicated to the farmers through multi-channel dissemination system like mobile, Radio, TV, Newspaper including dissemination Kisan Portal (http://farmer.gov.in) launched by the Ministry of Agriculture, other PPP (Public Private Partnership) mode via SMS and IVR (Interactive Voice Response Technology). At present mobile service is restricted to about 19.4 million farmers out of about 94 million farmers' families. Thus, there is a need to reach out each and every farmer in the country. In view of that, there is an urgent need to take up a national initiative in this regard and do it in a grand manner by preparing a road map so that more number of farmers will be benefitted.

Shri NarendraModi, Hon'ble Prime Minister, Govt. of India has launched a dedicated channel for the farmers, viz., DD Kisan. Inputs for ‚Crop Specific Weather based Agromet Advisories' for the country have been prepared on daily basis and sent for telecasting through DD Kisan Channel, New Delhi from the month of May, 2015.
Presently, this channel covers State level and Region wise weather and Agromet Advisories depending upon rainfall situation like dry spell, subdued rainfall, floods etc. and their impact on sowing and selection of crops and cropping on real time in programs like 'Kisan Samachar' and 'Mausam Khabar'. In addition, in some of the States like Maharashtra, regional DD channels (DD Sahyadri) as well as private channels like ETV, telecast weather forecast and Agromet Advisory in Marathi. Other TV channels in Maharashtra have been contacted to telecast weather forecast and Agromet Advisory in Marathi. Similar efforts are undertaken for other States, as well.

From its earliest days, the predecessor of Japan Meteorological Agency (JMA) sought the improvement and expansion of services to meet evolving and diversifying societal needs and requirements and to keep pace with scientific and technical development. The communication and dissemination tools for the public expanded from bulletin board, flag, and newspaper to radio in 1925, and the users of meteorological services were diversified shortly thereafter to include various socio-economic sectors, such as shipping and fishery, aviation, and railway and agriculture.

Under Agrometeorological extension in China and roles for CFSs, first lessons to be learned are (i) the necessity of a strong co-operation of meteorological and agronomical offices to combine trustable data and (ii) the importance of the art of reaching farmers with the information available/needed. One may call the agrometeorological extension system in China in most cases a “cascade” system, from Provincial Level to Sub-Provincial Level to County Level and Township Level to Village Level. At the lower levels, extension officers and village technicians must play an important role.
For example in the current decision making approaches on irrigation from soil moisture forecasting in Henan Province, important agrometeorological information has been successfully delivered to local governments and authorities. They disseminate it down to farming technique facilitation stations at township and village levels. The latter, in turn, show local farmers how to plant and irrigate on a guided basis and how to prevent or get prepared for agricultural hazards. However, some of this information and these services are not directly and quickly accessed by farmers. Farmers are able to get informed of general weather forecasts through some media, including TV and telephone. But too many are unable to receive detailed and practical recommendations on amounts and timing of irrigation. CFSs would be a solution to these problems.

There was a different extension mode in a successful agrometeorological service in Jiangxi Province, of establishing relay intercropping of late rice with lotus. Eight times a kind of Climate Field Classes was organized to demonstrate and popularize the method with the target groups concerned. An office was available for training. A comparison of such an approach with the “cascade” down coming of extension information in China would be a great last phase of the pilot projects started, also comparing class training with field training in CFSs. Even where the information supply line is short, such as in the case on peony flowering to the Luoyang City (Henan) Government and the City Office for Flowers, to benefit organizing the annual Peony Show, these services still cannot be made available to flower growers directly. Simple Field Classes would solve this issue.
In rather some places in China, apart from radio and TV as well as SMS messages on mobile phones, there is other dissemination of weather and climate information. This is done through visits, through telephone by using special numbers, through printed leaflets of some of the information or via the internet with separate weather and agricultural sites. However, Climate Field Schools would reach and stimulate many more farmers much better and would have all the organizational and other advantages that Farmer Field Schools showed to have

## Meeting/ Workshop

Media is a powerful channel for dissemination of sensible weather information and Agromet advisories to the farming community through multimedia including mobile technology. Strong linkages are being established with different Medias in RA II region. Agrimet Division, IMD, Pune organised National Level Media Workshop on “Communication of Agromet Advisories to the User Communities” at Meteorological Training Institute, IMD, Pashan, Pune on 28th March 2014. The basic purpose of this workshop was to make media personnel aware about weather processes and usefulness of weather information for the purpose of agriculture, educate them about various terminologies, concepts and definitions.

India Meteorological Department, Ministry of Earth Sciences & World Meteorological Organization, Geneva organised international workshop on “Capacity building for Agrometeorological Services” on 28th -29th October-2013.The overall objective of the proposed workshop is to review the existing training, capacity building practices, activities for agrometeorological services and to make recommendations on how to improve these activities. Another objective is to start the process of reviewing guidelines on ‘Education and Training’ in Agricultural Meteorology and make specific recommendations to 16th Session of CAgM in April 2014. The workshop brought together participants from many countries in the world to share their ideas and experiences. The workshop will provide important recommendations to the members of the CAgM and will provide input in the development of the work plan for 16th Session of CAgM. The users will get chance to interact with climate scientists and resource persons to develop user specific products. The participants will include members WMO Commission for Agricultural Meteorology’s Implementation / Coordination Team in Agrometeorological Services, representatives from WMO Regional Training Centers (RTCs) and other experts

CAgM Implementation / Coordination Team (ICT) 1.1 meeting was organized from 30th - 31st October 2013 at Pune, India. Terms of reference of the ICT were discussed elaborately and also the discussion was made on the strategies for preparation of working papers for the ensuing meeting of the Commission of Agricultural Meteorology, WMO in April 2014.

In collaboration with Space Application Centre, NRSA, ICAR and other organisations efforts are being made to incorporate satellite based information for monitoring and assessing near real time crop status in as well as development of products for crop and location specific agromet advisories. In line with this initiative, Agrimet Division, IMD, Pune organised workshop on “Applications of satellite information in GraminKrishiMausamSewa” at Meteorological Training Institute, IMD, Pashan, Pune on 27th March 2014. The basic purpose of this workshop was to build mechanism of use of satellite information in operational Agromet Advisory Services not only from the Indian satellites but also the other satellites available from other parts of the world. Different working groups have been formed to implement the concept operationally.

Agrimet Division, India Meteorological Department (IMD), Pune in collaboration with United States Agency for Interna-tional Development (USAID), Washington DC, USA jointly organized international workshop on “Improving Climate Ser-vices for Farmers in Africa and South Asia (ICSFASA)” during 2-3rd February, 2015 at Hotel Ramee Grand, Pune. Around 40 Scientists and farmers from the countries of South Asia and Africa participated in the workshop. The Workshop was the platform to ascertain the farmers’ needs in Africa and South Asia about weather and climate information for on farm decision making. The Workshop addressed the type of climate information and communication channels currently available and the constraints faced by farmers in obtaining this information. It also explored in laying the foundation to establish an effective network for farmers in Africa and South Asia to share knowledge and information on climate services and products for on-farm decision making. Review of currently available ICTs for the farmers in Africa and South Asia and enhancing such ICTs for effective dissemination of climate products and services was also addressed in the workshop. Farmers from Nepal, Ethiopia and India shared their valuable knowledge and experience thus enabling the workshop to evolve concrete recommendations.


Sixth Session of Regional Conference on “Management of National Meteorological & Hydrological Services (NMHSs) in Regional Association” was organized in Doha, Qatar during 2_4 December, 2014.

Agrimet Division, IMD, Pune organised a two day workshop on use of “Application of Satellite information in operational Agromet Advisory Services” at Meteorological Training Institute, Pune during 16-17 December, 2014. The objective of this workshop was to prepare road map for the use of satellite data in generation of accurate weather forecasting, Agromet products and ultimately preparation of Agromet Advisories.

## Agrometeorology under Global Framework for Climate Services (GFCS)

It is a well known fact that climate in vast territories of Russia is mostly strongly continental. Thus agriculture in Russia is defined by climate conditions. On the picture 6 is presented data on total grain crops yield in Russia, which varies from 47 mln metric tons in 1998 to 128 in 1978.

| Year | Total yield, mln tons |
|---|---|
| 2014 | 104.0 |
| 2013 | 92.3 |
| 2012 | 70.9 |
| 2011 | 94.2 |
| 2010 | 61.0 |
| 2009 | 97.1 |
| 2008 | 108.2 |
| ... | |
| 1998 | 47.5 |
| ... | |
| 1992 | 116.7 |
| ... | |
| 1978 | 127.4 |
| ... | |
| 1953 | 48.2 |

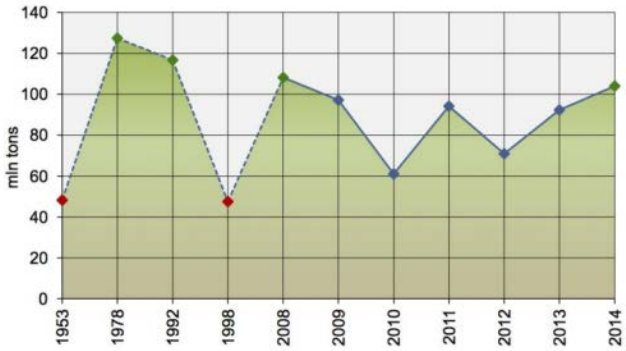



Figure 19 – Total yield of grains and beans in Russia (mln tons)

For the integrated assessment of climate the National Agro-meteorological Institute (NRIAM) developed a special indicator - bioclimatic potential (BCP). It represents the total yield of the agro-ecosystem for the warm season. In the BCP calculation it simulate(with help of Climate-Soil-Yield" imitation system) the growth of grass phytocenosis during the growing period (from the date of temperature transition over 5°C in spring to the date of temperature transition below 5°C in autumn).

BCP indicator has important practical application:

-BCP uses annually to estimate some influence of climate changes on agriculture

-Based on annual estimations of BCP value carried out by NRIAM for different subjects of the Russian Federation, Ministry of Agriculture determines the level of financial support to agricultural sectors of different Russian subjects (regions).

-Some Banks use BCP to evaluate the possibility of region to return credit for agriculture development

## Drought Preparedness and Management Strategies

The drought itself and the consequences of drought result in significant losses in corresponding countries. Droughts attract attention of national bodies and the international community. WMO makes a lot in this area. The commission of the UN on economic and social problems for Asia and Pacific organizes within the Committee on Disasters established the special working group to monitor droughts and to give some early warnings. There were several meetings; a regional mechanism is under development.

The droughts resulted in significant losses in harvest. On the table 1 there are presented the losses in harvest due droughts in some regions of Russia. Those are the historical data.

Table 1 Yield reduction due droughts (as percent of average yield)

| Territory | Year | Yield reduction |
|---|---|---|
| Russia | 1995 | 42 |
| | 1981 | 37 |
| | 1975 | 32 |
| | 1979 | 19 |
| | 1984 | 17 |
| Center of European part of Russia | 1995 | 91 |
| | 1981 | 89 |
| | 1979 | 88 |
| | 1984 | 77 |
| | 1975 | 19 |
| Volga river region | 1975 | 100 |
| | 1995 | 79 |
| | 1984 | 72 |
| | 1981 | 68 |
| | 1972 | 53 |
| | 1979 | 45 |
| Region of Northern Caucasia | 1995 | 33 |
| | 1979 | 36 |
| | 1975 | 30 |

Particularly severe drought was observed in Russia in 2010. The result of this drought was following:

Crop death from drought on the area of 13 200 000 hectares

That figure is equal to:

29% from planted area affected by drought

17% from Russia planted area

30% from planted area occupied by cereals

Drought causes damage Manufacture of agriculture in many of the former Republiks of the former USSR. Therefore by the decision of the Interstate Committee on Hydrometeorology of Commonwealth of Independent States Drought Monitoring Center was established in 2002 for the following countries: Azerbaijan, Armenia, Byelo-russia, Georgia, Kazakhstan, Kyrgyz-stan, Russia, Tajikistan, Uzbekistan. Aims: to develop techniques for drought detecting, evaluating and mitigation, estimation of impact on agriculture.

Remote sensing data could be used for drought monitoring as well as ground data. On the Figure 20 the results of monitoring atmosphere droughts of territory Russia and some countries of central Asian in 2016 year are showed.

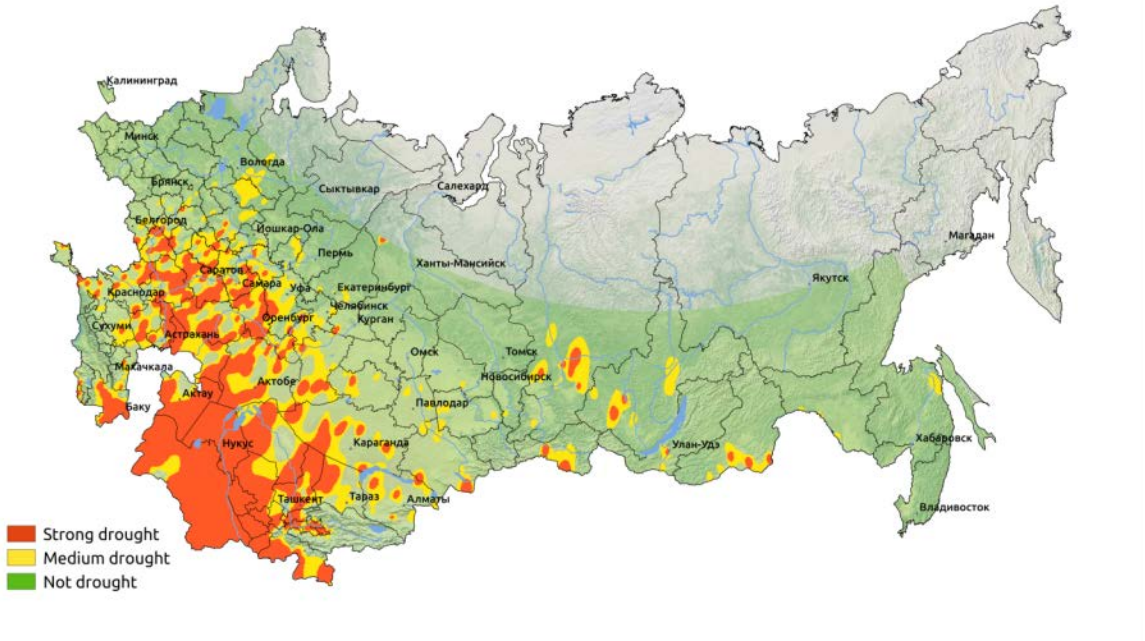



**Figure 20– Atmosphere drought at the mid of July 2016**

## Economic Impact of Agromet Advisory Services

Studies on Economic Impact of Agromet Advisory Services (AAS) in RA II are scanty. However, the same carried out in India indicates that agromet advisory services rendered by India Meteorological Department (IMD) through various channels have resulted in significant increases in farm productivity resulting in increased availability of food and higher income generation. The services helped the farmers not only in increasing their productions but also reducing their losses due to changing weather patterns and others problems. Economic assessment by the National Centre for Agriculture Economics and Policy Research (NCAP) on AAS estimated 10-25% economic benefit obtained by the farmers. The economic benefit of the agromet services runs in crores. The Ministry of Earth Sciences (MoES) had engaged National Council of Applied Economic Research (NCAER) to carry out a comprehensive study on “Impact Assessment and Economic benefits of Weather & Marine Services.” This study was carried out during September & October 2010 and restricted to main end users i.e. farmers for Agrometeorological Advisory Services. The field study was carried out in 12 states and 1 Union territory. According to the report only 10 to 15 percent of the farmers are benefitting from the SMS services and about 24% farmers are aware about Agromet Services It was revealed that economic profit estimates can vary between Rs. 50,000 Crore (where 24% farmers receive weather information) to 211,000 Crore (where all farmers receive weather information). This shows that its economic returns depend on the proportion of farmers receiving information.

Studies on Economic Impact of Agro advisory services in Nepal show that farmers could save significant losses of crops and make their farming profitable by using the agro advisory services. It should be planned to extend such studies for more number of years and more number of stations. Agro-meteorological stations across Afghanistan are providing farmers vital information on climatic and soil conditions, enabling them to grow and irrigate their crops more effectively. Five newly installed stations, supported by On-Farm Water Management Project (OFWMP) under the Ministry of Agriculture, Irrigation, and Livestock, are providing more reliable, timely information through an automated system.OFWMP, which works to improve agricultural productivity by enhancing the efficiency of water use, is supported by a $25 million grant from the Afghanistan Reconstruction Trust Fund.

**Report of the RA II Working Group on Hydrological Services (WGHS)**

**Sung Kim, Korea Institute of Civil Engineering and Building Technology**

**Chairperson of the RA II Working Group on Hydrological Services**

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**Muhammad Riaz**

**Vice-chairperson of the RA II Working Group on Hydrological Services**

## Report of the RA II Working Group on Hydrological Services (WGHS)

### 1. Introduction

At the fifteenth session of the RA II in December 2012, the establishment of the WMO RA II Working Group on Hydrological Services (WGHS) was decided.

### 2. Working Structure

The working group is composed of one Chairperson, one Vice-chairperson, six themes and eight theme leaders.

### 3. Terms of Reference

The terms of reference of the Working Group on Hydrological Services (WGHS) are as follows:

(a) To provide assistance and advice to the president of the Association on all questions pertaining to the regional aspects of the Hydrology and Water Resources Programme;

(b) To engage in and monitor the implementation of water-related activities documented in the RA II Strategic Operating Plan;

(c) To undertake activities relating to the Hydrology and Water Resources Programme as listed below;
- Strengthening the capability of Members to assess their water resources: water resources assessment, its variability and use (surface water including reservoirs and groundwater);
- Improve accuracy and timeliness of forecasting floods of different cause and origin through enhanced cooperation between National Meteorological Services and National Hydrological Services, within the context of the WMO Flood Forecasting Initiative;
- Hydrological aspects of drought, including drought monitoring, and assessment of water scarcity and deficits;
- Hydrological responses to climate variability and change and promotion of the use of climate information by water managers;
- Improved accuracy of hydrometric and sediment observations including space-based technologies;
- Sediment disasters and mass movements (flood and rainfall induced);

(d) To cooperate with the Commission for Hydrology and other WMO bodies on activities and projects related to hydrology and water resources;

(e) To seek cooperation with other regional bodies and organizations on issues related to the Hydrology and Water Resources Programme;

(f) To actively contribute to the Global Framework for Climate Services through dedicated components in the identified theme areas of work during the next intersessional period 2013–2016;

(g) To undertake activities related to the transfer of technology through the Hydrological Operational Multipurpose System and capacity-building in a cross-cutting manner;

## 4. Membership

| | | |
|---|---|---|
| Chairperson WGHS | Dr Sung Kim | Republic of Korea |
| Vice-chairperson WGHS | Mr Muhammad Riaz | Pakistan |
| Theme Leader in Water Resources Assessment | Ms Ge Gao | China |
| | Ms Hwirin Kim | Republic of Korea |
| Theme Leader in Flood Forecasting | Dr Sergey Borshch | Russian Federation |
| Theme Leader in Hydrological Aspects of Drought | Ms Irina Dergacheva | Uzbekistan |
| Theme Leader in Hydrological Responses to Climate Variability and Change and Promotion of the Use of Climate Information by Water Managers | Mr Guoqing Wang | China |
| | Dr Thuc Tran | Viet Nam |
| Theme Leader in Improved Accuracy of Hydrometric and Sediment Observations including Space-based Technologies | Mr Youngsin Roh | Republic of Korea |
| Theme Leader in Sediment Disasters and Mass Movements | Dr Tai-Hoon Kim | Republic of Korea |

## 5. Working Group meetings

5.1 The first session

The first session of the Working Group on Hydrological Services (WGHS) of the WMO Regional Association II (Asia) was held in Seoul, Republic of Korea, from 30 September to 2 October 2014 with the following agenda.

(a) Opening of the Meeting
(b) Adoption of the agenda and organization of work
(c) Review of activities since previous WG session (including meetings of CHy, Presidents of Technical Commissions and Presidents of Regional Associations)
(d) Modes of operation of the WGHS (including Task Teams)
(e) Consideration of decisions of RA-II-15, CHy-14, Cg-16 and relevant ECs
(f) Work programme
(g) Field trip
(h) Cooperation with other international organizations
(i) Other business
(j) Adoption of the report and closure of the session

The final report of the meeting is available at http://www.wmo.int/pages/prog/hwrp/RA2/documents/RA-II_WGH_2014_FINAL_REPORT.pdf.

5.2 The second session

The second session of the Working Group on Hydrological Services (WGHS) of the WMO Regional Association II (Asia) was held in Gyeongju, Republic of Korea, from 14 to 16 April 2015 with the following agenda.

(a) Opening of the Meeting
(b) Adoption of the agenda and organization of work
(c) Review and adjustment of work programme
(d) Presentations for WWF7 Regional Session and main messages
(e) Next meeting
(f) Adoption of the report and closure of the meeting

The final report of the meeting is available at
http://www.wmo.int/pages/prog/hwrp/RA2/RAII-WGH-Gyeongju.php

5.3 The third session

The third session of the Working Group on Hydrological Services (WGHS) of the WMO Regional Association II (Asia) was held in Seoul, Republic of Korea, from 25 to 27 October 2016

The draft final report of the meeting is attached to this document.

**WORLD METEOROLOGICAL ORGANIZATION**

# REPORT OF THE THIRD MEETING OF THE REGIONAL ASSOCIATION II (ASIA) WORKING GROUP ON HYDROLOGICAL SERVICES

## Seoul, Republic of Korea
## 25 to 27 October 2016

# FINAL REPORT
**22 November 2016**

**Table of Contents**

## 1. OPENING OF THE MEETING

1.1 At the kind invitation of the Government of the Republic of Korea, the third meeting of the Working Group on Hydrological Services (WGHS) of the WMO Regional Association II (Asia) was held in Seoul, Republic of Korea, from 25 to 27 October 2016.

1.2 The meeting was opened at 09:30 on Tuesday 25 October 2016 at the Han River Flood Control Office, Seoul, Republic of Korea.

1.3 Mr Hajoon Park, Director General, Han River Flood Control Office, welcomed participants to the Republic of Korea and, in particular, to the Han River Flood Control Office. He noted the rising losses in the countries of Regional Association II (Asia) from natural disasters, with flooding being the largest contributor to losses from weather-related natural disasters. He stressed the importance of the Working Group on Hydrological Services (WGHS) efforts pertaining to Water Resources Assessment (WRA), as this allows a Member to track current water availability and its predicted states. As such, this assists disaster managers with knowledge of potential drought and flooding, allowing early actions to be taken to reduce losses. In closing, he wished everyone a pleasant stay in Seoul and for a successful meeting.

1.4 Mr Paul Pilon, WMO Secretariat, thanked the Republic of Korea and the Han River Flood Control Office (HRFCO) for hosting the third meeting of the RA II WGHS, and welcomed everyone to the third meeting on behalf of the Secretary-General WMO, Mr Petteri Taalas. He reiterated the importance of the work of the Regional Association and, in particular, the work of the WGHS, particular with respect to helping build the capabilities of Members to provide services. He concurred with Mr Park's comments on the rising losses attributed in the region to flooding and the growing importance it is playing to the social and economic well-being of Members in the Region. He indicated there were two complementary activities that when undertaken could combine to help manage disaster risk. These activities included integrated flood and drought management as well as the application of early warning systems. He noted that even with the adoption of aggressive flood and drought management measures, constant vigilance through early warning systems was needed to trigger and direct emergency response measures. He concluded by commented that additional efforts were needed to bridge the meteorological and hydrological communities to allow making best use of advances in meteorological science in hydrological forecasting, leading to more effective early warning systems.

1.5 In his welcoming remarks, Senior Research Fellow, KICT, Mr Sung Kim highlighted the importance of this third meeting the RA II WGHS, as it permitted reporting on final progress achieved in this four-year intersessional period, a shaping of its future work plan for the period 2016-2019, and a discussion on decisions stemming from current and possibly future work for consideration of the Sixteenth Session of RA II, to be held 12-16 February 2017 in Abu Dhabi, United Arab Emirates. Mr Kim reviewed the draft agenda noting the opportunity for experts to report on their activities and achievements, the brief Workshop on the morning of Wednesday 26 October for the Dynamic Water resources Assessment Tool (DWAT) that was developed by HRFCO and Korea Institute of Civil Engineering and Building Technology (KICT), and the opportunity to develop follow-up actions for the upcoming Sixteenth Session of RA II in February 2017. He noted that these would be followed by further development of draft work plans consistent with the RA II Operating Plan for 2016-2019 and the development of specific activities for the WGHS for 2016-2019. He noted that in addition, there would be a field trip on Wednesday afternoon to the Kwater pumping station, which was the largest in the world. He recalled that there was a requirement to provide a final report for the WGHS associated with the RA II meeting, and he requested all experts to provide him with a brief summary of their major accomplishments and the revised final work plan for their area of endeavour.

## 2. ADOPTION OF THE AGENDA AND ORGANIZATION OF WORK

2.1 The meeting was attended by 13 participants from 5 countries of the RA II.

2.2 The list of participants is given in **Annex 1** to this report. Mr Paul Pilon acted as Secretary for the meeting and Mr Sung KIM, Senior Research Fellow, Korea Institute of Civil Engineering and Building Technology (KICT), chaired the sessions of the WGHS.

2.3 The WGHS discussed the agenda and adopted it (**Annex 2**). Mr Kim briefly mentioned that he had reported to the RA II Management Group on the activities of the WGHS during its meeting held 15 June 2016 . He also noted that he had provided the Management Group with the WGHS input to the RA II Operating Plan 2016-2019. It was also noted that all presentations made and material provided during the meeting can be downloaded from the following URL:

http://www.wmo.int/pages/prog/hwrp/RA2/RAII-WGH-III-Seoul.php

2.4 Mr Paul Pilon provided a presentation, which can be found on the URL above, on pertinent outcomes from the 2nd Meeting of the WMO Flood Forecasting Initiative – Advisory Group, which held its meeting in December 2015 in Geneva, and aspects of the Commission for Hydrology (CHy) as a result of the 3rd Meeting of its Advisory Working Group (AWG), which was held in Geneva in February 2016. He also presented on the outcomes directly of relevance to the WGHS stemming from the 68th Session of Executive Council (EC_68) held in June 2016. He noted as well the RA II Operating Plan for 2016-2019 and the upcoming 16th Session of the RA II in February 2017. He indicated that the group should consider what decisions should be placed before the next RA II Session pertaining to its work. This latter aspect would be discussed more fully Wednesday afternoon 26 October) and possibly Thursday morning (27 October).

## 3. REVIEW AND ADJUSTMENT OF WORK PROGRAMME

3.1 The work plans of all members present were reviewed and adjusted during the meeting. The revised work plans appear herein. The next section of this report provides a brief description of the progress made during the intersessional period. The work plans of those members who were absent, namely Messrs Muhammad Riaz, Sergey Borshch, Guoqing Wang, and Tran Thuc were revised by Mr Sung Kim through correspondence with said members following the conclusion of the meeting. This was also undertaken by Mr Sung Kim for Mr Tai-Hoon Kim who had to leave the meeting for an urgent work-related matter. All revisions to their work plans are also contained herein.

## 3.2 WORKPLAN: Chairperson of WGHS — Sung KIM

| Activities | Actions | Outputs | Resources | Milestones | Linkages | Progress |
|---|---|---|---|---|---|---|
| 1. In his capacity as Hydrological Adviser, to assist the president of RA II in accordance with the duties stipulated in Regulation 168 (b) of the WMO General Regulations | • Represent WGHS as and when required, (eg at MG and EC)<br>• Attend meetings of chairpersons of Working Groups<br>• Other duties as required of chairpersons WGHS (see General Regulation 168 (b)) | • Hydrology and Water Resources issues remain a key aspect of the work of RAII<br>• NMHSs are assisted in fulfilling their roles and responsibilities.<br>• WGHS is adequately represented within the RAII environment. | • Resources are provided to meet the needs of the theme leaders in doing the work of the Working Group.<br>• Secretariat support | • Meetings and other activities according to the WMO Schedule of meetings.<br>• Report at WGHS meetings<br>• Report at MG Sessions<br>• Report to RAII-16 (2016). | • WGHS<br>• RAII<br>• MG<br>• EC | • Attended RA II Management Group meetings<br>• Attended RA II Chairs Meetings (2014, 2015)<br>• Attended RA II Conference (2014) |
| 2. To develop a Working Group implementation plan in consultation with the president and the Management Group of the Association, with reference to the key performance indicators/targets and action plans under the respective expected results of the RA II Strategic Operating Plan, to undertake work on the various theme areas under the charge of the Working Group | • Chair theme leaders meetings of the WGHS to develop implementation plan<br>• Report to MG meeting for consultation<br>• Submit report | • WGHS implementation plan | • Resources are provided to meet the needs of the theme leaders in doing the work of the WGHS | • WGHS meeting (Sept. 2014)<br>• WGHS implementation plan (Oct 2014)<br>• Report at MG Sessions for consultation and submit a report to RAII president (2014) | • WGHS<br>• RAII<br>• MG | • Develop WGHS work plan and reported and updated (2013, 2014, 2015, 2016)<br>Develop future WGHS activity plan (2016) |
| 3. To participate in Executive Council sessions, when invited, representing the regional interests in relation to hydrology and water resources and to coordinate the WGHS activities with the Commission for | • Attend EC meeting if required<br>• Develop WGHS work plan in consideration of CHy and other regional WGHS activities<br>• Organize WGHS | • Meeting report<br>• WGHS implementation plan | • Resources are provided to meet the needs of the theme leaders in doing the work of the WGHS | • WGHS meeting (Sept. 2014)<br>• WGHS implementation plan (Oct 2014)<br>• Report at MG Sessions for consultation and submit a report to RAII president | • WGHS<br>• RAII<br>• MG | • Attended EC65, EC68<br>• Attend Hydrological Advisors Meeting during EC meeting (2013, 2016)<br>• Report of WGHS and implementation plan |

| Activities | Actions | Outputs | Resources | Milestones | Linkages | Progress |
|---|---|---|---|---|---|---|
| Hydrology and other regional Working Groups on Hydrology | meeting | | | (2014) | | |
| 4. To submit to the president of the Association an annual report by 31 December every year and a final report in time for presentation to the sixteenth session of the Association, both copied to the WMO Secretariat, with inputs from theme leaders under the Working Group | • Develop WGHS activity report with input from theme leaders | • WGHS activity report | • Resources are provided to meet the needs of the WGHS theme leaders | • Submit annual report to RAII president and WMO Secretariat (Dec 2014, Dec 2015)<br>• Submit final report to RAII president and WMO Secretariat (2016) | • WGHS<br>• RAII<br>• WMO | • Organize WGHS meetings and submitted report (2013, 2014, 2015, 2016)<br>• Nov 2016 Final Activity Report submitted |

### 3.3 WORKPLAN: Vice Chairperson of WGHS (RA II) Muhammad Riaz

| Activities | Actions | Outputs | Resources | Milestones | Linkages | Progress |
|---|---|---|---|---|---|---|
| 1. To assist the chairperson WGHS in accomplishing his work related to the group activities | As delegated by the chairperson | Not Specified | As appropriate | As appropriate | Chairperson | • On-going |
| 2. To review the reports sent by various Theme leaders through the Chairperson | Summary of review | Report | • Chairperson<br>• Theme Leaders<br>• RA II Secretariat<br>• CHy | Not specified | • Chairperson<br>• Theme leaders<br>• RA II Secretariat<br>• CHy | • On-going |
| 3. To review and develop the Hydrological Parts of S.O.P. | Review if required | Review report | • RA II strategic operation Plan<br>• RA II MG | Not specified | Chairperson | |
| 4. To put up suggestions and collaboration in strengthening of Flood Forecasting & Warning System amongst Member States | Review related reports | Suggestions | • Theme Leaders reports in RA II<br>• CHy report | Submission of report by 2016 | RA II<br>WGHS<br>CHy | |
| 5. To assist the Chairperson on matters related in combating marine pollution | Review S.O.P. and some suggestions | Suggestions | S.O.P | Suggestions by the end of 2014 | S.O.P<br>WGHS | |

## 3.4 WORKPLAN: Water Resource Assessment — GAO Ge and Hwirin KIM

| Activities | Actions | Outputs | Resources | Milestones | Linkages | Progress |
|---|---|---|---|---|---|---|
| 1. Assessment of basin-wide water resources availability, including use of climate predictions (3.3.2) | • Prepare assessment and outlook of basin-wide availability water surplus and deficits on a national level in a regional context including the use of climate scenarios. (Priority C) | | • RA II | | • RA II<br>• CHy | |
| 2. Assessment of basin-wide water resources availability, including use of climate predictions (3.3.2) | • Set up knowledge base to adapt to changes in water resources availability (trends, outlook) (Priority A) | • Report related to the case studies | • RA II<br>• Research documents<br>• Han River Flood Control Office(HRFCO), Ministry of Land, Transport and Infrastructure(MOLIT ), Republic of Korea<br>• Korea Institute of Civil engineering Technology (KICT), Republic of Korea | • Develop new system by Dec 2016<br>• Collection case studies by the end of 2016<br>• Evaluate model performance by Dec 2016<br>• Final case study report on new model in Jan. 2017 | • RA II<br>• AWG | • Case studies being collected<br>• Beta version of Dynamic Water Resources Assessment Tool(DWAT) using hydrologic components of KICT CAT(Catchment hydrologic cycle Assessment Tool) |
| 3. Implementation of Water Resources Assessment (WRA) (3.3.3) | • Provide guidance materials for WRA linking to Climate extended range prediction<br>- Downscaling<br>- monthly and seasonally prediction WRA models<br>- WRA (Priority B) | • Guidance for WRA | • China<br>• Korea | • Provide draft technical report by the end of 2016<br>• Provide draft technical manual of Dynamic Water Resources Assessment Tool by the end of 2016<br>• Provide Final user's Guidance of DWAT system by the end of in Mar.2017 | • RAII<br>• CHy | Technical Report draft has been finished preliminarily. |
| 4. Development of national and regional capacity building programmes and related training activities for hydrological services (3.3.4) | • Provide training material for a training course related to the advances in WRA:<br>- Downscaling methods for extended range prediction<br>- Data collection<br>- WRA methods<br>- WRA Information system (Priority B or C) | • Training Course | • WMO Regional Training Center in Nanjing | • Training Course in 2017 | | |

## 3.5 WORKPLAN: Flood Forecasting — Sergey BORSHCH

| Activities | Actions | Outputs | Resources | Milestones | Linkages | Activity report |
|---|---|---|---|---|---|---|
| 1. Improvement in hydrological warnings capability through enhanced and effective cooperation with other NMHSs (2.1.1) | (a) To prepare recommendations on the use of numerical weather prediction outputs in flood forecasts (Priority A)<br><br>(b) Document approaches to ascertain the deterministic error of each ensemble element of a NWP output, for example over the previous thirty day period, using this deterministic signal to provide a weighting on the confidence of the forecasted ensemble elements (Priority A)<br><br>(c) Use WMO FFI as platform [for a and b above] (Priority A)<br>(d) Organize training course for Members (Priority C)<br><br>(e) Organize training course for Members (Priority C) | (a) Recommendations on the use of NWP outputs in flood forecasting systems<br><br>(b) Document on the approaches to establishing the deterministic error in NWP outputs and for their use in establishing enhanced accuracy of hydrological forecasts | HMC of Russia | (a) Gathering of background material and documents on the FFI and associated activities - January 2015<br><br>Preparation of Draft Recommendations – June 2015<br><br>(b) Gathering of materials - September 2015<br><br>Preparation of Draft Report on procedures – February 2016 | OPACHE's<br><br>International Flood Initiative - WMO | At the 26/10/2016<br>1. *Recommendations for the development of forecast methods for the spring floods forecasting on the base of meteorological information (the experience of Roshydromet)* – S.Borshch, A. A. Gelfan, Y. Motovilov, Kristoforov, Y. Simonov, V. Belchikov, C. Leontieva and others, - Moscow, 2016, 65 p. (in Russian)<br>2. *Guidelines for verification of hydrological forecasts.* – S.Borshch, A. Khristoforov, C. Lieontieva. – Moscow, 2016, 84 p. (In English<br>3. *Operational Hydrologic Forecast System in Russia (in the book "Flood forecasting: a global perspective". Chapter 7, edited by Thomas E. Adams, III and Thomas C. Pagano),* pp.169-181 (with Y. Simonov), Academic Press, ELSEVIER, 2016 (in English). ISBN 978-0-12-801884-2.<br>In the chapter briefly touches on the hydrologic forecast system of the Roshydromet: hydrological phenomena to forecast; forecasting techniques and models used operationally; the hydrometeorological data network; and automated forecast systems.<br>4. *Recommendations on objective evaluation of observational networks configuration in terms of their density and composition of observations, taking into account the impact on the accuracy of hydrological forecasts.* – S. Borshch, A. Khristoforov, Y. Simonov and others. – Moscow, 2016, 81 p. (in Russian) |
| 2. Issuance of flood, flash and urban warnings and constantly improving upon them (2.2.5) | (a) To document experiences in the use of the Flash Flood Guidance System (FFGS) in various countries by reviewing use of the Flash Flood Guidance System (FFGS) in the various countries (Priority A) | (a) Report documenting experiences, including recommendations on approaching implementation of FFGS and its use | (a) Working meeting with hydrologists and meteorologists of the Central Asia countries on use the FFGS in | (a) Background material and documents on the FFGS and associated activities - April 2015<br><br>Preparation of Draft Document – June 2015 | NMHSs OPACHE's WMO Hydrological Research Center in San Diego (USA) | 1. *Flood forecasting and early warning system for rivers of the Black Sea shore of Caucasian region and the Kuban river basin* (S.V. Borsch, Y.A. Simonov, A.V. Khristoforov). - Proceedings of the Hydro-meteorological Research Center of Russian Federation. Special issue №356. – Moscow, 2015, 247 p. ISSN 0371 – 7089. (in Russian)<br><br>Main aspects, methodology, principles |

| | | | | | | |
|---|---|---|---|---|---|---|
| | (b) To investigate the potential use of FFGS in Central Asian countries and facilitate its understanding by operational hydrologists in the region (Priority A)<br><br>(c) To develop recommendations on use of hydrological forecasts (including probabilistic forecasts) in flood management (Priority A)<br><br>(d) Develop user-oriented flood forecasting products (Priority C)<br><br>(e) Conduct mission visit(s) to Members in developing countries or least developed countries (Priority C) | (b) Recommended path forward for advancing the adoption of the FFGS in Central Asia.<br><br>(c) Conduct kick-off meeting of senior meteorologists and hydrologists within Central Asia on the FFGS project<br><br>(d) Report containing recommendations on use of hydrological forecasts (including probabilistic forecasts) in flood management, based on experiences of Roshydromet | operative hydrological practice<br><br>(b) Funding for kick-off meeting for Central Asia FFGS | (b) Discussions with potential collaborating NMHSs in Central Asia - March 2015<br><br>Preparation of Draft Recommendations – March 2015<br>Conduct kick-off meeting - May 2015<br>(c) Report prepared by February 2016 | | of setup and operation of the flood forecasting and early warning system are described. Short-range forecast techniques of daily discharge on the hydrological river gauges of the Black Sea shore of the Caucasian region and the Kuban river basin are incorporated into the system. The main objective of the system is to increase quality and robustness of the operative decisions on flood prevention measures and water resources utilization. Developed structure and software of the forecasting system have universal nature and thus can be implemented in different regions of the Russian Federation. The special issue is addressed to specialists in hydrometeorological forecasting, hydrology, water resources, environmental monitoring and ecology. |
| 3. Improvement in capacity for water-related disaster management (hydrological extremes) [with theme on hydrological droughts] (2.1.3) | (a) Organize a workshop [or two workshops] on the provision of input and support to disaster management [on community-based flood and drought management including participation of NMHSs, emergency services and disaster management groups] (Priority B) | (a) Increased capacity for water-related disaster management | (a) Resources to conduct necessary workshop(s) through collaboration with APFM and IDMP | Training session on Integrated Flood Management dealing with development of community capacity - July 2016<br><br>Training session on Integrated Drought Management dealing with development of community capacity – November 2016 | APFM<br>IDMP<br>NMHSs<br>WMO | |

## 3.6 WORKPLAN: Hydrological Aspects of Drought — DERGACHEVA Irina

| Activities | Actions | Outputs | Resources | Milestones | Linkages | Progress |
|---|---|---|---|---|---|---|
| 1. Monitoring and Warning Systems for Droughts (2.3.1.) | (a) Develop indicators for the determination of the onset of hydrological droughts:<br>• Collection, analysis and systematization of data to identify indicators for the determination of the onset of hydrological droughts<br>• Identify the types of Hydrological drought is characteristic of the Asian region<br>• Study of the conditions of formation of hydrological drought (Priority A) | • Report on the Indicators for the determination of the onset of hydrological droughts | • Centre of Drought Monitoring of Uzbekistan<br>• Uzbekistan experts<br>• Materials for IDMP<br>• Materials for HMNDP | • Preparing of the data and information to develop indicators for the determination of the onset of hydrological droughts - Oct 2015<br>• Draft Report – Dec 2015<br>• Report – November 2016 | • OPACHE's<br>• WGHS<br>• RAII<br>• WMO | • Report prepared on review of potential drought indices leading to selection of Pedya drought index, Standardized Precipitation Index SPI, Drought index for snow storage Sw. It also describes functions and design of an EWS for drought for Central Asian countries.<br>• Uzhydromet established a National Centre for Monitoring of Drought to serve as a coordinating and consultative center for drought preparedness, monitoring, prevention and mitigation of the adverse effects of drought. Potential to expand for all CA countries.<br>• Report also includes an analysis of the conditions leading to low water and drought and an analysis of the frequency of low water and drought for Uzbekistan. Could be used as template for other countries.<br>• This EWS allows the calculation of snow storage, assessments of precipitation and temperature, enabling the analysis of the conditions for river runoff formation in the low water years and the factors for its formation for all drought indices for sub-basins in the runoff formation zone of the Amudarya and Syrdarya rivers (Aral Sea basins). |
| | (b) Prepare guidance for the development of drought monitoring networks :<br>• Gathering information about the status of drought monitoring networks in Asian region | • Guidance materials for the development of drought monitoring networks | • WGHS RAII<br>• OPACHE Uzbekistan experts<br>• Materials for IDMP<br>• Materials for HMNDP | • Information for the development of drought monitoring networks – April 2016<br>• Draft Report – November 2016 | • OPACHE's<br>• WGHS<br>• RAII<br>• WMO | Analysis was performed indicating the need to strengthen / further develop the hydrometeorological monitoring network to improve the early warning of drought. No formal report to be prepared. Analysis is being provided to World Bank project on strengthening hydrometeorological services |

| Activities | Actions | Outputs | Resources | Milestones | Linkages | Progress |
|---|---|---|---|---|---|---|
| | • Identification of gaps and needs of the national hydrometeorological services to improve the drought monitoring networks (Priority B) | | | | | in the region. |

## 3.7 WORKPLAN: Assessment of Changes in Climate Extremes, Their Impacts on Water Resources, and Translating Climate Information into Action in Water Resources Management WANG Guoqing and TRAN Thuc

| Activities | Actions | Outputs | Resources | Milestones | Linkages | Progress |
|---|---|---|---|---|---|---|
| 1. Improvement in adaptation capacity of water resources systems in a changing climate (2.1.2)<br><br>2. Assessment of basin-wide water resources availability, including use of climate predictions (3.3.2)<br><br>3. Improvement in capacity for water-related disaster management (Hydrological extremes) (2.1.3) | 1) Assessment of changes in climate<br>- Data and method of climate study: Data inventory, climate variables, methods – (Priority A)<br>- Trend of some climate variables: temperature, rainfall and other extremes – (Priority A)<br>- Changes in atmospheric circulation affecting climate extreme: e.g., Monsoon, typhoon and tropical depression, El Nino and Southern Oscillation – (Priority C)<br>- Change in climate affecting natural physical environment: e.g., drought, extreme rainfall, flood, sea water level – (Priority C) | Assessment report on climate change for participating countries | • WGHs<br>• WMO Secretariat<br>• NHRI, China<br>• CMA, China<br>• IMHEN, Vietnam<br>• Other countries | • Report to be submitted (May 2015)<br>• Reports to: AWG-II<br>• Documents as required<br>• Workshop if needed | WGHs<br>RA2<br>WMO Secretariat<br>CHY | 1. Data base establishment. Meteorological data at 758 stations within China and hydrological data recorded at 265 stations on major rivers in China were collected, and database was established.<br>2. Scientific report "climate change for major rivers in China", by Guoqing Wang, Jianyun Zhang, Junliang Jin, etc. May, 2015. China (in Chinese with English abstract)<br>3. Scientific report "Sea level rise along China's Coast line", by Guoqing Wang, Guowei Chen, etc. Feb, 2016. China (in Chinese with English abstract)<br>4. "Viet Nam Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation" (in Vietnamese (Nguyen Van Thang et al.) is being translated into English, and the report will be available by Nov 2016<br>5. Journal papers are as follows:<br>● Meixiu Yu, Xiaolong Liu, Li Wei, Qiongfang Li, Jianyun Zhang and Guoqing Wang. 2016. Drought assessment by a short-/long-term composited drought index in the upper Huaihe River basin, China. Advances in Meteorology. http://dx.doi.org/10.1155/2016/7986568<br>● Binquan Li, Zhongmin Liang, Jianyun Zhang, and Guoqing Wang. 2016. A revised drought index based on precipitation and pan evaporation. International Journal of Climatology. DOI: 10.1002/joc.4740<br>● Guoqing Wang, Cuishan Liu, Sicheng Wan, Zhenxin Bao and Yanli Liu. 2016. Variability in stream flows of the Xiang River in a changing climate. Int. J. Global Warming. http://www.inderscience.com/info/ingeneral/forthcoming.php?jcode=ijgw<br>● G.Q. Wang, J.Y. Zhang. 2015. Variation of water resources in the Huang-huai-hai areas and adaptive strategies to climate change. Quaternary International 380-381 (2015) 180-186. http://dx.doi.org/10.1016/j.quaint.2015.02.005<br>Song Xiaomeng, Zhang Jianyun, AghaKouchak Amir, Sen Roy S., Xuan Yunqing, Wang Guoqing, He Ruimin, Wang Xiaojun, Liu Cuishan. Rapid urbanization and changes in spatio-temporal characteristics of precipitation in Beijing metropolitan area. Journal of Geophysical Research: Atmosphere, 2014, 119(19): 11250-11271 |
| | 2) Conduct climate projections – (Priority A)<br>- Statistical downscaling<br>- Dynamic downscaling | Climate change scenarios for participating countries | | Report to be submitted (May 2015) | | 1. Scientific Report "Analysis and production of Climate Scenarios for Jinsha River basin", by Guoqing Wang, Junliang Jin, and Zhenxin Bao. Jan, 2016. China (in English)<br><br>2. Report of "Climate Chang and Sea level rise for Viet Nam" (in Vietnamese) (Tran Thuc, Nguyen Van Thang, Huynh Thi Lan Huong, Mai Van Khiem, Nguyen Xuan Hien, Doan Ha Phong), is being translated into English, and the report will be sent by Nov 2016 |

| Activities | Actions | Outputs | Resources | Milestones | Linkages | Progress |
|---|---|---|---|---|---|---|
| | 3) Assessment of potential hydrological impacts of climate change on water resources of some selected river basins – (Priority A)<br>- Temperature<br>- Rainfall<br>- Evapotranspiration<br>- Flood and inundation<br>- Drought<br>- Water Resources | Report on the impacts of climate extremes and climate change to water resources | | Report to be submitted (Dec 2015) | | 1. Scientific report "Impact of Climate change on water resources of China by using multiple GCMs projections", by Guoqing Wang, Junliang Jin, and Zhenxin Bao. Dec, 2015 (in Chinese), China<br>2. Report of "Changes in Climate Extreme and Impact on Water Resources in Viet Nam" (Tran Thuc, Nguyen Xuan Hien, Mai Van Khiem) was submitted on 25 Oct 2016<br>3. Report of "Projection of extreme temperature and precipitation and their impacts on water resources in Dong Nai river basin and vicinity – Viet Nam" (in Vietnamese) (Vu Thi Van Anh, Tran Thuc, Vu Hai Son, Truong Thi Thu Hang) is being translated into English, and the report will be sent by Dec 2016<br>4. Journal papers are as follows<br>● Guoqing Wang, Jianyun Zhang, Ruimin He, Cuishan Liu, Tao Ma, Zhenxin Bao, Yanli Liu. 2016. Runoff sensitivity to climate change for hydro-climatically different catchments in China. Stochastic Environmental Research and Risk Assessment. DOI 10.1007/s00477-016-1218-6<br>● Guoqing Wang; Jianyun Zhang; Xuemei Li, Zhenxin Bao; Yanli Liu; Cuishan Liu; Ruimin He; Junsong Luo. 2016. Investigating causes of changes in runoff by using hydrological simulation approach. Applied Water Sciences. DOI: 10.1007/s13201-016-0396-1<br>● GuoqingWang, Jianyun Zhang, Thomas C. Pagano, Yueping Xu, Zhenxin Bao, Yanli Liu, Junliang Jin, Cuishan Liu, Xiaomeng Song, Sicheng Wan. 2015. Simulating the hydrological responses to climate change of the Xiang River basin, China. Theor Appl Climatol. DOI 10.1007/s00704-015-1467-1<br>Guoqing Wang, Jianyun Zhang, Junliang Jin, Josh Weinberg, Zhenxin Bao, Cuishan Liu, Yanli Liu, Xiaolin Yan, Xiaomeng Song, Ran Zhai. 2015. Impacts of climate change on water resources in the Yellow River basin and identification of global adaptation strategies. Mitig Adapt Strateg Glob Change. DOI 10.1007/s11027-015-9664-x |
| | 4) Translating climate and climate change information into actions in water resources development and management: – (Priority A)<br>- Case study for a selected | Report of case study | | Report to be submitted (Feb 2016) | | 1. *Recommendation report "Recommendations for China's adaptation strategy in water sector to climate change", submitted to Ministry of Water Resources by RCCC (Research Center for Climate Change, Ministry of Water Resources), drafted by Guoqing Wang and Jianyun Zhang, Dec, 2015. (in Chinese)*<br>*Recommendation report "Recommendations on Sponge City Development of Zhenjiang City for better adaptation to climatic extremes", by Guoqing Wang, Cuishan Liu, and Yanli Liu. Feb, 2016 (in Chinese)* |
| 4. Development of national and regional capacity building | 5) Synthesize report from individual reports from participating countries in the RA II – (Priority A) | | | Report to be submitted (May 2016) | | 1. China's National Scientific Research and Development program "Scientific regulation and benefit sharing role of water resources for transboundary river, a case study of Mekong River basin", Guoqing Wang is the leader of sub-project of "Impact of climate change on eco-hydrology of the Mekong River", the project was approved in 2016 |

| Activities | Actions | Outputs | Resources | Milestones | Linkages | Progress |
|---|---|---|---|---|---|---|
| programmes and related training activities for hydrological service (3.3.4) | | | | | | 2. China's National Scientific Research and Development program "Impact of changes in climate and society on global terrestrial water cycle". Guoqing Wang is leading this project. The project was approved in 2016.<br>Training workshop on improving environment protection awareness, was held in Nanjing during Apr 12-14, 2016, organizing by Guoqing Wang |
| | 6) Lesson learn and experience sharing – (Priority B) | | | | | Training course for workshop on adaptation to climate change referencing experience from Japan and America, was held in Nanjing during March 12, 2015, organizing by Guoqing Wang. |

## 3.8 WORKPLAN: Improved Accuracy of Hydrometric and Sediment Observations including Space-based Technologies

**Youngsin ROH**

| Activities | Actions | Outputs | Resources | Milestones | Linkages | Progress |
|---|---|---|---|---|---|---|
| 1. Reliability of quality control procedure applied on data collected from hydrological stations (2.2.1) | a) assess the performance of hydrometric instruments and techniques of observations (Priority C) | | | | | |
| | b)Prepare documentation for the intercomparison of instruments and methods of observation (Priority C) | | | | | |
| 2. Hydrometric measurements with quality and accuracy (2.2.2) | a) Provide guidance on the use of appropriate instruments and methods of observation in diverse conditions (Priority A)<br>• Collection of existing technical information in IRDMIS<br>➢ Measurement instrumentation (ADVM)<br>➢ Methods of discharge calculation<br>➢ Construction and operation of IRDIMS<br>• Case study on measurement by IRDMIS (52 sites)<br>➢ Measurement of tidal influenced discharge<br>➢ Measurement under backwater conditions caused by weirs, sluice gates, and river junctions<br>➢ Evaluation of measurement results<br>➢ Development of index velocity ratings<br>• Writing Technical report about construction and management by field characteristics | • Technical report related to IRDIMS With case studies in various conditions<br>- Collection of the existing technical information of IRDIMS<br>- Development for index rating<br>- Installation and operation<br>- Procedure on development of index rating<br>• Development of Software tools to develop index rating | - Republic of Korea(ROK) | • Technical report and guideline with case studies<br><br>DEC 2016<br><br>• Software System (EDpad, MCDpad)<br><br>DEC 2016 | - CHy<br><br>- ROK | Translating Korean technical report into English version<br>• *Technical information of IRDIMS*<br>• *Installation and operation*<br>• *Discharge calculation including development of index rating*<br>• *Software tool for development of index rating*<br>• *Case study on various conditions*<br><br>*1st draft by DEC 2016*<br>*Final ver. will be completed by Feb 2017*<br><br>Development of Software tools have been |

| Activities | Actions | Outputs | Resources | Milestones | Linkages | Progress |
|---|---|---|---|---|---|---|
| | | | | | | completed, and its manual will be ready by DEC. 2016 |
| | b) Improve sediment measuring techniques (Priority B)<br>• Collection of existing technical information<br>➢ The status of existing sediment measurement techniques<br>➢ The status of new technologies and their applications<br>➢ The status of analysis methods<br>• Case studies on sediment measurements under various conditions (15 - 20 sites)<br>➢ Analysis of river construction effect on characteristics of sediment load, focused on 4 major river projects in Korea<br>➢ A comparative analysis on sediment load by sequence of rainfall event<br>• Writing Technical report about sediment measurement method and analysis of field characteristics | • Technical report on sediment measurement methods and with case studies in various conditions<br>- Analysis on characteristics of sediment load during rising & falling water level(Loop)<br>- Analysis on river construction effect on characteristic of sediment load, focused on 4major river project in Korea<br>- A comparative analysis on sediment load by sequence of rainfall event. | - Republic of Korea(ROK) | • Provide technical report and guideline with case studies<br><br>DEC 2016 | - CHy<br><br>- ROK | Translating Korean technical report into English version<br>• *Technical information of sediment measurement*<br>• *Case study on sediment measurement various conditions*<br><br>*1st draft by DEC 2016*<br>*Final ver. will be completed by 2017* |
| | c) assess the accuracy and use of space-based observation (Priority C) | | | | | |
| 3. Calculation of runoff with quality and accuracy (2.2.3) | a) Focus on the development of rating curve(Priority B)<br>• Collection of existing technical information<br>➢ On major procedures for rating curve development<br>➢ On tools for rating curve development<br>• Case analysis with various field conditions<br>➢ On development of rating | • Report on methods to develop rating curves<br><br>- *Status of flow measurement the past 3 years*<br>- *Procedure of H-Q rating development*<br>- *Software tools to* | - Republic of Korea(ROK) | • Provide Technical report and guideline with case studies<br><br>DEC 2016 | - CHy<br><br>- ROK | Translating Korean Technical Report into English version<br>• *Status of flow measurement the past 3 years*<br>• *Procedure of H-Q rating development* |

| Activities | Actions | Outputs | Resources | Milestones | Linkages | Progress |
|---|---|---|---|---|---|---|
| | curves when backwater conditions exist (weir, junctions)<br>• Writing technical report on rating curve development | - *develop & to manage of H-Q rating curve*<br>- *Case study on development of H-Q rating curve in various conditions and its guideline (backwater by weir, bed change, vegetation)* | | | | • *Software tools to develop & manage of H-Q rating curve*<br>• *Case study on development of H-Q rating curve in various conditions and its guideline*<br>• *(backwater by weir, bed change, vegetation)*<br>• *1st draft by DEC 2016*<br>*Final ver. will be completed by 2017* |
| | b) detect trends and variability in selected river basin in the region (Priority C) | | | | | |
| | c) provide guidelines for calculating runoff data accuracy (Priority C) | | | | | |
| 4. Establishment of Quality Management Frameworks for Hydrology using current guidance materials for hydrology and water resource management (3.3.3) | Encourage and facilitate exchange and training on relevant know-how (Priority C) | | | | | |
| 5. Development of national and regional capacity building programmes and related training activities for hydrological services (3.3.4) | Encourage and facilitate exchange and training on relevant know-how (Priority C) | | | | | |

## 3.9 WORKPLAN: SEDIMENT DISASTERS AND MASS MOVEMENTS — TAI-HOON KIM

| Activities | Actions | Outputs | Resources | Milestones | Linkages | Progress |
|---|---|---|---|---|---|---|
| 1. Issuance of landslide/debris flow warnings and consistently improving upon them | • Collect and disseminate materials for assessment of sediment disasters (Priority A)<br>• Investigate warning technologies based on adaptive concepts (Priority B)<br>• Generate sediment disasters risk map (Priority C) | • Actual example for implementation of adaptive sediment disasters risk management tools with identification, reduction and evacuation | • Republic of Korea (ROK)<br>• National Disaster Management Institute (NDMI) | • Case study report for present systems for sediment disasters management - May 2015<br>• Analyzing models for the integrating system - Oct 2015<br>• Report for adaptive sediment risk management tools - Aug 2016 | • SOP 2.2.6<br>• RA II<br>• WMO Secretariat<br>• ROK (MPSS) | • <u>Governmental research reports</u><br>*1. National Disaster Management Institute (2014) A development of regional major disasters response scenarios and standards (I) focusing on urban flooding and drought, NDMI-PR-2014-07-01, 228p.(in Korean)*<br>*2. National Disaster Management Institute (2014) Construction of fundamental technology for disaster risk assessment and response(I), Disaster risk assessment system in Korea, NDMI-PR-2014-07-02-01, 313p.(in Korean)*<br>*3. National Disaster Management Institute (2014) Improvement of design element based on empirical experiments, NDMI-PR-2014-07-09-01, 262p.(in Korean)*<br>*4. National Disaster Management Institute (2015) Enhancement of criteria for disaster mitigation through practical based cause analysis, NDMI-PR-2015-01-02, 130p.(in Korean)*<br>*5. National Disaster Management Institute (2015) The reduction and management plans for risk factors of repeated structural disasters, NDMI-PR-2015-03-02-01, 200p.(in Korean)*<br>*6. National Disaster Management Institute (2015) Establishment of foundation for regional urban flood response system, NDMI-PR-2014-07-02-01, 156p.(in Korean)*<br>• <u>Professional research papers</u><br>*1. Lee, K.S., Jang, C-L., Lee, N.J., and Ahn, S.J. (2014). "Analysis of Flow Characteristics of the Improved-Pneumatic-Movable Weir through the Laboratory Experiments", Journal of Korean Water Resources Association, Vol. 47, No. 11, pp.1007-1015.*<br>*2. Lee, K.S., Ryu, J.K., and Ahn, S.J. (2014). "Change of regime coefficient due to dredging and dam construction.", Journal of Korean Environmental Dredging Society, Vol. 4, No. 1, pp.30-38.*<br>*3. Lee, K.S., and Jang, C-L. (2014). "Estimation of erosion resistance of vegetation mat for protecting bank surface erosion by laboratory experiments.", Journal of Korea National University of Transportation, Vol. 49, No. 1, pp.205-210.*<br>*4. Lee, K.S., and Jang, C-L. (2016). "Numerical investigation of space effects of serial spur dikes on flow and bed changes by using Nays2D.", Journal of Korean Water Resources Association, Vol. 49, No. 3, pp. 241-251.*<br>*5. Lee, K.S., and Jang, C-L., and Lee, N.J. (2016). "Analysis of Submerged Flow Characteristics of the Improved-Pneumatic-Movable weir through the Laboratory Experiments.", Journal of Korean Water Resources Association, Vol. 49, No. 7, pp. 615-623.*<br>*6. Song, Y.K., Kim, Y.U., Kim, K.J., and Lee, K.S. (2016). "Countermeasures on Safety Management of Decrepit Reservoir Based on the Comparative Analysis for Its Collapse Accidents.", Crisisonomy Vol. 12, No. 7, pp. 615-623.* |

| Activities | Actions | Outputs | Resources | Milestones | Linkages | Progress |
|---|---|---|---|---|---|---|
| 2. Improvement in capacity for sediment disaster management (2.1.3 in OP) | • Attend seminars on sediment disasters in order to communicate and cooperate among member countries (Priority A)<br>• Share and bring related technologies to developing countries (Priority B) | • Workshop on the provision of sharing knowledge for sediment disasters (e.g. attend workshop of TC DRR)<br>• ODA projects which transplant knowhow to developing countries | • Republic of Korea (ROK)<br>• National Disaster Management Institute (NDMI)<br>• WMO/ESCAP Typhoon Committee, Disaster Risk Reduction (TC DRR) | • Report for feasibility survey for ODA projects by April 2016<br>• Attend Workshop of TC DRR on May 2015<br>• Attend International Workshop among Korea, Taiwan, and Japan | • SOP 2.1.3<br>• RA II<br>• WMO Secretariat<br>• TC DRR<br>• ROK (MPSS and KOICA) | • Governmental research reports<br>*1. National Disaster Management Institute (2014) Construction of Forecasting and Warning System for Disaster Mitigation in the Philippines-II, NDMI-ODA-2014-1, 150p. (in Korean and English)*<br>*2. National Disaster Management Institute (2014) Regional Peer Learning Forum for Disaster Risk Reduction Capacity Building of Central Asia, NDMI-ODA-2014-02-01, 121p. (in Korean)*<br>*3. National Disaster Management Institute (2014) Development of NDMI's Roadmap for Its International Cooperation Work: Through Promoting international research and ODA project, NDMI-PR-2015-03-02-07, 176p. (in Korean)*<br>*4. National Disaster Management Institute (2015) Technical applicability analysis on disaster risk reduction technology transfer to strategic priority countries (I), Disaster risk assessment system in Korea, NDMI-PR-2014-07-02-01, 313p.(in Korean)*<br>• International cooperation<br>*1. Regional forum on space technology applications for drought monitoring and early warning, UN-ESCAP, July 1-2, Colombo, Sri Lanka, 2014.*<br>*2. Expert mission for UNESCAP/WMO Typhoon Committee members, Oct. 21-25, 2014.*<br>*3. MOA bet. NDMI-ESCAP, Oct. 20-24, 2014.*<br>*4. NDMI Regional Peer Learning Forum (PLF) for Central Asia, Nov. 17-22, 2014.*<br>*5. The 47th UNESCAP/WMO Typhoon Committee General Meeting, Thailand, Feb. 9-13, 2015.*<br>*6. Expert mission for automatic rainfall warning system in Philippines Apr. 26-May 1, 2015.*<br>*7. 2015 UNESCAP/WMO Typhoon Committee Working Group on Disaster Risk Reduction meeting, May 19-20, 2015.*<br>*8. Establishment of automatic rainfall warning system in Laos, Sept. 4-6, 2016.*<br>*9. ADRC annual meeting, Thailand, Mar. 25-26, 2016.*<br>*10. The 48th UNESCAP/WMO Typhoon Committee General Meeting, Hawaii, Feb. 22-25, 2016.* |
| 3. Optimization of disseminating sediment disasters related information | • Collect and analyze disseminating methodologies and related policies for sediment disasters information that alarm people not to be involved to the designated areas | • Actual example for sediment disasters information by public broadcasting system and other media (e.g., Facebook, Twitter, etc.) | • Republic of Korea (ROK)<br>• National Disaster Management Institute (NDMI) | • Summary report for present disseminating codes and regulations by June 2015<br>• Report about the effective disseminating framework by Dec. 2015 | • Above SOP<br>• RA II<br>• WMO Secretariat<br>• TC DRR<br>• ROK (MPSS) | • Governmental research reports<br>*1. National Disaster Management Institute (2014) Construction of heat wave risk map based on various heat wave-related information, NDMI-PR-2014-08, 87p. (in Korean)*<br>*2. National Disaster Management Institute (2014) A study on the safe system and resilience circumstances to promote citizen's participation in safety improvement, NDMI-ER-2014-08, 346p. (in Korean)*<br>*3. National Disaster Management Institute (2015) Research on improvement of the evacuation guidance system based on evacuation simulation, NDMI-PR-2015-02-01-01, 105.(in Korean)*<br>• Public services<br>*1. App for foreigners, Safety First, released, Nov., 2014.*<br>*2. The second phased service of Safety Map is available, Jan. 26, 2015.* |

## 4. DESCRIPTION OF PROGRESS MADE DURING THE INTERSESSIONAL PERIOD

4.1 Brief descriptions on progress made during the intersessional period are provided herein for the subject-matter topic areas.

4.2 Water Resources Assessment

4.2.1 Many achievements were obtained for the Activities in the Work Plan (see section 3) having the highest priority, specifically Activity 2 (Priority A) and Activity 3 (Priority B). Various case studies and documents on investigations and practices were reviewed. These were primarily on case studies related to climate change adaptation in water resources and its impact on availability. These covered different basins and regions in China during 2015-2016. These were thought to be helpful for providing guidance to users who may be considering studies on water resource assessment as well as adaption analysis. Suggestions are also given on how to present findings to decision makers.

4.2.2 A draft technical report was made available in September 2016 on water resources assessment linked to extended range climate forecasts. In the report, two methods of water resources prediction are introduced, one is hydrological prediction during the flood season based on a statistical method, and the other is a one-way coupling method based on a dynamic extended range climate forecast and hydrological model. Statistical downscaling methods as input to some hydrological models are also included. An introduction to the water resources assessment and prediction tool is made through its application to some basins in China. These applications include examples of major products, which are valuable as reference material. The report also can be used as a source of material for training.

4.2.3 During the meeting, Mr Mikhail Georgievsky provided a presentation informing the WGHS of the efforts being undertaken in the Russian Federation on Water Resources Assessment. His presentation is available on the webpage for the 3rd Meeting of the RA II WGHS.

4.3 Flood Forecasting

4.3.1 The basic direction of RA-II activities in the area of flood forecasting during the last intersessional period has been connected to the realization of the WMO Flood Forecasting Initiative (FFI). The FFI is the basic implementation framework related to hydrological forecasting and flood management. The main task of FFI is to improve the capacity of meteorological and hydrological services to jointly deliver timely and more accurate products and services required in flood forecasting and warning and to further collaboration with disaster managers, active in flood emergency preparedness and response. The goal of this task is to improve interaction and understanding of meteorologists and hydrologists in the effective use of numerical weather forecasts in hydrological modelling for flood forecasting.

4.3.2 In a number of National Meteorological and Hydrological Services there is valuable experience in creating Flood Forecasting Systems based on sharing of meteorological and hydrological data and model outputs. Hydrologists and meteorologists take part in the development of these systems in common. However many flood forecasting systems have separate meteorological and hydrological modelling systems. In such cases, numerical weather forecasts are used as input to the hydrological modelling systems. When approached in this manner, it is necessary to develop requirements for the meteorological forecasts to mesh with the

spatial and time resolution requirements of hydrological models, resulting in hydrological forecasts. Hence, it would be helpful to have general recommendations on the requirements of numerical weather forecasts for use in flood forecasting.

4.3.3 Now there are many meteorological models at the global, meso-, and regional scales which are used in flood forecasting systems. Some hydrological modelling systems are making use of ensemble meteorological forecasts. This leads to the development of ensemble hydrological forecasts. Sometimes, such hydrological forecasts have high variance, reflective of the uncertainty in the meteorological forecasts. In addition, analyses can be conducted to ascertain the deterministic error of each ensemble element, for example over the previous thirty day period, using this deterministic signal to provide a weighting on the confidence of the forecasted ensemble elements. This results in improvements in the accuracy of hydrological forecasts. To assist in this regard, a report has been prepared entitled "Guidelines for verification of hydrological forecasts." It is felt that this report will be useful for professionals involved in operational hydrological forecasting, as well as for professionals involved in the development of forecasting methods.

4.3.4 The Flash Flood Guidance System (FFGS) has been developed by the Hydrologic Research Center in San Diego (USA) under the direction of Mr K. Georgakakos. The Flash Flood Guidance System (FFGS) project with global coverage was endorsed by Resolution 21 (Cg-XV) as a Flood Forecasting Initiative component that had been developed by the WMO Commission for Hydrology (CHy) jointly with the WMO Commission for Basic Systems (CBS) and in collaboration with the US National Weather Service, and the Hydrologic Research Center in San Diego. This system provides a very useful tool for establishing guidance on the possibility of threats of flash floods occurring on small basins. The Flash Flood Guidance System is being implemented with the assistance of the USAID/OFDA, and it is now being used in several countries.

4.3.5 Currently there are three projects being implemented in RA II. These are the Mekong River Commission FFGS, the South Asia FFGS and the Central Asia Region FFGS. It would be beneficial to further expand the number of countries in RA II (Asia) being covered by the Flash Flood Guidance System. To assist in this regard, it would be advantageous to:

(a) disseminate broadly the experiences and benefits obtained through the use of the FFGS in various countries throughout Asia and the world; and

(b) investigate the potential use of FFGS in other Asian countries and facilitate its understanding by operational hydrologists in the region.

4.3.6. Flood management effectiveness depends not only on quality and timeliness of the hydrological forecast, but also on the ability of users to understand and use the various forecast products. Over the last decade, advances have been made in the use of probabilistic hydrological forecasts. The utility of such forecasts is highly related to the training of experts in their use, and such forecasts have greatly enhanced the utility of flood forecasting in the area of flood management. To further advance the use of probabilistic forecasts and their utility in flood management, it is recommended that effort be undertaken to prepare guidance and training material on the use of hydrological forecasts (including probabilistic forecasts) in flood management.

4.4 Hydrological Aspects of Drought

4.4.1 Coverage areas and scope of the negative impacts on the population from drought is dominant among other natural disasters in Central Asia. Currently in Central Asia a lot of attention paid to the development of drought early warning systems. Early identification of drought is key to developing a set of measures aimed at mitigating the effects of drought and food security of the countries. In 2008, Uzhydromet established the National Centre for Drought Monitoring. Its purpose is to serve as a coordinating and consultative centre for drought preparedness, monitoring, prevention and mitigation of the adverse effects of drought. This Centre in Uzbekistan uses the infrastructure and scientific knowledge in the country as well as neighbouring ones to study the problem of drought. It also promotes informing stakeholders on various aspects of drought and its prevention. Center specialists developed and implement a drought early warning system.

4.4.2 A Drought Early Warning System is a tool for assessing, monitoring, warning, information sharing and decision making, supported by the necessary information platform and providing dissemination (warning) and exchange of necessary information. The objective of the Drought Early Warning System is to provide decision makers and population with early information about a possibility of drought occurrence with a view to reducing the drought risk as much as possible. Functional capabilities of the Drought Early Warning System are: assessment of water resources; analysis of low water availability and drought formation conditions; assessment of water resources conditions based on climate scenarios; and assessment of low water availability and drought occurrences possibilities based on climate scenarios.

4.4.3 To identify the on-set of drought, the Drought Early Warning System uses three indices: Pedya drought index; Standardized Precipitation Index (SPI); and the Drought index for snow storage (Sw). Using the Pedya drought index has a number of advantages because it gives a degree of deviation of temperature and precipitation from the normal (multi-year) value and allows one to objectively classify all cases according to the degree of aridity or lack of moisture. This index is suitable for any natural area for any length of time (decade, month, season). This indicator does not depend explicitly on the main climatic characteristics: the mean and the variance of temperature and precipitation. The advantage of the SPI is that it can be used over different time intervals (up to several decades) to assess the severity of the drought. It also allows the comparison of moisture conditions at various points in the region. For river basins having snow and snow-glacier regimes, water availability should reflect the accumulation of snow in the mountains in winter. In such cases, it is advisable to use the accumulation of snow in the mountains for a certain period of time as a criterion (index) of the water availability, termed Sw.

4.4.4 These three indices within the EWS allow the calculation of snow storage with assessments of precipitation and temperature, thereby enabling the analysis of the conditions for river runoff formation in the low water years and the factors for its formation for all drought indices for sub-basins in the runoff formation zone. These would be most valuable for assessing the early on-set of drought in the Amudarya and Syrdarya rivers within the Aral Sea basin.

4.5 Assessment of Changes in Climate Extremes, their Impacts on Water Resources, and Translating Climate Information into Action in Water Resources

4.5.1 The activities include: (1) Assessment of change in climate extremes; (2) Climate projections; (3) Assessment of potential impacts of climate extremes and climate change on water resources of selected river basins; (4) Translating climate and climate change information into actions in water resources development and management for selected river basins; (5)

Compilation of reports; and (6) Experience sharing and lesson learned. The participating countries developed their case studies and compiled reports.

4.5.2 In the activities in China, scientific studies of “climate changes for major rivers”, “sea level rise along China’s Coastal line”, and “Impact of climate change on water resources of China by using multiple GCMs projections” were conducted and reported. In addition, recommendation reports for “China’s adaptation strategy in water sector to climate change” (in Chinese) and “Sponge City Development of Zhenjiang City for better adaptation to climatic extremes” (in Chinese) were conducted.

4.5.3 In the activities in Vietnam, scientific studies of “Changes in Climate Extremes and Impacts on the Natural Physical Environment”, “Climate Change and Sea level rise for Viet Nam”, and “Projection of extreme temperature and precipitation and their impacts on water resources in Dong Nai river basin and vicinity – Viet Nam” were conducted and reported in Vietnamese and being translated into English. The report shows that Extreme climatic events in Viet Nam are expected to increase in both frequency and intensity due to climate change.

4.5.4 During the meeting, Mr Nguyen Xuan Hien provided a presentation entitled “Changes in Climate Extreme and Impact on Water Resources in Viet Nam”. As well, he provided the report entitled “Changes in Climate Extreme and Impact on Water Resources in Viet Nam” as a contribution to the efforts within this thematic area. The presentation and the report are available on the webpage for the 3rd Meeting of the RA II WGHS.

4.6 Improved Accuracy of Hydrometric and Sediment Observations including Space-based Technologies

4.6.1 In order to improve the accuracy of field measurements, it is necessary to review and research relevant techniques. It is also very important to use appropriate instrumentation and analytical techniques for specific flow conditions. The main objective of the activity is to provide a technical report or guideline, based on case studies for various conditions, comprising three parts: hydrological observation techniques; real-time discharge measurements (IRDIMS, Integrated Real-time Discharge Measurement System); and sediment measurement and development of rating curves.

4.6.2 In the activities on hydrometric measurements with quality and accuracy, the first action is to **'Provide guidance on the use of appropriate instruments and methods of observation in diverse conditions’**. In terms of the use of appropriate instruments and methods of observation in diverse conditions, the actions have focused on IRDIMS (Integrated Real-time Discharge Measurement System), which has been used to guide the design and construction and subsequently the operation for difficult sites. This was for measuring discharge under backwater and tidal effects in the Republic of Korea. The main purpose of this action is to provide technical information and guidance on the application of real-time discharge measurements for difficult to monitor sites.

4.6.3 Two sub-actions were conducted in this action plan: (1) Collection of the existing technical information of IRDIMS and (2) Case studies on the measurement of IRDIMS for 52 sites. Technical information related to real-time measurement include measurement instruments, method of discharge calculation, and the construction and operation of IRDIMS. Case studies were used to assess the result of measurements attained using IRDIMS for various specific conditions categorized on characteristics of flow conditions, such as tidal affected areas and backwater affected areas caused by weir, sluice gate, junctions, etc. These case studies also include an evaluation of the results by a comparative analysis using individual measurements and

assessment of runoff between upstream and downstream stations. In regards to the development of index ratings, the procedure and software tools (EDpad, MCDpad) have been introduced including analysis of the available measurement range of the ADVM and development of index rating curves, which have been developed using Microsoft Excel. These will be provided to other members to help standardize and facilitate developing index ratings for real-time discharge measurement.

4.6.4 The 2nd action to **'Improve sediment measuring techniques'** is achieved by providing technical information related to sediment measurement and a case study of how to do so reflecting various conditions. Two sub-actions were conducted in this action plan : (1) Collection of the technical information related to measurement and analysis of sediment and (2) Case studies on sediment measurement under various conditions. The collected technical information about sediment measurement included existing and advanced new technologies and their application. Case studies focused on sediment measurement under various conditions, which included an analysis of the characteristic of suspended sediment in rising and falling flow conditions (known as a loop in the concentration-discharge or C-Q rating curve), comparative analysis before and after construction using 4 major river projects, and the characteristic of suspended sediment for successive rainfall event.

4.6.5 In the activity of Calculation of runoff with quality and accuracy, the main action was entitled **'Focus on the development of H-Q rating curve'**. This action aimed to provide a report outlining procedures for developing the optimal H-Q rating curve under various conditions in the Republic of Korea and providing technical information about improved development procedures and introducing a development tool for establishing the H-Q rating curve. Two sub-actions were conducted in this action plan: (1) Collection of the existing technical information and (2) Case studies on development of the H-Q rating curve under various field conditions. For the first sub-activity, the procedure of discharge measurement and its calculation, the evaluation of the measurement and its data quality control (QC), and procedures for the development and evaluation of rating curves were introduced in software tool being used in Hydrological Survey Centre (HSC) of the Republic of Korea. Case studies were used to illustrate the proper development of H-Q rating curves under various fields conditions based on practical experience. The case studies also recommended methodologies and introduced the evaluation using the basin's water balance The case studies focused on developing rating curves for backwater affected areas as caused by weirs and stream junctions. Consideration was also given to the development of H-Q rating curves that reflect changing aquatic vegetation conditions (method and procedure of vegetation monitoring), and the effect of stream-bed changes on H-Q rating curves.

4.7 Sediment Disasters and Mass Movements

4.7.1 The main goal of the Sediment Disasters and Mass Movements theme is to develop the Integrated Management Platform that consists of systems, policies and international cooperation. It has three different perspectives on sediment disasters. These include: (1) issuance of landslide/debris flow warning and consistently improving upon them; (2) improvement in capacity for water-related disaster management; and (3) optimization of disseminating sediment disasters related information.

4.7.2 In 2016, as the last year of the activity, this theme tried to make all possible results to complete outcomes which the theme leader suggested in the first meeting. Major results of the Activity 1 can be divided into three ingredients: (1) Identify the mechanism of sediment disasters; (2) Establish the analysing system and data base; and (3) Develop various measures for sediment disasters. Our research found that one single landslide would make catastrophic disasters as it moves along the stream, therefore understanding the nature of sediment disasters is top priority.

Evaluation of structures such as dam, levee, and so on also needs to be done. Finally, developing guidelines to reduce the sediment disasters and managing data are also required.

4.7.3 The Activity 2 focuses on increasing our ability to manage sediment disasters through collaboration with experts from other countries. This year the thematic area generated three remarkable achievements in this field: (1) International workshop among Korea, Taiwan, and Japan (July 5 to 7, 2016); (2) Korea-Italy bilateral symposium on landslide prediction and warning technology (Mar. 14 to 15, 2016); and (3) Official Development Assistance (ODA ) project in Vietnam and Laos. From these events, we have learned the importance of cooperation in dealing with sediment disasters and have tried to find a better way to help developing countries based on their needs.

4.7.4 In the Activity 3, the main objective is disseminating information on sediment disasters into communities. Two methods are considered: (1) Early Warning System; and (2) Public dissemination. The thematic area suggests advancing the use of “safety map” (http://www.safemap.go.kr/main/smap.do) of MPSS (Ministry of Public Safety and Security, Republic of Korea) for ordinary people. This map is the world’s first portal site on this topic and contains 127 items on safety information from 20 governmental agencies. Sediment disaster is applicable to the category of Disasters in this map.

## 5. WORKSHOP FOR THE DYNAMIC WATER RESOURCES ASSESSMENT TOOL (DWAT)

5.1 The **D**ynamic **W**ater Resources **A**ssessment **T**ool (DWAT) was developed by HRFCO and KICT. Mr Cheol-Hee Jang provided a presentation explaining the concepts and approaches undertaken, including a description of the hydrological process model used within the tool and how various elements within the hydrological cycle are mathematically modelled.

5.2 The presentation resulted in several questions and comments being provided. It was learned that public domain GIS (GDAL) was used within the model, to help reduce the costs associated with implementing it. The tool has been designed to assist long-term planning and policy assessment and development. Its application can allow assess of land-use changes within the basin over time, the impacts on water availability under different consumptive use scenarios, and the impact on availability due to climate change through the application of scenarios.

5.3 Mr Cheol-Hee Jang indicated that the model has been tested on basins ranging in size form 23 $km^2$ to 1,000 $km^2$. It was noted that the computational time step could vary form 1 minute (for smaller basins) to monthly. The Tool was tested to explore its ability to assist in city planning and development. He also indicated that a draft user guide has been prepared.

5.4 The experts also discussed possible future features that could be advantageous to develop. For example, it was noted that the Tool does not consider snow accumulation and ablation, while this would be needed for application in environments where snow is more common and is a significant contribution to the timing and amount of stream discharge and a source for soil moisture and groundwater recharge. As well, the Tool currently only considers in situ climate stations to estimate various elements (e.g., rainfall, temperature, etc) for sub-basins as input to the model. It was noted that this was due to the large observing network that exists, but that consideration should be given to also allowing use of satellite and radar data to derive the best estimates of Quantitative Precipitation Estimates (QPE) for the sub-basins. It was thought that should a Flash Flood Guidance System be operating covering the basin, its merged QPE could be used within the Tool, rather than replicating the computational process. As well, the use of Numerical Weather Prediction outputs was discussed, particularly if the Tool were to be used for shorter-term planning purposed for planning water use restrictions, etc. It was also noted that a

module would be needed to downscale climate scenario input to the sub-basin scale for sue in the longer-term planning applications.

5.5 Mr Cheol-Hee Jang noted that the beta version of the Tool will be available by end of 2016. This version would be applied within RA II to further test the system. It was thought that about two years would be required to finalize the beta version of the Tool including making some additional modules available. These would include the ability to easily incorporate climate change scenarios including downscaling, as well as a module to reflect snow modelling. The experts commented that the Tool as illustrated in the workshop was excellent, and they were excited with the possibility of receiving the Tool for testing and use within their countries.

## 6. FUTURE WORK PLAN

6.1 Participants discussed the development of work plans for the next intersessional period and the future structure of the RA II Working Group on Hydrological Services. The future structure agreed upon for the consideration of the 16th Session of RA II was:

**Working Group on Hydrological Services (WGHS)**

**Expert Group on Coordination and Capacity Building (EG-CCB)**

- Theme I Water Related Disaster Management

- Theme II Provision of Hydrological Services

**Expert Group on Measurements, Monitoring and Infosystems (EG-MMI)**

- Theme I Hydrometric Measurements

- Theme II Sediment Disasters and Debris Flows

**Expert Group on Hydrological Applications (EG-HA)**

- Theme I Water Resources Assessment

- Theme II Flood Forecasting

-Theme III Hydrological Aspects of Drought

-Theme IV Hydrological Adaptation to Climate Change

6.2 Participants reviewed the aspects of the RA II Operating Plan 2016-2019 pertaining to the Working Group on Hydrological Services (WGHS). The above working group structure was added to the Operating Plan for the WGHS for ease of future reference.

| DEPT | BRANCH | ER | KEY OUTCOME | KEY PERFORMANCE INDICATOR | DELIVERABLE | PRORGAMME | TC | REGION | ACTIVITY | Y2016 | Y2017 | Y2018 | Y2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRA | RAP | 2 | 2.2 | 2.2.1 [EG-HA Theme II] | Improvement in hydrological warnings capability through enhanced and effective cooperation with other NMHSs | WWW, HWRP, DRR | CBS, CHy | RA II | (a) Prepare recommendations on the use of NWP outputs in flood forecasts; (b) Document approaches to ascertain the deterministic error of each ensemble element of NWP products; (c) Use WMO Flood Forecasting Initiative as platform | | x | x | x |
| DRA | RAP | 3 | 3.3 | 3.3.1 [EG-HA Themes 1 & IV] | Improvement in adaptation capacity of water resources systems in a changing climate [using Water Resources Assessment methodologies] | WWW, HWRP, WCP | CBS, CHy, CCl | RA II | (a) Assess changes in climate extremes - Data and method of climate extreme study: data inventory, climate index - Trend of some climate extremes: temperature, rainfall and others (b) Translate climate and climate change information into actions in water resources development and management | x | x | x | x |
| DRA | RAP | 3 | 2.1 | 2.1.1 [EG-CCB Theme I] | Improvement in capacity for water-related disaster management (Hydrological extremes) | WWW, HWRP, DRR | CBS, CHy | RA II | (a) Organize a workshop on the provision of input and support to disaster management (b) Attend seminars on sediment disasters in order to communicate and cooperate among member countries | | x | x | x |
| DRA | RAP | 3 | 3.3 | 3.3.1 [EG-MMI Theme I] | Improvement in hydrometric measurements with quality and accuracy | WWW, HWRP | CBS, CHy, CIMO | RA II | Provide guidance on the use of appropriate instrumentation and methods of observation in diverse conditions | | X | x | X |
| DRA | RAP | 2 | 2.2 | 2.2.1 [EG-HA Theme II] | Issuance of flood, flash and urban flood warnings and constantly improving upon them | WWW, HWRP, DRR | CBS, CHy | RA II | (a) Document experiences in the use of the Central Asia Region Flash Flood Guidance System (FFGS) in participating countries by reviewing its use (b) Facilitate FFGS understanding by operational hydrologists in the Region (c) Develop recommendations on the use of hydrological forecasts in flood management | x | x | x | x |
| DRA | RAP | 2 | 2.1 | 2.1.1 [EG-MMI Theme II] | Issuance of landslide/debris flow warnings and constantly improving on them | WWW, HWRP, DRR | CBS, CHy | RA II | Collect and disseminate guidance materials and manuals on the assessment of rainfall/flood induced mass movement hazards and potential forecast methodologies | | x | x | x |
| DRA | RAP | 3 | 3.3 | 3.3.1 [EG- CCB Theme II] | Development of national and regional capacity building programmes and related training activities for hydrological services | HWRP | CHy | RA II | Synthesize report from individual reports from participating countries in RA II on national and regional capacity development activities in hydrology and make recommendations on their enhancement | | x | x | x |

## 7. CONSIDERATION OF INPUT TO CHy-15 AND 16th SESSION OF RA II

7.1 The meeting considered the major accomplishments achieved by the WGHS and developed a short list of those where decisions from either or both the next Session of CHy or the 16th Session of RA II would be desirable. These major accomplishments included:

| Major Accomplishments | Session | Decision |
|---|---|---|
| Dynamic Water Resources Assessment Tool (DWAT) | CHy, RA II | CHy: urges CHy to assess the Tool testing its ability and to provide guidance on its further development for global utility<br>RA II: requests RA II Members to assess the Tool, testing its ability and to provide guidance to the RA II WGHS Chairperson on its further development for the benefit of Members |
| Guidelines for Verification of Hydrological Forecasts | CHy, RA II | CHy: urges CHy to review and assess the global utility of the Guidelines as a potential contribution to the WMO Flood Forecasting Initiative<br>RA II: requests RA II Members to review and apply the verification procedures, reporting their results and views on the procedures to the RA II WGHS Chairperson |
| Software tool for index velocity method | CHy, RA II | CHy: urges CHy to assess the utility and applicability of the software tool and methods therein for measuring discharge under backwater and tidal influence<br>RA II: requests RA II Members to test the Software Tool, reporting their results and views on the procedures to the RA II WGHS Chairperson |

## 8. ADOPTION OF THE REPORT AND CLOSURE OF THE MEETING

8.1 Participants agreed that the final draft report would be circulated to participants allowing a period for Mr Sung Kim to update the work plan with members who were not in attendance and to include their description of progress made during the intersessional period. Once their views have been incorporated, the draft report will be circulated to participants with a two week period for provision of revisions. It was agreed that the final endorsement of the report should be sought from the Chair of the Working Group before finalizing it and seeking approval of the President of RA II for its publication.

8.2 The Chairperson, Mr Sung KIM, thanked the participants and the WMO Secretariat for their contributions and professionalism that made the meeting a success. He also thanked experts for their hard work over the last four year period, and he indicated with pleasure that he has seen the experts accomplish many of their tasks in their work plan.

8.3 Mr P. Pilon expressed his gratitude on behalf of WMO to the Government of Korea for their having provided financial assistance, as without this funding the second and third meetings of the RA II WGHS would not have been held. He also thanked Mr Sung Kim, Mr Cheol-hee Jang and all staff in supporting the effective organization of the meeting and for their efforts and assistance. He also thanked Mr Kim specifically for his demonstrated leadership and persistence in directing the work of the working group and in reporting their successes. In closing, he underscored the importance of fulfilling the work plans as outlined prior to the next session of RA II to be held in February 2017, not only for the benefit of National Hydrological Services in RA II, but for all Regions.

8.4 Participants thanked everyone for the excellent, productive meeting at 16:45.

8.5 The meeting closed on the 27th of October 2016.

**ANNEX 1**

**List of Participants - RA II (Asia) Working Group on Hydrological Services (WGHS)**

**(Seoul, Republic of Korea, 25-27 October 2016)**

***Working Group on Hydrological Services (WGHS):***

| | |
|---|---|
| **Chairperson**<br><br>**(HOST)** | Dr Sung KIM<br>Senior Research Fellow<br>Korea Institute of Civil Engineering and Building Technology (KICT)<br>283 Goyangdae-ro, Iisanseo-gu,<br>Goyang-si, Gyeonggi-do 10223<br>Republic of Korea<br>Telephone: +82 31 910 0602<br>Telefax: +82 31 910 0251<br>E-Mail: skim@kict.re.kr |
| **Vice-Chairperson WGHS (absent)** | Mr Muhammad RIAZ<br>Pakistan Meteorological Department<br>Flood Forecasting Division<br>46 Jail Road<br>LAHORE<br>Pakistan<br>Phone: +92 42 99 200 208<br>fax: +92 42 99 200 209<br>E-Mail: riaz1962@hotmail.com |
| **Theme Leader in Water Resources Assessment** | Ms Ge GAO<br>National Climate Center<br>China Meteorological Administration<br>No. 46 Zhuang-guan-cun Nan-da-jie<br>Haidian District<br>Beijing 100081<br>China<br>Telephone: +8610 68406915<br>Telefax: +8610 68406975<br>E-Mail: gaoge@cma.gov.cn |
| **Theme Leader in Water Resources Assessment** | Dr Hwirin KIM<br>Han River Flood Control Office<br>Ministry of Land, Infrastructure and Transport<br>328, Dongjakdaero, Seocho-gu<br>Korea 06501<br>Telephone: +82 2 590 9973<br>Fax: +82 2 590 9989<br>Email: hydro@korea.kr |
| **Theme Leader in Hydrological Responses to Climate Variability and Change and Promotion of the Use of Climate Information by** | Dr Guoqing WANG<br>Nanjing Hydraulic Research Institute<br>225 Guangzhou Road<br>Nanjing 210029 |

| | |
|---|---|
| **Water Managers (absent)** | China<br>Tel: +8625 85828531<br>Fax +8625 85828555<br>E-Mail: gqwang@nhri.cn<br>E-Mail: guoqing_wang@163.com |
| **Theme Leader in Flood Forecasting (absent)** | Dr Sergey BORSHCH<br>Hydrological Center of Russia<br>Bolshoy Predtechensky Per., 11-13<br>MOSCOW 123242<br>Russian Federation<br>Tel: +7 499 795 21 84<br>Fax: +7 499 252 32 49<br>Mobile +7 916 328 5352<br>E-mail: borsch@mecom.ru<br>E-Mail : borsch56@mail.ru |
| **Theme Leader in Hydrological Aspects of Drought** | Ms Irina DERGACHEVA<br>Research Hydrometeorological Institute of Hydromet<br>Ahmad Yugnaki, 30-40<br>Tashkent 100052<br>Uzbekistan<br>Telephone: +998 71 2359140<br>E-Mail: Dergacheva_iv@mail.ru |
| **Theme Leader in Hydrological Responses to Climate Variability and Change and Promotion of the Use of Climate Information by Water Managers (absent)** | Dr TRAN Thuc<br>Institute of Meteorology Hydrology and Climate Change<br>No. 23 Lane, 62 Nguyen Chi Thanh<br>HANOI 10000<br>Vietnam<br>Telephone: +84 903282894<br>Telefax: +84 38355993<br>E-Mail: thuc@netnam.vn<br>Tranthuc.vkttv@gmail.com |
| **Theme Leader in Sediment Disasters and Mass Movements** | Dr Tai-Hoon KIM<br>Senior Analyst<br>National Disaster Management Research Institute<br>Ministry of Public Safety and Security<br>365, Jongga-ro, Jung-gu<br>Ulsan, 44538<br>Republic of Korea<br>Telephone: +82 52 928 8270<br>Mobile : +82 10 7302 0309<br>Telefax: +82 52 928 8299<br>E-Mail: taihoon@ualberta.ca<br>ddahoon@korea.kr |
| **Theme Leader in Improved Accuracy of Hydrometric and Sediment Observations including Space-based Technologies** | Dr Youngsin ROH<br>Hydrological Survey Center<br>Office building, KINTEX, 407<br>Hallyuworld-ro, Ilsanseo-gu,<br>Goyang-si, Gyeonggi-do<br>Goyang<br>Republic of Korea<br>Telephone: +82 31 929 0823 |

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**ANNEX 2**

**World Meteorological Organization** **RA II - WGHS/Doc. 1**

**REGIONAL ASSOCIATION II**
**WORKING GROUP ON**
**HYDROLOGICAL SERVICES**

SEOUL, REPUBLIC OF KOREA
**25 TO 27 OCTOBER 2016**

Submitted by: Secretariat
Date: 25.10.2016
Original Language: English
Status: **FINAL**

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**FINAL MEETING AGENDA**

**3rd Meeting for WMO Regional Association II**
**Working Group on Hydrological Services (WGHS)**
**and**
**Workshop on the Dynamic Water resources Assessment Tool**

**Venue: Han River Flood Control Office / Western Coop Residence Hotel**
**Seoul, Republic of Korea**

**25 October to 27 October, 2016**

**<u>Tuesday 25 October</u> (Han River Flood Control Office)**

**3rd WGHS Morning Session (09:00 – 10:00) Session Chairman: Dr. Hwirin Kim**

- Opening of the meeting and welcome by representatives of the hosting organization and WMO (Han River Flood Control Office Director: Mr Hajoon Park)
- Introduction of participants and adoption of the agenda (Sung Kim)
- Report on activities of the Commission for Hydrology (CHy) as a result of the 3rd AWG Meeting, February 2016 (Paul Pilon)
- Report on decisions and recommendations of RA-II, including the RA-II Strategy as a result of the Working Group and Chairs' Meeting in RA-II, December 2015 (Paul Pilon)
- The RA II Operating Plan 2016-2019 as approved by the RA II Management Group on 15 June 2016 (Paul Pilon)

**3rd WGHS Morning Session (10:00 – 12:00)**
**Session Chairman: Dr. Sung Kim**

Report of activities (actions, outputs, milestones and progress) as per the work plans in the following theme areas, focusing on main achievements:

- Water Resources Assessment (Dr. Hwirin Kim, Ms GAO Ge)
- Hydrological Aspect of Drought ( Ms. Irina Dergacheva)

**Lunch break (12:00 – 14:00)** (Lunch will be provided by HRFCO.)

**3rd WGHS Afternoon Session (14:00 – 17:30)**
**Session Chairman: Dr. Sung Kim**

Report of activities (actions, outputs, milestones and progress)as per the work plans in the following theme areas, focusing on main achievements:

- Hydrological Responses to Climate Variability and Change and Promotion of the Use of Climate Information by Water Managers for adaptation of climate change in the context of climate variability in hydrological cycle in each country (Dr. Nguyen Xuan Hien) (Substitute)
- Improved Accuracy of Hydrometric and Sediment Observations including Space-Based Technologies (Mr Youngsin Roh)
- Sediment Disasters and Mass Movements (Dr Tai-Hoon Kim)
- Water Resources Assessment in Russia (Dr Mikhail GEORGIEVSKIY) (observer)

**Welcoming Dinner (18:00 – 20:00)** hosted by the Director of Han River Flood Control Office, Ministry of Land, Infrastructure and Transport (Venue: Korea House 18:00)

**Wednesday 26 October**

**Workshop for the Dynamic Water resources Assessment Tool (DWAT) developed by HRFCO and KICT (09:00 – 10:00): Dr. Cheol-Hee Jang**

- Presentation for the development of the Dynamic Water resources Assessment Tool (DWAT)
- Demonstration of the Dynamic Water resources Assessment Tool (DWAT)
- Discussion on application of the DWAT and identification of possible future improvements

**Discussion on follow-up and future implementation for the upcoming CHy and RA-II sessions (Sung Kim and Paul Pilon)**

- 15th Session of the Commission for Hydrology, Rome, Italy, 7-13 December 2016; and
- 16th Session of RAII, Abu Dhabi, UAE, 12-16 February 2017 and Regional Conference on Management of Meteorological and Hydrological Services (RECO-7) 10-11 February 2017 **(10:00 – 11:00)**

**Lunch break (12:00 – 14:00)** (Lunch will be provided by HRFCO)

**Afternoon session (14:00 – 17:30)**

**FIELD TRIP**

**Welcoming Dinner (18:00 – 20:00)** hosted by the Director of KICT Hydro Science and Engineering

**Thursday 27 October**

**3rd WGHS Morning Session (09:00 – 12:00)**
**(Sung Kim and Paul Pilon)**

- Discussion on the approved RA II Operating Plan 2016-2019 and development of activities for the RA-II WGHS for the following period (2016-2019)

**3rd WGHS Afternoon Session (14:00 – 16:00)**
**(Sung Kim and Paul Pilon)**

- Reviewing and adoption of meeting report
- Closing session

# Report of the RA II Working Group on WMO Integrated Global Observing System and WMO Information System (WG-WIGOS/WIS)

**Yongqing Chen, China Meteorological Administration**

**Chairperson of the RA II Working Group on WIGOS/WIS**

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**Yongqing Chen and Jaegwang Won**
**Co-coordinators, Expert Group on WIGOS**

**Xiang Li and Kenji Tsunoda**
**Co-coordinators, Expert Group on WIS**

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**Report of the RA II Working Group on WMO Integrated Global Observing System and WMO Information System (WG-WIGOS/WIS)**

## 1. Introduction

In the fifteenth session of Regional Association II which was held in Doha, Qatar, from 13 to 19 December 2012, the Regional Association II Working Group on WMO Integrated Global Observing System and WMO Information System (WG-WIGOS/WIS) was re-established to bear the responsibility of facilitate the accomplishing of missions of WIGOS and WIS.

## 2. Working Group Structure

The Working Group is composed of Expert Group on WIGOS (EG-WIGOS) and Expert Group on WIS (EG-WIS). Both EG- WIGOS and EG- WIS consist of two co-coordinators and several theme leaders. In addition, a number of volunteer experts who are expected to assist the tasks of each Expert Team have also been registered.

## 3. Terms of Reference

(a) To monitor and coordinate the implementation of WIGOS and WIS in the Region; propose measures for improvements, especially for overcoming gaps, deficiencies and inconsistencies in the implementation of these systems; and promote active involvement of the Members of the Region in the implementation of these systems;
(b) To advise on and provide overall technical guidance, assistance and support to the Members of the Region for the implementation of WIGOS and WIS at the regional and national levels;
(c) To promote capacity-development and outreach activities to assist Members in the implementation of WIGOS and WIS;
(d) To liaise with the relevant RA II Working Groups on matters related to WIGOS and WIS implementation;
(e) To advise the president of the Association on matters concerning the implementation of WIGOS and WIS in the Region;
(f) To provide the president of the Association with recommendations for presentation under appropriate agenda items in sessions of technical commissions, joint sessions of the presidents of technical commissions and presidents of regional associations, and the Executive Council;

## 4. Membership

Expert Group on WIGOS (EG-WIGOS)

| **EG-WIGOS** | | |
|---|---|---|
| Co-Coordinators | Mr Yongqing Chen | China |
| | Dr Jaegwang Won | Republic of Korea |
| Theme Leader in Implementation and Updating of R-WIP | Mr Yoshiro Tanaka | Japan |
| Theme Leader in Implementation of EGOS-IP | Mr Yatian Guo | China |
| Theme Leader in Standard and Best Practice | Mr. Namsan Cho<br>Mr. Chulwoon Choi | Republic of Korea |
| Theme Leader in Observational Requirements and Regional Network | Mr D. K. Malik | India |
| | Mr Abdulqaleq Ali Ali | Iraq |

| | | |
|---|---|---|
| Theme Leader in Data Availability and Quality of Observations | Mr Nobuyuki TANAKA | Japan |
| Theme Leader in Surface-based Remote Sensing for Disaster Risk Reduction | Mr Feng Li | China |
| | Dr Oleg Pokrovsky | Russian Federation |
| Theme Leader in Satellite Data, Products and Training | Mr Tomoo Ohno | Japan |
| | Dr Dohyeong Kim | Republic of Korea |

Expert Group on WIS (EG-WIS)

| **EG-WIS** | | |
|---|---|---|
| Co-Coordinators | Ms Xiang Li | China |
| | Mr Kenji Tsunoda | Japan |
| Theme Leader in Data Communication Techniques and Structure | Dr Sunghoi Huh | Republic of Korea |
| Theme Leader in Data Representation and Metadata | Ms Jitsuko Hasegawa | Japan |
| Theme Leader in WIS-GTS operations, including Early Warning | Dr Shyamlal Singh | India |
| | Mr Aleksandr Soloveychik | Uzbekistan |
| Theme Leader in Climate Data Management/Data Rescue | Mr Hongzheng Zhang | China |
| Theme Leader in Integrated Global Data Dissemination System | Ms Wang Chunfang | China |

**5. Completing of membership Working Group on WIGOS and WIS**

In accordance with resolution 11 of RA II-15, there are an Expert Group on WIGOS (EG-WIGOS) and an Expert Group on WIS (EG-WIS) under WG-WIGOS/WIS. Each of these two expert groups consists of two Co-Coordinators and some Theme Leaders and Volunteer Experts. Mr. Yongqing Chen (China) and Dr. Jaegwang Won (Republic of Korea) were approved to be Co-Coordinators of EG-WIGOS in the session, and meanwhile, Ms. Li Xiang (China) and Mr. Kenji Tsunoda (Japan) were approved to be Co-Coordinators of EG-WIS.

Co-coordinators of EG-WIGOS and EG-WIS initially proposed the lists of Theme leaders (areas) of EG-WIGOS and EG-WIS in accordance with Terms of reference (TOR) of EG-WIGOS and EG-WIS, the R-WIP-II approved by XV-RA II, as requested by the WMO secretariat.

The theme areas of EG-WIGOS focus mainly on how to carry out main projects in the R-WIP-II. The list of Theme leaders (areas) of EG-WIGOS is as follows,

(a) Theme leader in Implementation and Updating of R-WIP;
(b) Theme leader in Implementation of EGOS-IP;
(c) Theme leader in Standard and Best Practice;
(e) Theme leader in Observational Requirements and Regional Network;
(f) Theme leader in Data Availability and Quality of Observations;
(g) Theme leader in Surface-based Remote Sensing for Disaster Risk Reduction;
(h) Theme leader in Satellite Data, Products and Training.

The Theme areas of EG-WIGOS focus mainly on coordinating and promoting WIS implementation, operation and services, including GTS and IGDDS, and data management in RA II. The list of Theme leaders (areas) of EG-WIS is as follows,

(a)Theme Leader in Data Communication Techniques and Structure
(b)Theme Leader in Data Representation and Metadata
(c) Theme Leader in WIS-GTS operations, including Early Warning

(d)Theme Leader in Climate Data Management/Data Rescue

(e)Theme Leader in the Integrated Global Data Dissemination System

Then, Theme Leaders of both EG-WIGOS and EG-WIS were nominated by members and finally decided by the management group (MG-7) in May 2013.

The Theme Leaders are expected to lead the activities in their respective theme areas in close coordination with the Members in the Region, monitoring the key performance indicators/targets concerned, and reporting progress of development and implementation to the Expert Group Co-Coordinators concerned.

After that, Volunteer Experts for EG-WIGOS and EG-WIS were also nominated by members finally approved by President of RA II in October 2013.

Therefore, the WG-WIGOS is composed of two co-coordinators, 10 theme leaders and 13 Volunteer Experts, while the WG-WIS is composed of two co-coordinators, 6 theme leaders which and 12 Volunteer Experts.

**6. Drafting the Work Plan of Working Group**

A work plan for the WG-WIGOS/WIS was developed by coordinators of Expert Group on WIGOS and Expert Group on WIS, with the help of theme leaders and WMO secretariat. The work plan for the WG-WIGOS/WIS has been submitted to WMO secretariat by the end of October 2013.

The work plan was developed mainly based on the deliverables outlined in the RA II Strategic Operating Plan, the terms of reference of the Expert Group, and the projects listed in the R-WIP-II, and outlined the main tasks which would be carried out by the Working Group before the next session and key deliverable, activity, expected accomplishing time and responsibility.

Nine tasks for EG-WIGOS were established in the work plan and each task includes several activities which will be accomplished in the expected years. Most of activities would be implemented through the RAII WIGOS projects and RA II members under the initiative of key regional players. The theme leaders of EG-WIGOS have responsibility to track and promote the execution of these activities and projects. Key deliverables for EG-WIGOS in the work plan are as follows,

(a) A new version of R-WIP-II to be developed

(b) A portal to share progress EGOS IP implementation in RA II to be developed

(c) A portal on standards and best practices to be developed

(d) Collaborative working mechanism toward integrated surface-based remote sensing observations in the East Asia for operational monitoring and forecasting severe weather to be established.

(e) Technical support for instrument maintenance and calibration by experts from RICs to be provided.

(f) ISO/IEC 17025 certification to be obtained.

(g) Report on status on QC/QA procedures and site management in RA II will be available.

(h) Reports on status on meteorological instruments, calibration and training in Regional Association II to be available.

(i) Capacity in use of satellite data/products and facilitation of training datasets and tool boxes to be improved.

(j) The systematic Near Real Time monitoring of sand and dust storm to be carried out in SDS-WAS Asia Node.

(k) RBSN and RBCN to be updated.

Seven tasks for EG-WIS were established in the work plan and each task included several activities which would be accomplished in the expected years. The theme leaders of EG-WIS had responsibility to carry out or promote these activities. Key deliverables for EG-WIS in the work plan are as follows,

(a)RA II- WIS-IP (2013: first version, 2014-2016: review and update)

(b) Status and Plans of RMTN in RA II (2014-2016)

(c) Amendments of Volume II of the manual on the GTS in RA-II (2016)

(d) Status Report of Data Representation and Metadata in RA II (2014-2016)

(e) Status Report of the implementation of WIS service and WIS monitoring in RA II (2014-2016)

(f) Status Report of the Climate Data Management/Data Rescue in RA II (2014-2016)

(g) Status Report on IGDDS in RA II (2014-2016)

Each theme leader in the expert group, supported by volunteer experts if available, would bear responsibility for one or several tasks in the plan which was relevant to his or her theme area and would submit report to co-coordinators of the expert group as required.

**7. Develop and Publish RA II Regional WIS Implementation Plan**

Fifteenth session of RA II reviewed the initial draft of the RA II WIS Implementation Plan which has been developed by local secondments from CMA and KMA and coordinator of WG-IOS/WIS SG-WIS, and the session requested EG-WIS to complete developing the plan as priority items. In accordance with the agreement and user reviews of the initial draft, co-coordinators of EG-WIS established a Task Team on RA II WIS Implementation Plan (TT-R2-WIS-IP) in May 2013 and invited experts from all GISCs and one DCPC and two NCs in RA II to finalize the WIS Implementation Plan.

The final version of RA-II WIS-IP (available at: http://wis.wmo.int/file=653) was completed and approved by the President of RA-II in December, 2013. The RA-II WIS-IP is updated in 2015 and will be submitted to RA II and WMO secretariat by the end of 2016, and it will be available from WMO website. In this time, amendments will be mainly updating WIS Centres Implementation status. In addition, the co-coordinators of EG-WIS will propose a new structure of IP to RA II-16.

To continue identification of WIS requirements of Members, and to better support the implementation and operation of WIS services in RA II, the review and updates of RA-II WIS-IP is ongoing by using the mechanism of local secondment. CMA has nominated Ms. Zhu Ting and Mr. Wang Peng as local secondments. The co-coordinators invite other GISCs and DCPCs in RA II to nominate a few more experts to join this work as local secondments. The nominations are expected to send to WMO secretariat and the co-coordinators by the end of 2016.

**8. The First session of RA II EG-WIGOS** (EG-WIGOS-1)

At the kind invitation of the Government of the United Arab Emirates, the First session of the WMO RA II Expert Group on the WMO Integrated Global Observing System (EG-WIGOS-1) was held from 31 October to 1 November 2016 in Abu Dhabi, United Arab Emirates. H.E. Dr. Abdullah Ahmed Al Mandoos, Director-General of the National Centre for Meteorology & Seismology, Permanent Representative of United Arab Emirates with WMO, opened the meeting and welcomed the participants to Abu Dhabi.

On behalf of the Secretary-General of WMO, Dr. I. Zahumensky, WIGOS Project Office, opened the session and welcomed the participants to Abu Dhabi. Mr. Yongqing Chen, the Co-Coordinator RA II EG-WIGOS, made the opening remarks, in which he reviewed the activities carried out from 2013 to 2016 by the EG-WIGOS.

The Secretariat informed EG-WIGOS-1 about the WIGOS related recommendations from Cg-17 and EC-68, recent progress on the OSCAR/Surface, WIGOS Data Quality Monitoring System, the concepts of the Regional Basic Observing Network (RBON) and Regional WIGOS Centers, respectively, and the protection of radio frequencies.

The progress achieved and the future plans for the seven regional projects defined in RA II WIGOS Implementation Plan (R-WIP-II) were presented by the theme leaders.

The future implementation of WIGOS in RA II, such as establishment of RBON and RWCs in pilot mode, the continuation of the current RBSN/RBCN during the next intersessional period and the future structure of EG-WIGOS were discussed at the meeting.

Several recommendations to the WIGOS Workshop for West Asia (2 to 3 November 2016, Abu Dhabi) were drafted and consequently submitted to the workshop by Dr. Yongqing Chen, chair RA II EG-WIGOS.

The main conclusion of the meeting could be summarized as follows:

Good progress was made in the projects of the R-WIP-II; however, there is the need for future activities to complete them during the following four years. The progress and future actions to be undertaken are detailed in the section 8.

EG-WIGOS-1 recommended that the Projects I, II, III-2, IV, V, and VI should continue during the next intersessional period; they should be updated accordingly, and in line with the Plan for the WIGOS pre-operational phase 2016-2019; new projects should be drafted when appropriately, especially on establishing RWCs in pilot mode. A proposal for Regional WIGOS Centers in RA II is submitted to RA II MG meeting for consideration.

A Task Team on developing the RBON in RA II is proposed to be established by RA-II-16. TOR with a roadmap for the implementation of RBON in RA II is also submitted to RA II MG for consideration. It is proposed that chair of Task Team on RBON should be a member of EG-WIGOS.

EG-WIGOS-1 recommended that the R-WIP-II should be updated taking into account the Plan for the WIGOS pre-operational phase 2016-2019. The updated R-WIP-II is submitted to RA II MG for consideration.

EG-WIGOS-1 further recommended that the current RBSN/RBCN should continue to be operational until the new RBON is formally implemented based on the approval by P-RA/MG or the RA session. The RBSN/RBCN lists should be updated and be submitted to the 16th session of RA II for approval. When the RBSN/RBCN lists are being updated, the RBON concept, specifically the key attributes and criteria for the selection of stations/platforms into RBON should be taken into account.

EG-WIGOS-1 also recommended that the term “Theme Leader” should be changed to “Project Leader”. The name of the Project Leaders should be identical to those listed in the R-WIP-II Projects.

**9. The First meeting of RA II EG-WIS (EG-WIS-1)**

At the kind invitation of the Government of Japan, the first meeting of the Expert Group on the WMO Information System (WIS) in Regional Association II (RA II EG-WIS) was held from 25 to 27 November 2015 in Tokyo, Japan.

On behalf of the Secretary-General of WMO, Dr Chung Kyu PARK, the Director of the Regional Office for Asia and the South-West Pacific, presented the results of the fifteenth session of Regional Association II (RA II-15) held in 2012 and the operating plan of EG-WIS. The participants were informed of the WMO Strategic Plan and Priorities for the next fiscal years 2016-2019, which were endorsed by the seventeenth World Meteorological Congress (Cg-17) to meet the global societal needs and to contribute to the Post-2015 Sustainable Development Agenda. Among the WMO Strategic Priorities is to strengthen the global observing systems through the implementation of the WIGOS and WIS.

Mr Peiliang SHI, the Director of WMO Information System Branch, presented the summary of the recommendations from CBS-Ext. (2014) with a link to the associated Cg-17 resolution to allow easy mapping by RA II EG-WIS when considering the progress of WIS implementation in the region, ensuring that the work plans of the group align with the latest technical regulations and guidance that has been agreed since CBS-Ext (2014). He pointed the publishing of the WIS competencies and learning guide essential for Members to be able to ensure that they have staff with the right set of competencies to be able to use and maintain WIS.

The meeting reviewed the regional requirements on WIS, as well as the TLs’ reports on Data communication techniques and structure, Data representation and metadata, GTS/WIS operation including Early Warning, and IGDDS. The co-coordinators summarized progress of WIS/GTS in RA II since the RA II-15. 6 GISCs and 4 DCPCs reported the implementation status.

The meeting noted the importance of WIS monitoring for stable operation and continuous improvement of WIS services, and reviewed the pilot dashboards developed by GISCs Beijing and Tokyo, and encouraged all the operational GISCs to consider the implementation of WIS monitoring and start providing JSON files as soon as possible. The meeting also reviewed the progress of Application Pilot Project (PP-App).

The meeting reviewed the current structure of EG-WIS, and the designation procedure of the EG-WIS members after the RA II-15 (2012).

The main recommendations of the meeting could be summarized as follows:

- Amendment of the Manual on WIS. The meeting noted that NC Pyongyang (Democratic People's Republic of Korea (DPRK)) had designated its principal GISC, and requested WMO secretariat to update the information of DPRK in table B.3 (National Centres) of the Manual on the WIS (WMO No.1060).
- Future structure of EG-WIS in RA II. The meeting noted that it’s necessary to establish a new group to coordinate WIS Centres (e.g. Implementation and Coordination Group on WIS), and requested the co-coordinators and WMO

secretariat to draft a new structure on EG-WIS to consider establishing ICG-WIS in RA II-16 (February 2017).

- Designation procedure for expert group EG-WIS in RA II. The meeting noted that the EG-WIS members including Volunteer Experts were approved in the 8th RA II MG meeting in 2014, and agreed that it must have been approved in a short time. The meeting requested RA II MG to consider designation procedure to be approved within 6 months after RA II session.

**10. Monitoring progress on implementation of WIGOS and WIS**

Theme leaders of EG-WIGOS and EG-WIS are responsible for the monitoring of progress on each project of IP-WIGOS and WIS in close cooperation with the contact person of main players of the Project.

**10.1 Status of implementation of WIGOS**

The implementation of R-WIP-II relies mainly on seven RAII WIGOS projects listed in the R-WIP-II. Seven project contact persons provided progress information to the co-coordinator of EG-WIGOS. The progress for each project is listed as bellow.

**10.1.1 Project No. I- Monitor and review the Implementation of EGOS- IP in RA II**

A portal for sharing the national progress of EGOS-IP implementation was established by CMA Meteorological Observation Centre (MOC). A report template has been prepared by S.T. Chen from Hong Kong, China. The technical scheme of assessing the progress was drafted by CMA MOC. The evaluation indexes were divided into seven aspects: management, integration, observation capacity, products, standardization, data quality and acquisition, cooperation.

**10.1.2 Project No. II- Standard and Best Practice Portal, including Technical Documents with Necessary Details in English from all RA II Members**

As the meteorological data, including NWP, observations, etc, is considered highly valued things in socio-economic sector of Korea, many Korea government agencies, except for KMA, started observation for their own purpose in the 1990s. However, there were not involved regulations and system at that time. KMA enacted the law, that is called “Weather observation and Standardization Act”, based on which, KMA has been collaborating with up to 28 agencies and the AWS amounts to over 3,700 at present. A shearing system called “Observation Standard Sharing System (OSS)” was established in 2012. It can collect all data and conduct QC, followed by displaying the data for application. Responding to the challenges on insufficient knowledge and data errors from other agencies, KMA provided e-learning courses for their staff, and built up intermediate server for data flow.

**10.1.3 Project No. III.1 - Observing systems integration for supporting disaster risk reduction - Integration of Surface-based Remote Sensing Data in the East Asia**
***Real-time exchange of radar CAPPI products and automated weather station data between Japan and Korea***

The Japan Meteorological Agency (JMA) and the Korea Meteorological Administration (KMA) mutually agree to exchange radar CAPPI products and automated weather station (AWS) data in near real-time basis to use for operational purpose. In near real-time, KMA obtains radar 2km-height pseudo CAPPI products of JMA’s weather radar stations as well as hourly data of JMA’s surface observation network, called the Automated Meteorological Data Acquisition System (AMeDAS). JMA also obtains radar CAPPI products of KMA’s weather radar stations as well as most data of KMA’s AWSs in near real-time.

JMA succeeded in generating experimentally a two-dimensional grid product of analyzed precipitation over the region of the Republic of Korea using the radar CAPPI data and in-situ precipitation data of AWSs. JMA is now developing a quality control system to remove noise from radar CAPPI products. JMA conducted some experiments for a certain period to investigate the impact of this new analyzed precipitation using JMA’s mesoscale NWP system. Although the assimilation of the analyzed precipitation improved precipitation forecasts in some cases, it is also confirmed that the overall precipitation forecast skill degraded. To

improve the overall skill, it is inferred that simultaneous assimilation of other humidity observations such as ground-based GNSS data over the Republic of Korea would be essential.

***Non-real-time exchange of raw data of Doppler radar between Japan and Korea***

JMA and KMA also agree to exchange raw data of their Doppler radars in off-line basis to investigate the benefit of operational use of these data in individual NWP system.

In March 2013, JMA obtained a set of raw data for 5 days of July 2012 on the case of heavy rainfall over Kyushu Island from KMA. It was revealed that a quality control was necessary to use such raw data in a meso-scale NWP system.

***Dissemination of ground-based stations of the Global Navigation Satellite Systems on WIS/GTS***

Data of ground-based stations of the Global Navigation Satellite Systems (GNSSs) are disseminated on WIS/GTS in real time so that these data are available for operational use. Table 1 shows a list of such ground-based GNSS stations in China, Korea and Japan. At the Joint Meeting of the 12th Asia Pacific Satellite Data Exchange Meeting (APSDEU) and 24th North America / Europe Data Exchange Meeting (NAEDEX) (22-25 October 2012, Met Office, Exeter, U.K.), CMA, JMA and KMA were requested to provide data of more ground-based GNSS stations on GTS. It is, therefore, expected to increase the data amount in the future. However, any significant progress is not observed yet according to the Members' reports to the Joint meeting of 14th APSDEU and 26th NAEDEX (6-9 October 2015, Montreal, Canada).

KMA have established a new system for ground GNSS data collection and QC in 2015 for the improved meteorological utilization, especially for the NWP model. By the end of November 2015, total 57 stations including 7 IGS around Korean Peninsula are linked to the system, and 39 out of them can be converted into bufr format for the NWP usage after the quality control procedure.

Since the technical method to assimilate zenith tropospheric delay data or total precipitable water vapor data of ground-based GNSS stations is established, the data on WIS/GTS can be used for operational purpose.

Table 1 List of Ground-based GNSS Stations whose data are disseminated on WIS/GTS

| Country | Station Name | Longitude (East) | Latitude (North) |
|---|---|---|---|
| **China** | Wuhan(WUHN-MET) | 114.36 | 30.53 |
| | Lhasa(LHAZ-MET) | 91.10 | 29.66 |
| **Japan** | Usuda(USUD-GOP) | 138.36 | 36.13 |
| **Rep. of Korea** | Daejeon(DAEJ-MET) | 127.37 | 36.40 |

### 10.1.4 Project No. III.2 -Observing systems integration for supporting disaster risk reduction - Capacity Building in Radar Techniques in the Southeast Asia

Thai Meteorological Department (TMD) cooperated with JMA for a regional capacity building project on the maintenance and rainfall estimation and forecast by using weather radar initiated by ASEAN/SCMG (Sub-Committee on Meteorology and Geophysics). With the support of Japan-ASEAN Integration Fund (JAIF), the Regional Training Workshop on Weather Radar Basis and Routine Maintenance and Real-Time Radar Rainfall Estimation and Forecasting was held in Bangkok, from 24 February to 7 March 2014, with 20 participants from 7 ASEAN countries (Indonesia, Lao PDR, Malaysia, Philippines, Singapore, Thailand and Viet Nam), together with three experts from JMA, two experts from Japan Radio Company, and one expert from JICA. The workshop was highly successful.

National reports of many ASEAN members on usage of weather radar was submitted to the 35th and consecutive ASEAN/SCMG annual meetings

TMD-JMA technical meetings on radar issues started in 2011 and followed by every year as activities of the WMO/ESCAP Typhoon Committee.

Experimental international radar data exchange among TMD, MMD and JMA has started in 2016 as an activity of the WMO/ESCAP Typhoon Committee.

MMD-JMA technical meetings on radar issues started in 2014.

BMKG-JMA technical meetings on remote-sensing technology started in 2015.

### 10.1.5 Project No. IV - RA II WIGOS Project to Enhance the Availability and Quality Management Support for NMHSs in Surface, Climate and Upper-air Observations

Based on the mailing list established for the members of coordinating group of RA II Pilot Project to Enhance the Availability and Quality Management Support for NMHSs in Surface, Climate and Upper-air Observations (approved by 14th session of RA II, Tashkent, December 2008), information has been exchanged through the mailing list which was periodically updated.

In 2010, as a pilot project activity, WMO/JMA Survey on Surface, Climate and Upper-air Observations and Quality Management in RA II was implemented to investigate implementing status on meteorological observations by Members. The results of the survey was issued as WMO IOM Report (No. 111) in 2011 and shared by Members. In addition to the Survey, JMA/WMO Workshop on Quality Management in Surface, Climate and Upper-air Observations in RA II (Asia) was held in Japan (July 2010) with 22 participants from 20 Members in the Region.

The survey and workshop revealed that information on calibration of meteorological instruments by Members was required to promote the project, and consequently the WMO/JMA Survey on Meteorological Instruments, Calibration and Training in RA II was implemented in 2011. Following the survey, JMA/WMO Training Workshop on Calibration and Maintenance of Meteorological Instruments in RA II was held in Japan (Feb 2013) with 13 participants from 13 Members in the Region. The survey was reviewed and issued as WMO IOM report (No.122) in 2015.

As one of the activities of the project, quality of land surface observations in RA II Members is regularly monitored by RSMC Tokyo, by analyzing the differences between the surface observations and the corresponding first-guess fields of 6-hour forecasts of JMA's global model. The monitoring results are shared by Members concerned.

To achieve one of the expected key results (provision of technical support for instrument maintenance and calibration by experts from RICs), experts of JMA/RIC Tsukuba visited the Bangladesh Meteorological Department (BMD) and provided practical on-the-job training on meteorological instrument aiming at establishing the operational calibration system using meteorological standards (barometer and thermometer) donated in the framework of JICA technical cooperation project. The same project schemes are ongoing with Fiji, Sri Lanka, Mozambique and the Philippines.

### 10.1.6 Project No. V – Developing a Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) in Asia Node

According to the current GDPFS Manual - Designation and Mandatory Functions of Regional Specialized Meteorological Centres with Activity Specialization in Atmospheric Sand and Dust Storm Forecasts(RSMC-ASDF),SDS-WAS in Asia Node has carried out the following functions:

Has been preparing regional forecast fields by using CUACE/Dust continuously throughout the year on a daily basis. The model consists of a numerical weather prediction model incorporating online parameterizations of all the major phases of the atmospheric dust cycle;

Has been generating forecasts, with an appropriate uncertainty information statement, of the following minimum set of variables:

Dust load (kg•m–2)

Dust concentration at the surface (μg•m–3)

Dust optical depth at 550 nm (-)

3-hour accumulated dry and wet deposition (kg•m–2)

All those forecasts cover the period from the starting time (00 and/or 12 UTC) up to a valid time of 72 hours, with an output frequency of 3 hours. They cover the whole designated area with a horizontal resolution of about 0.5x0.5 degrees. KMA, NCEP and ECMWF have shared its output of SDS model forecast since 2016 in NRT.

The SDS-WAS in Asia Node Web Portal (http://eng.weather.gov.cn/dust/) has been designed to allow users to access to SDS forecast products as well as sources of basic information.

The Non-real-time functions according RSMC-ASDF have been fulfilled by SDS-WAS in Asia Node since 2014 as well. The CUACE/Dust forecasting system has been put into operational run in Asian region node centre(Asian-RC). It shows the forecasting results on the web portal and provides a link with forecasting results from two other SDS forecasting modle systems of JMA and KMA respectively.

### 10.1.7 Project No. VI - RA II WIGOS Project to Develop Support for NMHSs in Satellite Data, Products and Training

***Issuance of newsletters to RA II Members.***

Quarterly newsletters have been issued to share recent satellite-related information on topics such as imagery data, products and training. The newsletters listed below contained brief reports on relevant meetings, product development report, news on successful launch of new satellites and information on preparations for the Himawari-8/9 satellite series of JMA and Geo-KOMPSAT-2A of KMA. For example, in the vol.5/No.4, JMA introduced the first images captured by Himawari-8 new-generation geostationary meteorological satellite, which was launched on 7 October 2014.

Vol. 4/No. 1, April 2013
Vol. 4/No. 2, June 2013
Vol. 4/No. 3, November 2013
Vol. 4/No. 4, December 2013
Vol. 5/No. 1, March 2014
Vol. 5/No. 2, August 2014
Vol. 5/No. 3, October 2014
Vol. 5/No. 4, December 2014
Vol. 6/No. 1, March 2015
Vol. 6/No. 2, June 2015
Vol. 6/No. 3, October 2015
Vol. 6/No. 4, December 2015
Vol. 7/No. 1, March 2016
Vol. 7/No. 2, June 2016
Vol. 7/No. 3, October 2016
All the newsletters in the past are available at the following RAII WIGOS Project webpage: http://www.jma.go.jp/jma/jma-eng/satellite/ra2wigosproject/ra2wigosproject-intro_en_jma.html

*6th Asia/Oceania Meteorological Satellite Users' Conference and training event*

The sixth AOMSUC was held in Tokyo, Japan from 9 to 13 November 2015. The conference was hosted and sponsored by JMA and was co-sponsored by CMA, KMA, ROSHYDROMET, AuBOM, WMO and GEO. The two day training event was also held with participants from Region II and V.

In addition, the Third Meeting of the Coordinating Group of the WMO Regional Association II (Asia) WIGOS Project to Develop Support for National Meteorological and Hydrological Services (NMHSs) in Satellite Data, Products and Training was held at the JMA headquarters in Tokyo, Japan, on 14 November 2015, following the AOMSUC-6. The progress of the WIGOS Project was reviewed and the work plan 2015-2016 was discussed in the meeting by the participants of RA II Members and observers of RA V Members.

*7th Asia/Oceania Meteorological Satellite Users' Conference and training event*

The seventh AOMSUC was held in Songdo, Korea from 24 to 27 October 2016. The conference was hosted and sponsored by JMA and was co-sponsored by CMA, KMA, ROSHYDROMET, AuBOM, WMO and GEO. The two day training event (21-22 October 2016, Jincheon, Korea) was also held with participants from Region II and V before the Conference.

In addition, the Fourth Meeting of the Coordinating Group of the WMO Regional Association II (Asia) WIGOS Project to Develop Support for National Meteorological and Hydrological Services (NMHSs) in Satellite Data, Products and Training was held at Songdo,

Korea, on 28 October 2016, following the AOMSUC-7. The progress of the WIGOS Project was reviewed and the work plan 2017-2020 was discussed in the meeting by the participants of RA II Members and observers of RA V Members.

### 10.1.8 Collaboration of RA-II and RA-V for future regional WIGOS projects

The Joint RA-II/RA-V Workshop on WIGOS for Disaster Risk Reduction was held in Jakarta, Indonesia, 12-14, October 2015, to seek synergies for the increase of data availability, geographic coverage, timeliness and quality of observations in the region, primarily those relevant for weather watch and nowcasting activities. The participants in the Workshop decided to propose two joint projects as follows.

a) A “Joint RA-II/RA-V WIGOS Satellite Data Project” aiming at
   (i) strengthening the capabilities of all Members to use geostationary satellite images and derived products in support of Disaster Risk Reduction,
   (ii) developing a protocol for the NMHSs in the project countries to request event-driven rapid-scan imagery for their respective national areas of interest

b) A “Joint RA-II/RA-V WIGOS Radar Data Project” aiming at
   (i) improvement of data quality of existing radars,
   (ii) development and expansion of national radar networks,
   (iii) near real time international exchange of radar data, and
   (iv) development of «sub-regional» radar data centre(s);

## 10.2 Status of implementation of WIS

With the framework of WMO Information System, WIS centres (GISC, DCPC, and NC) have been established by WMO members complying with the WIS technical requirements. As of November 2015, there are 7 GISCs[3] (6 are operational: 86%), 29 DCPCs (26 are endorsed: 90%) with 37 NCs in Regional Association II (RA II). 35 out of 37 NCs in RA-II decided their principal GISC in 2012, after that remaining two NCs decided their principal GISC. To facilitate the implementation and operation of WIS in RA II, there are various capacity building activities provided by the GISCs, which includes 6 on-site trainings and WIS workshops run by GISC Beijing, 1 workshop organized by GISC Jeddah, 2 workshops organized by GISC Seoul, 1 workshop organized by GISC Teheran, and 4 workshops organized by GISC Tokyo, in the course of 2014-2015.

### 10.2.2 WIS components

As the WIS core network, RMDNC-NG managed by ECMWF has been completed on its migration at the last May, 2014. GISC Beijing, Jeddah, Moscow, New Delhi, Seoul, Tokyo have completed their RMDCN-NG migration or connection to RMDCN-NG, but GISC Tehran has not been connected yet due to the license issue from supplier.

An annual survey for the status and plans of RMTN in RA II has completed. As of October 2016, the RA II RMTN consists of 108 links. One NI (Not Implementation) circuit between Bhutan and RTH New Delhi was established in 2015, and then, Bhutan started issuing their surface observation data in BUFR format since March 2016. On the other hand, ten circuits in the Regional configuration plan are not in operation. Especially NMCs Baghdad (ought to have 2 regional circuits), Kabul (3) is isolated from the GTS. Meanwhile, the NI circuit between Karachi and Tashkent has not been implemented yet, because there are difficulties to deploy telecommunication infrastructure for the area, and both RTHs requested to remove the link from RA II regional circuit plan. EG-WIS recognized the situation and accepted their requirement.

The operational links (90) in RMTN are operated on three types of communication infrastructure, dedicated leased line (30), MPLS/VPLS (28) and the internet (31). Before 1999, all the GTS circuits in RA-II were operated on dedicated leased line, but these days, communication links tend to migrate to the internet. Internet is a cost-effective, but centres need to consider and understand the characteristics of internet, in particular the internet security and best-effort serves. Satellite broadcasting systems, including CMACast, Meteoinform, INSAT-DMDD, EUMETCast and etc., are being used for complements to the GTS, backup sources and cost-effective alternatives to HF radio broadcasts.

The IGDDS is for the efficient circulation of space-based observation data and products meeting the needs of WMO programmes and regional requirements. It is noted that CMACast began operation in June 2012 and has established data exchange and re-dissemination service with EUMETCast, JMA started to distribute Himawari-8/9 data via Internet cloud and DVB-S2 based HimawariCast in July 2015. KMA is planning for the follow-on geostationary meteorological satellite GEOKOMPSAT-2A which will be launched in May, 2018. With the advent of advanced sounding instruments like METOP/IASI and SNPP/CrIS, and with successful launches of Chinese FY-3 series satellites, the scope of Regional ATOVS Retransmission Service (RARS) has been extended as DBNet (Direct Broadcast Network for Near Real-Time Relay of Low Earth Orbit Satellite Data). The DBNet Coordination Group has been established in 2015 and has drafted “A Guide to DBNet” to record the DBNet specifications, define standards, best practices and coordination mechanisms. The draft Guide has been discussed at APSDEU-NAEDEX (now GODEX-NWP), ITSC-20, WMO IPETSUP-2 and CGMS-44 and will be submitted to WMO CBS-16 (November 2016)for formal endorsement as a WIS guide. In the future, it is necessary to collaborate with DBNet expert team and activities to improve the data availability, user awareness, data access and technological training in RA II.

### 10.2.3 Data management

The main activities related to the theme of Data Representation and Metadata include technical consultation and support for Members working on code form migration, monitoring,

[3] *GISC Moscow is geographically located in RA VI, but GISC Moscow provides services to DCPCs/NCs in RA II. In this document, GISC Moscow is counted as an RA II GISC.*

analysis and questionnaires on the status of migration to Table Driven Code Forms (TDCF) and implementation of WIS discovery metadata. To determine the level of Members' understanding on the migration to TDCFs and WIS metadata management and status of implementation, and to assess training requirements on these areas, a questionnaire was sent to RA II Members in November 2015 and received responded by 18 Members.

According to the statistics collected every three months from January 2013 to July 2016, (1) notable progress has been seen with the migration of SYNOP data since October 2014, (2) number of BUFR TEMP report increased by about 50 in the first half of 2014, which is attributed to India's BUFR TEMP reports, (3) As of November 2016, Four Members were reporting CLIMAT data in BUFR format, which is a major setback compared to the situation in 2014-2015.

Creation and registration of WIS metadata for GTS bulletins in RA-II is showing a good progress in general. GISCs Moscow, Seoul, Teheran and Jeddah started operation during 2013-2015 and 31 RA-II Members (89%) out of 35 have registered at least one WIS metadata record to the catalogue. The community is waiting for GISC New Delhi to become operational and starting catalogue management for its area of responsibility. As of November 2016, Uzbekistan (its principal GISC is Seoul) has not registered its records to the catalogue yet.

The questionnaire survey results indicated the requirements for improving communication between Global Information system Centres (GISCs) and National Centres (NCs) and for training on WIS metadata management.

10.2.4 Discontinuing Volume II of the Manual on GTS

In accordance with the decision of Cg-17, Volume II of WMO No. 386 (Manual on GTS) will be discontinued and replaced by web-based documentation. EG-WIS agreed to organize a Task Team (TT) to proceed and create the web-based document. Theme Leader in Data Communication Technics and Structure will lead the TT with Volunteer Experts of the Theme, and some experts would be invited. The EG-WIS will establish the TT with ToR and plans to submit the draft of web-based document to RAII Management Group.

10.2.5 WIS related projects

WIS monitoring is aimed at monitor availability of WIS centre functions and services in order to ensure stable operation, and the pilot project has been conducted by CBS/ET-WISC and leaded by two project managers. Currently four GISCs in RA II (Beijing, Moscow, Seoul and Tokyo) are providing actual operation status and GISC Beijing and Tokyo are providing prototype service to be available by web browser.

- GISC Beijing: http://wisportal.cma.gov.cn/wis/
- GISC Tokyo: http://www.wis-jma.go.jp/cms/about-wis/

GISCs Jeddah, New Delhi and Teheran have a plan to join the project.

## APPENDIX

### 1. Proposed RA II Expert Group on WIGOS (EG-WIGOS)

(draft)

**Terms of Reference**

(a) To coordinate the planning and implementation of WIGOS in the Region in accordance with the Regional WIGOS Implementation Plan (R-WIP-II), in accordance with decisions and guidance from Cg-17, the follow-up EC sessions, RA II Management Group, and the RA II Strategic and Operating Plan;

(b) To provide support and assistance to RA II Members in accordance with the R-WIP-II and in a response to their requests (subject to availability of resources/funds);

(c) To assist RA II Members to develop their National WIGOS Implementation Plans (N-WIPs);

(d) To monitor the progress in the implementation and operations of WIGOS in the Region; advise on possible improvements and priorities for appropriate actions and the need for external support, where required, according to the technical guidance from the technical commissions, specified in the GFCS-IP, EGOS-IP, GCOS-IP and other observing system implementation plans in order to evolve and implement WIGOS in the Region;

(e) To support the implementation and improvement of OSCAR/Surface in the Region;

(f) To collaborate with related bodies on the implementation of WDQMS in the Region;

(g) To collaborate with the RWC candidates, RA II management group and WIGOS-PO on the establishment of the Regional WIGOS Centres in the Region;

(h) To coordinate relevant activities with the regional groupings involved in observations to ensure consistency of approach and synergy;

(i) To advise the president of the Regional Association and the chair of the WIGOS relevant Working Group on the proposed composition and changes to the Regional Basic Synoptic Network and Regional Basic Climatological Network;

(j) To collaborate with TT-RBON on the implementation of the Regional Basic Observing Network in the Region.

(k) To advise RA-II/MG on WIGOS implementation in the Region.

**Membership**

RA II Expert Group on WIGOS (EG-WIGOS)

| Title | NAME | Country |
|---|---|---|
| Co-Coordinators | | |
| | | |
| Project Leader in Monitoring and Reviewing the Implementation of EGOS IP in RA II | | |
| Project Leader in The web-interface for sharing status of standardization and experience and monitoring synoptic observations in RA II | | |
| Project Leader in Capacity Building in Radar Techniques in the Southeast Asia | | |
| Project Leader in Enhancing the Availability and Quality Management Support for NMHSs in Surface, Climate and Upper-air Observations | | |
| Project Leader in Developing a Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) in Asia Node | | |
| Project Leader in Developing Support for NMHSs in Satellite Data, Products and Training | | |
| Chair of Task Team on RBON | | |

## 2. RA II Task Team on the Regional Basic Observing Network (TT-RBON)

**3.**

**Terms of Reference**

1. Develop the proposal for the Regional Basic Observing Network in RA II:
    a. Prioritize the WMO application areas relevant to the Region;
    b. Define the RA II specific criteria for the selection of stations/platforms into RBON of RA II;
    c. Select the RBON stations/platforms in accordance with the RBON concept and RA II specific criteria;
    d. Identify gaps and develop a draft action plan to deal with them;
    e. Develop the Roadmap for, and coordinate the activities on the implementation of the RBON in RA II;
2. Work with RA II EG-WIGOS and WIGOS-PO on the further elaboration of the RBON concept.

**Roadmap for the implementation of the RBON in RA II:**

February 2017, establishment of TT-RBON;

April 2017, RA II specific criteria for the selection of stations/platforms into RBON;

June 2017, a draft pilot RBON;

July 2017 to June 2018, the pilot RBON testing;

September 2018, evaluation for the pilot RBON

December 2018, the draft RBON

January 2019, submission of the draft RBON to president of RA II

## 1. Proposed RA II Expert Group on WIS (EG-WIS)

(draft)

**Terms of Reference**

(a) To monitor the progress made in the implementation and operation of WIS in the Region and advise on possible improvements and priorities for appropriate actions to be carried out under the respective WMO Programmes and cosponsored Programmes;

(b) To keep abreast of new developments in WIS, promote the relevant WIS support to all WMO Programmes, and make recommendations, in compliance with relevant WMO Technical Regulations, for WIS implementation in the Region as regards communication techniques, communication structure, data management, data and metadata representation and relevant monitoring activities;

(c) To keep under constant review the Regional Meteorological Telecommunication Network and its implementation, as the WIS component for time-critical and operation-critical exchange, identify shortcomings and recommend appropriate measures for remedial action in the Region;

(d) To provide guidance to the Members of the Region in capacity-building for information and outreach relevant to improving WIS;

(e) To communicate with WIS 2.0 strategy and plan on the regional requirements.

**Membership**

RA II Expert Group on WIS (EG-WIS)

| **Title** | **NAME** | **Country** |
|---|---|---|
| Co-Coordinators | | |
| | | |
| Theme Leader on WIS Infrastructure and Implementation (TL-II) | | |
| Theme Leader on Data representation and Metadata (TL-DM) | | |
| Theme Leader on Capacity Development (TL-CD) | | |
| Theme Leader on Information Management and Emerging Data Issues (TL-IM) | | |

**Terms of Reference of the Co-Coordinators and Theme Leaders of EG-WIS**

## 1. Terms of reference of the co-coordinators of the Expert-Group on WIS

(a) To coordinate activities of the regional theme leaders;

(b) To advise and report to the president of the Regional Association on issues and all matters concerning the regional aspects of the WMO Information System (WIS) implementation, operation and services, including the Global Telecommunication System (GTS) and the Integrated Global Data Dissemination System (IGDDS), and data management in the Region;

(c) To advise members of the Working Group on issues and all matters related to the regional aspects of the WIS;

(d) To promote regional contributions to implementation of the WMO Information System;

(e) To represent the Region at relevant sessions of the Commission for Basic Systems (CBS) Open Programme Area Group on Information Systems and Services.

## 2. Terms of reference of the theme leader on WIS Infrastructure and Implementation

(a) To keep under review the organizational, technical, procedural aspects of the WIS data communication structure, and especially of the Global Telecommunication System in the Region;

(b) To keep under review the status of implementation and operation of the Regional Meteorological Telecommunication Network (RMTN), including in particular routing arrangements for the exchange of operation-critical observational data and processed information within the Region and with other Regions, with special attention to arrangements for the distribution of early warnings and related information;

(c) To keep under review and assist in the definition of regional requirements for data exchange, management and access of WMO programmes and other relevant international programmes, and their impact on WIS implementation, services and plans;

(d) To formulate recommendations for the further development and upgrading of the RMTN and of the regional data communication structure of WIS, including implementation of telecommunication facilities and techniques, and updating the Volume II of the Manual on the GTS (WMO-No 386);

(e) To support to multi hazard early warning systems, WIS centre nominations and compliance and evolution of WIS to 2.0.

## 3. Terms of reference of the theme leader on Data Representation and Metadata

(a) To keep under review inter-programme data representation matters, including migration to Table Driven Code Forms (TDCF) and regional codes, and make recommendations;

(b) To keep under review the status of implementation of the WIS DAR metadata catalogue and migration from WMO Catalogue of Meteorological Bulletins (Volume C1) to DAR metadata;

(c) To review procedures for the reception of operation-critical data and products, especially for the World Weather Watch (WWW), in case of major outages at key

facilities;

(d) To keep under review WIS monitoring developing activities and implementation in the Region, including the real-time and non real-time WWW monitoring activities pertaining to the GTS in the Region, and make recommendations on how to benefit from it regionally.

**4. Terms of reference of the theme leader on Capacity Development**

(a) To keep under review the regional requirements on capacity development related to WIS;

(b) To assist RA II WIS centres in developing the training plan on the implementation and operation of WIS.

(c) To communicate with RA II GISCs and RTCs to collect their training plan related to WIS, and keep under review and update the training plan in R2-WIS-IP.

**5. Terms of reference of the theme leader on Information Management and Emerging Data Issues**

(a) To keep under review and report on available information management practices, and plan on the regional requirements;

(b) To communicate with CBS Task Team on Information Management (TT-IM) and ensure the regional requirements taken into consideration by the TT, and develop the regional plan on Information Management;

(c) To communicate with the other TLs of ET-WIS on the plan and practices on information management.

**ANNEX IV-4.1**

## Current RA II WIGOS IMPLEMENTATION PROJECTS

### Project No. I

| | |
|---|---|
| **Project Title** | **RA II WIGOS Project to Monitor and Review the Implementation of EGOS-IP in RA II** |
| **Type** | Regional Implementation Project (RA II) |
| **Status** | Draft Design |
| **Overview** | A vision for the Global Observing Systems in 2025 which provides high-level goals to guide the evolution of the global observing systems during the coming decades has been approved by EC-LXI in 2009. Accordingly, CBS-15 adopted a recommendation for the Implementation Plan for the Evolution of Global Observing Systems (EGOS-IP) to complement and respond to this Vision. The Implementation Plan outlined the key activities to be implemented during the period 2012 to 2025 aiming at maintaining and developing all WMO component observing systems. Thus, a project can be established to monitor the progress of RA II Members on the implementation of EGOS-IP, analyze gaps in the regional observing network, and therefore, prioritize actions listed in EGOS-IP. The concerned information should be shared by RA II Members and all users by establishing a portal. This project will:<br>● Encourage RA II Members to appoint National Focal Points and submit EGOS National Reports annually,<br>● Identify gaps and prioritize actions listed in EGOS-IP through reviewing the progress of EGOS-IP in RA II,<br>● Develop a Portal to share the progress of EGOS-IP Implementation of RA II Members. |
| **Aim(s)** | ● To identify gaps and prioritize actions listed in the EGOS-IP through reviewing the progress of the Evolution of Global Observing Systems (EGOS),<br>● The progress and experiences are shared by RA II members when implementing the EGOS-IP. |
| **Benefits** | The Portal will provide Members and users with a platform for sharing updated progress of EGOS-IP implementation in RA II |
| **Key Regional Players** | China and Hong Kong, China |
| **Capacity development requirements** | ● Technical assistance by CBS,<br>● Workshop(s) on gaps analysis and actions prioritizing listed in EGOS-IP. |
| **Partners/Participants** | All RA II Members |
| **Funding Source(s)** | This project will rely on existing budget allocations at the national level. Additional funding will be needed to facilitate some elements such as the cost for developing the portal software. |
| **Overall Costs** | (TBD) |
| **Timescale** | 2013–2016 |
| **Expected Key Deliverables/Key responsible body** | ● A list of RA II EGOS National Focal Points,<br>● Prioritized actions listed in the EGOS-IP,<br>● Portal to share progress EGOS IP implementation in RA II. |
| **Main risk(s)** | Lack of resources (funds/expertise), lack of cooperation and missing or mistaken information from Members |
| **Website** | Not available |

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| **Summary** | This project will develop a Portal that will provide updated progress on EGOS-IP in RA II, identify gaps and prioritize actions listed in EGOS-IP identify regional prioritized actions to be taken. |
| **Date of the update** | 21 November 2012 |
| **Contact Person 1** | Ms GUO Jianxia<br>Meteorological Observation Center,<br>China Meteorological Administration (CMA)<br>China<br>Tel: +86 10 68407934<br>Fax: +86 10 68400936<br>E-mail: gjxaoc@cma.gov.cn |
| **Contact Person 2** | Mr LEE Lap Shun<br>Hong Kong Observatory<br>Hong Kong, China<br>Tel.: +852-2926-8416<br>Fax: +852-2311-9448<br>E-mail: lslee@hko.gov.hk |

**Project No. II**

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|---|---|
| **Title** | **RA II WIGOS Project for Standard and Best Practice Portal, including Technical Documents with Necessary Details in English from all RA II Members** |
| **Type** | Regional Implementation Project (RA II) |
| **Status** | Draft Design |
| **Overview** | This project will develop a Standard and Best Practise Portal including mechanism and procedures needed for a regular updating process. |
| **Aim(s)** | ● To develop a Standard and Best Practise Portal,<br>● To establish regional standard and best practices documentation (regional practices database) for enhanced observational data/products utilization, including data/metadata management,<br>● To specify mechanisms, procedures for regular monitoring and updating of the portal. |
| **Benefits** | The standard and best practices portal will enhance and improve quality and utilization of data/products. |
| **Key Regional Player** | Republic of Korea |
| **Capacity development requirements** | Technical assistance by CBS and CIMO |
| **Partners/Participants** | RA II Members |
| **Relationship with existing project(s)** | KMA WIGOS demonstration project |
| **Funding Source(s)** | This project will rely on existing budget allocations at the national level |
| **Overall Costs** | (TBD) |
| **Timescale** | 2013–2016 |
| **Expected Key Deliverables / Key responsible body** | Portal on standards and best practices with mechanisms and procedures for regular monitoring and keeping the portal up-to-dated. |
| **Main risk(s)** | Lack of resources (funds/expertise), lack of cooperation and missing or mistaken information from Members. |
| **Website** | Not available |
| **Summary** | This subproject will establish a RA II Portal of standards and best practices for enhanced observational data/products utilization. |
| **Date of the update** | 21 November 2012 |
| **Contact Person 1** | Dr WON Jaegwang<br>Korea Meteorological Administration (KMA)<br>Republic of Korea<br>Tel.: +82-2-2181-0694<br>Fax: +82-2-2181-0709<br>E-mail: wonjg@kma.go.kr, ecotus37@korea.kr |
| **Contact Person 2** | Dr PARK Seongchan<br>Korea Meteorological Administration (KMA)<br>Republic of Korea<br>Tel. +82-2-2181-0696<br>Fax: +82-2-2181-0709<br>E-mail: scpark@korea.com |

**Project No. III.1**

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|---|---|
| **Project Title** | **RA II WIGOS Project for Observing Systems Integration for Supporting Disaster Risk Reduction** |
| **Subproject Title** | **Integration of Surface-based Remote Sensing Data in the East Asia** |
| **Type** | Regional Implementation Project (RA II) |
| **Status** | Draft Design |
| **Overview** | In order to enhance observing capabilities in severe weather monitoring and forecasting, specifically in East Asia, surface-based remote sensing datasets/ products, such as radar and GPS data, should be integrated for their better utilization.<br>This project, as a first step, aims at developing a feasible and optimal draft design of integrated surface-based remote sensing observations toward future operational assimilation in meso-scale NWP system at the sub-regional level, as well as real-time quality-assured radar composite maps. The project will be Observing System Experiments (OSE) driven and proceed as follows:<br>1. Offline Exchange of surface-based remote sensing datasets/products including radar echo intensity, Doppler velocity, AWS data, and, if available, GPS precipitable water vapour, together with supplementary information (e.g. data format, details on observations, and data quality) among participating organs.<br>2. Examination of impacts of assimilation of exchanged remote sensing observation on its NWP performance. Also, sub-regional radar composite maps meeting their own operational requirements will be developed. Results and identified technical issues (e.g. data format, data policies, telecommunication for real-time data exchange, and quality of data) will be shared with and worked out cooperatively by the participating organs. Thus, requirements of data exchange for operational phase will be specified.<br>3. A feasible and optimal draft design of integration of surface-based remote sensing observations will be developed based on the results of the project.<br>To proceed with this project, existing frameworks such as CMA-JMA-KMA NWP meeting will be expanded to include this project into its agenda. |
| **Aim(s)** | The aim of this project is to develop a feasible and optimal draft design of integrated surface-based remote sensing observations toward operational assimilation of those data in meso-scale NWP model of the participating organs at the sub-regional level, as well as real-time quality-assured radar composite maps. |
| **Benefits** | Members in East Asia will benefit from this project through enhancement of their capabilities in observations for better early monitoring/warning/nowcasting/very short-range forecasting.<br>All the other RA II Members, particularly ones in Southeast Asia which might plan a similar project in the future, will benefit from shared outcomes of this project, namely: (1) solutions to identified issues for integration of surface-based remote sensing observations at sub-regional level; as well as (2) results of impact analysis on capacities in severe weather monitoring and forecasting. |
| **Key Regional Player** | China, Japan and Republic of Korea |
| **Capacity** | Workshop(s) on better utilization (decision making & assimilation) |

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| **development requirements** | |
| **Partners/Participants** | CMA, JMA, KMA |
| **Relationship with existing project(s)** | 1. WMO Workshop on the Impact of Various Observing Systems on Numerical Weather Prediction.<br>2. CMA-JMA-KMA joint workshop on NWP (The 1st CMA-JMA-KMA joint workshop on NWP was held in September 2011).<br>3. WMO/CIMO Radar Quality Control and Quantitative Precipitation Estimation Intercomparison (RQQI). |
| **Funding Source(s)** | This project will rely on existing budget allocations at the national level. The project will build on existing national observational networks and information management infrastructures. Additional funding might be needed to regularly hold technical meetings among CMA, JMA, and KMA to proceed with this project. |
| **Overall Costs** | (TBD) |
| **Timescale** | 2013 – 2016 |
| **Expected Key Deliverables / Key responsible body** | 1. Establishment of collaborative working mechanism toward integrated surface-based remote sensing observations in the East Asia for operational monitoring and forecasting severe weather.<br>2. Solutions to identify issues to be solved for integration of surface-based remote sensing observations at sub-regional level and their solutions.<br>3. Impacts on capacities of NMHSs in severe weather monitoring and forecasting through utilization of surface-based remote sensing observations. |
| **Main risk(s)** | 1. Limited exchange of observational data, for instance, due to data policies of providers.<br>2. Lack of sharing relevant technical documentation on exchanged data. |
| **Website** | Not to be established |
| **Summary** | This project will develop a feasible and optimal draft design of integrated surface-based remote sensing observations toward the sub-regional utilization in East Asia. |
| **Date of the update** | 21 November 2012 |
| **Contact Person 1** | Mr Yuki HONDA<br>Office of International Affairs<br>Japan Meteorological Agency (JMA)<br>Japan<br>Tel.: +81-3-3211-4966<br>Fax: +81-3-3211-2032<br>E-mail: iao-jma@met.kishou.go.jp, |
| **Contact Person 2** | Dr Jaegwang WON<br>Korea Meteorological Administration (KMA)<br>Republic of Korea<br>Tel.: +82-2-2181-0694<br>Fax: +82-2-2181-0709<br>E-mail: wonjg@kma.go.kr, ecotus37@korea.kr |
| **Contact Person 3** | Mr LI Feng<br>Meteorological Observation Center<br>China Meteorological Administration (CMA)<br>China<br>Tel.: +86 10 68409293<br>Fax: +86 10 68400936<br>E-mail: liflif04@cma.gov.cn |

**Project No. III.2**

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|---|---|
| **Project Title** | **RA II WIGOS Project for Observing Systems Integration for Supporting Disaster Risk Reduction** |
| **Subproject Title** | **Capacity Building in Radar Techniques in the Southeast Asia** |
| **Type** | Cross-regional Implementation Project (RAs II and V) |
| **Status** | Draft Design |
| **Overview** | Developing countries in Southeast Asia share common challenges for severe weather monitoring and forecasting. In spite of many radars having been installed in the region, they are not fully utilized due to lack of their expertises in weather radar techniques. Thus, capacity building in weather radar techniques is crucial concern for the countries.<br>Although their levels of operational usage of radar vary, they are often facing common technical challenges. In this regard, sharing their technical issues and lessons learnt among countries in the Region and developing the regional strategy on development of the radar network in the Region will enable them to tackle those challenges collaboratively with help from the WMO community in an effective and efficient manner.<br>This project, initiated by Thailand and Malaysia, within the framework of the ASEAN Sub-Committee on Meteorology and Geophysics (SCMG), aims at establishing a collaborative mechanism within SCMG through the following steps:<br>1) Thailand and Malaysia, as leaders of this project, will develop their national reports toward operational rainfall estimation/forecasting based on radar data. In order to share their experiences and lessons learnt among the participating organs, and to identify technical problems to be solved and necessary technical supports for, the reports should include the following items in a well-structured format:<br>(a) overview of the current radar systems,<br>(b) organization (department, division, staff, and budget),<br>(c) specification of radar systems,<br>(d) maintenance of equipment,<br>(e) data processing (QC, calibration, and composite technique),<br>(f) radar products,<br>(g) details of current technical problems associated with (a) to (f),<br>(h) lessons learnt from the past experiences,<br>(i) recent progress,<br>(j) future development plans.<br>The reports will be submitted to the 35th SCMG meeting (2013).<br>2) The other ASEAN member countries will also develop their national reports in the same format as that of Thailand and Malaysia, and submit their reports to 36th SCMG meeting. Based on the submitted report, the meeting will develop a regional strategic plan on radar which identifies common technical issues and necessary actions to be taken.<br>3) During the period of the project, all the above Members will be requested to update their national reports and submit the latest version to a SCMG meeting every year. Thailand and Malaysia are requested to encourage the other Members to develop and keep their national reports up-to-date. The regional strategic plan is also to be updated at every SCMG meeting.<br>*Each Member will consult with the WMO or advanced RA II Members about appropriate technical missions focused on identified technical issues in the reports such as dispatch of radar experts to recipient countries, with |

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| | the VCP or other funds. On completion of such a mission, the recipient Member is requested to update its national report by including details of the outcomes of the mission.<br>*SCMG set up a new agenda item for discussion on the progress of this project. |
| **Aim(s)** | This project aims to develop effective early warning systems building on radar data in Southeast Asia. |
| **Benefits** | Capacity in monitoring and forecasting of the severe weather using radar data will be enhanced by shared experiences and lessons among the participating organs and technical missions focused on technical issues identified in national reports and the regional strategic plan. |
| **Key Regional Player** | ASEAN-SCMG: Thailand, Malaysia |
| **Partners/ Participants** | All the ASEAN Member countries (Cambodia, Brunei Darussalam, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam) |
| **Relationship with existing project(s)** | - Radar composite map in Southeast Asia, one of the on-going projects under the Meteorological Working Group of the WMO/ESCAP Typhoon Committee,<br>- Severe Weather Forecasting Demonstration Project (SWFDP) for Southeast Asia,<br>- ASEAN Sub-Committee on Meteorology and Geophysics(SCMG). |
| **Funding Source(s)** | This project will rely on existing budget allocations at the national level. The project will build on existing national observational networks and information management infrastructures. Additional funding will be needed for technical cooperation for those countries by dispatching appropriate experts and/or providing training workshops. |
| **Overall Costs** | (TBD) |
| **Timescale** | 2013–2016 |
| **Expected Key Deliverables / Key responsible body** | - National reports in the Southeast Asia toward operational rainfall estimation/forecasting based on radar data,<br>- Regional strategic plan on development of the radar network. |
| **Main risk(s)** | 1) Failure of development of national reports by participating organs.<br>2) Lack of available experts.<br>3) Lack of funds available. |
| **Website** | Not to be established |
| **Date of the update** | 21 November 2012 |
| **Contact Person 1** | Dr.Somchai Baimoung<br>Deputy Director-General/Acting Director-General<br>Thai Meteorological Department<br>Thailand<br>Tel.: +66 81 989 9025<br>Email: somchaib@tmd.go.th |
| **Contact Person 2** | Mr A. Kamiluddin Hj Ibrahim<br>Director, Radar Meteorology Division<br>Malaysian Meteorological Department<br>Malaysia<br>Tel.: +603 7967 8154<br>Fax: +603 7955 0964<br>E-mail: kamiluddin@met.gov.my |

**Project No. IV**

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|---|---|
| **Project Title** | **RA II WIGOS Project to Enhance the Availability and Quality Management Support for NMHSs in Surface, Climate and Upper-air Observations** |
| **Type** | Regional Implementation Project (RA II) |
| **Status** | Draft Design |
| **Overview** | The Japan Meteorological Agency (JMA)/World Meteorological Organization (WMO) Workshop on Quality Management in Surface, Climate and Upper-air Observations, held at Tokyo in July 2010 as part of activities of the Pilot Project to Enhance the Availability and Quality Management Support for NMHSs in Surface, Climate and Upper-air Observations (hereafter, Pilot Project), found out that primary factors adversely affecting data quality in RA II are calibration and maintenance of instruments mainly due to lack of traceability of measurements to international standards and calibration facilities. This project will build on outcomes of the workshop. It consists of the following two activities: (i) improvements of data quality of RBCN/RBSN stations; and (ii) enhancement of capabilities of RIC-Tsukuba and RIC-Beijing. All the outcomes of this project will be shared at a Portal to be established by the Coordinator.<br>1. Improvements of data quality at RBCN/RBSN stations<br>(a) Monitoring Data Quality<br>The Coordinator checks data quality of RA II stations and identifies and requests RA II Members to identify technical issues, based on the following results:<br>• Questionnaire on the Surface, Climate, and Upper-air Observations and Quality Management in Regional Association II (Asia) (conducted in July 2010),<br>• Questionnaire on meteorological instruments, calibration and training in Regional Association II (Asia) (conducted in January 2012),<br>• 6-monthly monitoring reports by the Lead Centre for monitoring the quality of land surface observations in Region II.<br>(b) Survey on status on QA/QC procedures and site managements for the network of RBCN/RBSN stations, and report the results.<br>Based on requests from the Coordinator, the following Members will consider the possibility of technical support if funds are available, and share the summary of the technical missions with RA II Members:<br>- CMA, HKO, JMA, and KMA for Southeast Asia,<br>- IMD for South Asia,<br>- Roshydromet for Central Asia,<br>- Kuwait for Middle East.<br>2. Enhancement of RIC's Services<br>RICs plan to implement the following action items for further enhancement of their services in capacity building and calibration during the project:<br>(a) Organization of a training workshop to improve understanding of calibration and maintenance of |

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| | meteorological instruments according to needs of RA II Members to be identified by the "Questionnaire on Meteorological Instruments, Calibration and Training in Regional Association II (Asia)",<br>(b) Development of training materials on calibration and maintenance of instruments (to be prepared for publication as an Instruments and Methods of Observation Programme (IMOP) technical document),<br>(c) Obtaining the International Standard ISO/IEC 17025 – General requirements for the competence of testing and calibration laboratories – certification for air pressure, temperature, and humidity,<br>(d) Development of RIC's Websites,<br>(e) Intercomparison between RIC-Tsukuba and RIC-Beijing,<br>(f) Reports on status on calibration instruments for surface-based observations in RA II (to be prepared for publication as an Instruments and Methods of Observation Programme (IMOP) technical document). |
| **Aim(s)** | This project aims at improvement of data quality at RBCN/RBSN stations and enhancement of services of RA II RICs. |
| **Benefits** | RA II Members, especially those with technical issues on data quality of observations, will potentially benefit from this project. |
| **Role / Involvement of WMO Regional Centres in RA II** | Regional Instrument Centres (RICs)<br>Lead Centre for monitoring the quality of land surface observations |
| **Key Regional Player** | JMA (Coordinator), and Members of Coordination Group<br><br>Technical Mission:<br>- CMA, HKO, JMA, and KMA for Southeast Asia,<br>- IMD for South Asia,<br>- Roshydromet for Central Asia,<br>- Kuwait for Middle East. |
| **Capacity development requirements** | 1. Workshop on maintenance, field inspection, etc. (basic level),<br>2. Workshop on traceability, measurement uncertainty, etc. (advanced level). |
| **Partners / Participants** | RA II Members |
| **Funding Source(s)** | This project will rely on existing budget allocations at the national level. Additional funding will be needed to dispatch experts to NMHSs in developing countries and/or invite their observational staff to RICs for trainings and calibrations of national standards. |
| **Overall Costs** | (TBD) |
| **Timescale** | 2013–2016 |
| **Expected Key Deliverables / Key responsible body** | 1. Provision of technical support for instrument maintenance and calibration by experts from RICs.<br>2. Holding a RIC's training workshop for RA II Members.<br>3. Development of training materials (to be prepared for publication as an IMOP technical document).<br>4. Obtaining ISO/IEC 17025 certification.<br>5. Portal Website to share outcomes of this project.<br>6. Report on status on QC/QA procedures and site management in RA II. |

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| | 7. Reports on status on meteorological instruments, calibration and training in Regional Association II. |
| **Main risk(s)** | • Lack of funding for technical missions by RICs,<br>• Insufficient communication between the Coordinator, RICs, and RA II Members on their status on maintenance and calibration of instruments to specify needs of technical supports,<br>• Lack of responses from RA II Members. |
| **Website** | RIC's Website/Portal on QC/QA |
| **Summary** | Improvement of data quality of RA II Members through enhancement of RIC's services and capacity |
| **Date of the update** | 21 November 2012 |
| **Contact Person 1** | Mr Yoshihisa NAKAMOTO<br>Senior Coordinator for Observation Planning<br>Administration Division, Observations Department<br>Japan Meteorological Agency (JMA)<br>Japan<br>Tel.: +81 3 3211 6018<br>Fax: +81 3 3211 7084<br>Email: nakamoto@met.kishou.go.jp |
| **Contact Person 2** | Mr He Xiaolei<br>Meteorological Observation Center<br>China Meteorological Administration (CMA)<br>China<br>Tel: +86 10 68409767<br>Fax: +86 10 68400936<br>E-mail: hxlaoc@cma.gov.cn |

**Project No. V**

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|---|---|
| **Project Title** | **RA II WIGOS Project to Develop a Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) in Asia Node** |
| **Type** | Regional Implementation Project (RA II) |
| **Status** | Draft Design |
| **Overview** | SDS-WAS was established in 2007 to achieve comprehensive, coordinated and sustained observations and modelling capabilities of sand and dust storms in order to improve the monitoring of sand and dust storms to increase the understanding of the dust processes and to enhance dust prediction capabilities for mitigation of risks in many affected area (aviation, health impacts, etc.).<br><br>The WMO SDS-WAS Region for Asia third meeting of Regional Steering Group (RSG) was held at Tsukuba, Japan in March 2012. At the meeting, it was confirmed that observation data exchange schemes should be implemented promptly in order to enhance systematic near-real-time (NRT) monitoring of sand and dust events in each country, and the following near-term implementation plan was agreed within the SDS-WAS Asia Node activity:<br><br>• Each country will confirm their data policy on observation data delivery, to reach an agreement on the provision of observation data to be shared within the Node in NRT,<br><br>• Regional Centre (RC: China) will provide a portal website with a function for sharing the observation data and announce it to the Node members,<br><br>• At the beginning, experimental observation data sharing will be conducted in off-line basis (not NRT) for the sand/dust storms (SDS) seasons,<br><br>• For the data exchange, the ad-hoc working group will propose appropriate data format and parameters,<br><br>• In SDS season in the spring (from February to June) 2013, the NRT (with a goal of approximately 1-day delay) data exchange will be conducted regularly,<br><br>• NRT data will be used for intercomparison of sand and dust storm forecast model to improve forecast accuracy as well as for monitoring of sand and dust storms. |
| **Aim(s)** | This project aims at mitigation of risks in many affected areas in the Asia Node countries through enhancement of systematic NRT monitoring of sand and dust storm. |
| **Benefits** | The systematic NRT monitoring of sand and dust storm will provide the Asia Node countries with useful information for sand and dust storm risk mitigation. |
| **Role / Involvement of WMO Regional Centres in RA II** | Regional Specialized Meteorological Centre with activity specialization on Atmospheric Sand and Dust Forecast (RSMC-ASDF) (TBD) |
| **Key Regional Player** | China, Japan, Republic of Korea |
| **Partners / Participants** | Countries in SDS-WAS Asia Node (China, Japan, Kazakhstan, Republic of Korea and Mongolia) |

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|---|---|
| **Funding Source(s)** | This project will rely on existing budget allocations at the national level. |
| **Overall Costs** | (TBD) |
| **Timescale** | 2013–2015 |
| **Expected Key Deliverables / Key responsible body** | The systematic NRT monitoring of sand and dust storm in SDS-WAS Asia Node |
| **Main risk(s)** | Lack of resources (funds/expertise) |
| **Website** | SDS-WAS Asia Node portal |
| **Summary** | Improvement of sand and dust storms monitoring in the SDS-WAS Asia Node |
| **Date of the update** | 12 November 2012 |
| **Contact Person 1** | Mr. ZHOU Qingliang<br>National Meteorological Center<br>China Meteorological Administration (CMA)<br>China<br>Tel.: +86 10 68406184<br>Fax: +86 10 68408454<br>E-mail: zhouql@cma.gov.cn |
| **Contact Person 1** | Mr Hiroshi Koide<br>Senior Coordinator for Global Atmosphere Watch<br>Atmospheric Environment Division<br>Global Environment and Marine Department<br>Japan Meteorological Agency (JMA)<br>Japan<br>Tel.: +81-3-3287-3439<br>Fax: +81-3-3211-4640<br>E-mail: hkoide@met.kishou.go.jp |
| **Contact Person 1** | Dr Youngsin Chin<br>Korea Meteorological Administration (KMA)<br>Republic of Korea<br>Tel.: +82 70 7850 6752<br>Fax: +82 2 831 4930<br>E-mail: hwangsa@korea.kr |

**Project No. VI**

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|---|---|
| **Project Title** | **RA II WIGOS Project to Develop Support for NMHSs in Satellite Data, Products and Training** |
| **Type** | Regional Implementation Project (RA II) |
| **Status** | Draft Design |
| **Overview** | At its fourteenth session (December 2008), Regional Association II adopted a resolution to establish a pilot project for the development of support for National Meteorological and Hydrological Services (NMHSs) in the areas of satellite data, products and training. The Coordinating Group of the Pilot Project is composed of Japan (Co-coordinator); Republic of Korea (Co-coordinator); Bahrain; China; Hong Kong, China; India; Kyrgyzstan; Maldives; Oman; Pakistan; Russian Federation; Uzbekistan; Viet Nam and EUMETSAT (observer).<br><br>The object of this project is to encourage NMHSs in RA II to make a kind of self-help effort to improve the flow of satellite-derived information by:<br><br>● Identifying the requirements of NMHSs of developing countries, regarding satellite imagery, data and products, use the results to update the RRR user requirements database and to fine tune the EGOS-IP,<br>● Facilitating the timely provision of satellite-related information by satellite operators themselves to users via the project web page, newsletters, etc., and<br>● Aligning with VLab activities to optimize assistance to NMHSs in RA II and coordinating training activities on use of satellite data/products). |
| **Aim(s)** | ● To encourage NMHSs in RA II to make a kind of self-help effort to improve the flow of satellite-derived information,<br>● To improve the knowledge and techniques to use satellite data and products. |
| **Benefits** | NMHSs in RA II have benefited from this project to find means to access satellite data, products and training they want, and to improve the usage of satellite-derived information. This is expected to improve NMHSs' activities from nowcasting to climate and environment monitoring. |
| **Key Regional Player** | Japan, Republic of Korea and other satellite operators in RA II |
| **Capacity development requirements** | ● Assistance (or support) of WMO VLab activities and other regional training activities,<br>● Assistance of satellite operators,<br>● Liaison with EGOS-IP. |
| **Partners/Participants** | Members of the Coordination Group members: Japan (Co-coordinator); Republic of Korea (Co-coordinator); Bahrain; China; Hong Kong, China; India; Kyrgyzstan; Maldives; Oman; Pakistan; Russian Federation; Uzbekistan; Viet Nam, RA V (observer) and EUMETSAT (observer)<br><br>All other RA II Members can be nominated as the Group members. |

| | |
|---|---|
| **Relationship with existing project(s)** | (TBD) |
| **Funding Source(s)** | Regular activities of this project rely on existing budget allocations at the national level. Additional funding will be needed to hold the Coordination Group meetings and training events regularly. |
| **Overall Costs** | (TBD) |
| **Timescale** | 2012–2016 |
| **Expected Key Deliverables / Key responsible body** | • Reports on requirements of NMHSs regarding satellite imagery, data and products,<br>• Improvement on access to information on satellite data/products,<br>• Improvement on capacity in use of satellite data/products and facilitation of training datasets and toolboxes. |
| **Main risk(s)** | Lack of resources (funds/expertise) and lack of cooperation from Members |
| **Website** | The portal site of the project is operated on JMA's web server.<br>http://www.jma.go.jp/jma/indexe.html |
| **Summary** | The project will encourage NMHSs in RA II to make a kind of self-help effort to improve the flow of satellite-érelated information. |
| **Date of the update** | 30 November 2015 |
| **Contact Person 1** | Mr Takeshi Otomo<br>Senior Coordinator for Satellite Systems<br>Satellite Program Division, Observation Department<br>Japan Meteorological Agency (JMA)<br>Japan<br>Tel: +81-3201-8677<br>Fax: +81-3217-1036<br>E-mail: ootomo@met.kishou.go.jp |
| **Contact Person 2** | Dr Dohyeong KIM<br>Senior Scientist<br>National Meteorological Satellite Center<br>Korea Meteorological Administration<br>Republic of Korea<br>Tel: +82-70-7850-5705<br>Fax: +82-43-717-0210<br>E-mail: dkim@kma.go.kr |

**ANNEX IV-4.2**

## Outcomes of EG-WIS-1

The first meeting of the Expert Group on the WMO Information System (WIS) in Regional Association II (RA II EG-WIS) was held from 25 to 27 November 2015 in Tokyo, Japan. The outcomes are summarized as follows.

(1) The meeting noted that the NMC Thimphu, Bhutan Department of Hydro-Meteorological Service (DHMS) connected to the GTS in July 2015 with support from RTH New Delhi, RTH Bangkok and JICA, and Thimphu has started receiving data/products from the GTS. Their observation data are being collected through EUMETSAT Data Collection Platform (DCP) and plan to distribute it over the GTS in BUFR format. The meeting agreed that the link RTH Bangkok and NMC Thimphu should be added in RMTN as a supplement regional circuit.

(2) Pakistan Meteorological Department (PMD) requested EG-WIS to remove the regional circuit between Karachi and Tashkent from RA II point-to-point Regional Meteorological Telecommunication Network. The current status of the link is NI (Not Implementation). The meeting recognized difficulties to deploy telecommunication infrastructure for the area and requested the Theme Leader on DCTS to confirm the intention of Tashkent about removing the circuit from RMTN.

(3) The meeting noted that EG-WIS organizes the RMTN status survey annually. The result of the survey is very helpful for understanding the status and progress of RA II RMTN. The meeting suggested that EG-WIS include the MSS/FSS status in the survey.

(4) The meeting reviewed implementation status from six GISCs and four DCPCs and identified things RA II need to do next. The meeting drafted a table to make the status visible.

(5) The meeting noted that Myanmar changed the location of NMC/NC from Yangon to Nay Pyi Taw. NMC Nay Pyi Taw connected to RTHs Bangkok and New Delhi and started GTS operation in 2013. The change has been reflected in the annual RMTN survey produced by EG-WIS and in the latest RMTN diagram. The meeting requested NMC/NC Nay Pyi Taw to confirm its “CCCC” used for WIS/GTS and report the change to WMO secretariat in proper procedures with the support of its RTH and principal GISC.

(6) The meeting reviewed implementation status of the TDCF migration in RA II and confirmed a progress since 15th RA-II (2012). The meeting confirmed the fact that we were still in the process of migration and encouraged Members to complete the migration. The meeting also reviewed the problems on upper-air BUFR converted from TAC (e.g. TEMP/PILOT series) and recognized the letter from the CBS president. The meeting agreed that RA II members should continue parallel distribution until the problem has been resolved. http://www.wmo.int/pages/prog/www/WIS/wiswiki/tiki-view_blog_post.php?postId=171

(7) The meeting recognized that RA II-15 requested to promote the recovery and digitization of old climate records which remain critical for climate change assessment and the development of climate services in the context of climate change adaptation and the GFCS as a matter of high priority. The meeting noted it is necessary to collaborate with RA II WG on Climate Services. The meeting asked the TL in Climate Data Management/Data Rescue to take actions on keeping under review and report CDMS and DARE project in the region.

(8) The meeting noted some Theme Leaders have been keeping a good communication with Volunteer Experts in their theme, and it built teamwork and stimulated the regional activities. The meeting encouraged all Theme Leaders to consider making collaboration and sharing the workload with Volunteer Experts.

(9) The meeting discussed utilizing communication tools among EG-WIS members. Normally, this face-to-face meeting is held once four years, and it’s not easy to have more frequently. The meeting noted that WMO provides communication service (don’t need any additional cost)

and CBS expert teams are using WebEx, WIS WIKI, Google group and so on. The meeting agreed to use these services to keep good communications and share the information.

(10) The meeting noted the RA II RMTN is operated by three major types of communication infrastructure: MPLS/VPLS, The Internet and leased circuit. The meeting noted that if the centers operate GTS over the Internet, centres have to carefully consider and understand the characteristics of Internet, in particular, the Internet security and best-effort service (actual link speed: bandwidth).

(11) The meeting reviewed RA II WIS Implementation Plan (R2-WIS-IP) Version 1.00 issued in December 2013. The meeting noted the Plan should be updated including progress since the first version has been issued. The meeting noted the IP has status and plan but status already reported in TL's annual report and needs to be restructured to avoid duplication. The co-coordinators of EG will propose a new structure of IP to the next RA II session

(12) The meeting recognized that WIS should support all Working Groups in RA II and related projects. The meeting agreed that the GISCs should support requirements of data exchange/sharing not only for WIGOS but also for other activities in RA II. The meeting requested particularly GISCs to support activities in its AMDCN in cooperation with other WGs.

(13) The meeting noted the importance of WIS monitoring for stable operation and continuous improvement of WIS services. The meeting noted that GISCs Beijing, Seoul and Tokyo have participated in the WIS monitoring pilot project which is organized by TT-GISC, and reviewed the pilot dashboards developed by GISCs Beijing and Tokyo. The meeting encouraged all the operational GISCs to consider the implementation of WIS monitoring and start providing JSON files as soon as possible.

(14) The meeting reviewed the progress of Application Pilot Project (PP-App). The coordinator of PP-App proposed adding WIS monitoring as a new item for the PP-App. The meeting agreed to continuously support the project and proposal continuing support the PP-App. The meeting noted that issuing newsletters (since 2013, twice a year) is a good way to stimulate the project, but all the newsletters were published by only JMA so far. The meeting proposed all participants of the project to contribute issuing newsletters.

(15) The meeting noted that continuing participation in of the Expert Group would be efficient and effective to achieve deliverables. The meeting invited TLs to be nominated as a member of the group in the next period of RA II (2016-2019).

# WORLD METEOROLOGICAL ORGANIZATION

# REGIONAL ASSOCIATION II (ASIA)

# WIS Implementation Plan

## DRAFT

(Version 1.10 1st December 2015)

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Appendix V: List of acronyms

# 1. EXECUTIVE SUMMARY

The XV Session of RA II (Doha, 2012) was pleased with the progress of WIS Implementation in the Region noting that GISCs Beijing and Tokyo have been operational since August 2011. It noted that GISC Seoul had also been successfully audited by CBS and that it will become operational in early 2013. GISCs Jeddah, Moscow, and Tehran are preparing for their audits with an aim to beginning operations in 2013. Seven GISCs are expected to be directly supporting RA II by the end of 2013. The Association expressed its appreciation to GISCs Beijing and Tokyo for providing WMO Interim Metadata Management Services (WIMMS[4,5]) to support those WIS centres that do not yet have access to an operational GISC. It further noted that GISC Seoul will be able to provide WIMMS starting from early 2013. The Association noted the important role of GISCs in ensuring effective exchange of information between Members, and encouraged Members to work with GISCs on network and data management issues and to participate in the WIS Application Pilot Project in Regions II and V (former WIS VPN Pilot Project) focusing on pragmatic applications providing benefits from GISC services via internet.

Since the beginning of the year 2012, the RA II WIS Implementation Plan has been developed and discussed in meetings with the relevant bodies in RA II. In addition, the WMO Secretariat was involved in many aspects of the evolving plan.

The plan is based on WMO regulatory material, in particular the WMO Technical Regulation, Volume I, Section A3 (WMO No. 49[6]), the Manual on the WIS (WMO No. 1060[7]) and the Guide to the WIS (WMO No. 1061[8]). The plan focuses on the Members of RA II to set up National Centres (NC) connected to one of the seven designated Global Information System Centres (GISC) in the Region. Plans of RA II Members to establish Data Collection or Production Centres (DCPC) are presented briefly. Their implementation is not covered in detail by this document, because implementation procedures for DCPCs are covered by the Manual on WIS and WIS Demonstration Process "Procedures and Guidelines,"[9]

After describing the features of WIS and highlighting the benefits for Members to be connected to WIS, the current status of WIS in RA II and the telecommunication network used for meteorological data and products are delineated. The role of WIS core network, which is implemented via RA-VI RMDCN (Regional Meteorological Data Communications Network[10] ), is highlighted, in particular in view of its ability to support WIS structures by allowing any-to-any connectivity. The list of countries in RA II together with their principal GISC (arranged in 15th session of RA-II, Qatar Doha, December 2012) provides an overview of the structure of WIS after its regional implementation. The steps an NMHS has to take to become a WIS NC are described in detail. The initial steps to establish a DCPC are mentioned as well, in particular, for the existing RTHs, which as components of the GTS still have crucial roles to play, including providing GTS connectivity to centres not on the RMDCN. Sample step-by-step implementation approaches for these two cases are provided in the Appendices.

Furthermore, risks for the success of the plan are assessed together with possible remedies. The future activities to implement the plan are listed with the goal that most of the RA II Members will be WIS enabled by the end of 2013 to 2014.

Finally, the responsibilities of the GISCs and DCPCs in the WIS implementation monitoring are described with their importance for the successful implementation of the plan. The participation and cooperation of the national WIS Focal Points is stressed.

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[4] GISC Beijing WIMMS http://wisportal.cma.gov.cn/wis/jsp/UserGuide/downloadFile.jsp?file=WIMMS_Service_in_GISC_Beijing.pdf

[5] GISC Tokyo WIMMS http://www.wis-jma.go.jp/cms/help-desk/user-guide/guide-to-maintenance-of-gts-metadata-at-giscwimms-tokyo/

[6] WMO-No. 49 Volume 1 - http://library.wmo.int/opac/index.php?lvl=notice_display&id=14073

[7] WMO-No. 1060 Manual on the WIS - http://library.wmo.int/opac/index.php?lvl=notice_display&id=9254

[8] WMO-No. 1061 Guide to the WIS - http://library.wmo.int/opac/index.php?lvl=notice_display&id=6856

[9] WIS Demonstration Process Guidelines - http://www-db.wmo.int/WIS/centres/guidance.doc

[10] Regional Meteorological Data Communications Network - http://www.ecmwf.int/en/computing/our-facilities/rmdcn

## 2. INTRODUCTION

The Fourteenth World Meteorological Congress (Cg-14) in 2003 noted that the current WMO information systems had been developed to meet a diverse set of requirements. The principal system was the GTS along with the related data management functions that had been developed to serve the WWW for the exchange of real-time high priority data. Other information systems had been developed to meet the needs of other programmes and commissions. Congress recognized that the multiplicity of systems operated for different programmes had, however, resulted in incompatibilities, inefficiencies, duplication of effort and higher overall costs for members. A further uncoordinated development would exacerbate those problems and would isolate the WMO programmes from the wider environmental community.

Congress supported the views and conclusions of CBS that an overarching approach was required a single coordinated global infrastructure. The solution was called Future WMO information system (FWIS) with the following features:

- FWIS would be used for the collection and sharing of information for all WMO and related international programmes.
- The information and communication responsibilities of existing WWW and other WMO Programme Centres could be mapped into the corresponding functions within the FWIS.
- FWIS would provide a flexible and extensible structure that would allow the participating centres to enhance their capabilities as their national and international responsibilities grew.
- The implementation of FWIS should build upon the most successful components of existing WMO information systems in an evolutionary process.
- FWIS should pay special attention to a smooth and coordinated transition.
- FWIS would build upon the GTS with respect to the requirements for highly reliable delivery of time-critical data and products, taking into account that information systems technology was evolving rapidly, and strengthening further the current trend of the current GTS development.
- FWIS should utilize international industry standards for protocols, hardware and software to allow exploitation of the wide range of modern data communication services, including the ubiquitous Internet and Web services.

The Fifteenth World Meteorological Congress (Cg-15) in 2007 recalled the Fourteenth Congress decision to establish an overarching WMO Information System (WIS) that would be used for the collection and sharing of information for all WMO and related international programmes. The name, Future WMO information system (FWIS), was transformed to WMO information system (WIS). Congress recognized the good progress that has been made in demonstrating the technological solutions for WIS through pilots and prototypes projects, but noted that much work remained to be done before an operational version of WIS could be realized.

Congress agreed that the WMO Information System should provide three fundamental types of services to meet the different requirements, as follows:

(a) Routine collection and dissemination service for time-critical and operation-critical data and products: The service was based on real-time “push” mechanism including multicast and broadcast; it would be implemented essentially through dedicated telecommunication means providing a guaranteed quality of service.

(b) Data discovery, access and retrieval service: The service was based on request/reply “pull” mechanism with relevant data management functions; it would be implemented essentially through the Internet.

(c) Timely delivery service for data and products: The service was based on delayed mode “push” mechanism; it would be implemented through a combination of dedicated telecommunication means and of public data-communication networks, especially the Internet.

Congress emphasized that the WIS implementation should build upon existing WMO information systems in a smooth and evolutionary process. It agreed that the WIS implementation plan had two parts that would be developed in parallel:

(a) Part A: the continued consolidation and further improvements of the GTS for time critical and operation-critical data, including its extension to meet operational requirements of WMO Programmes in addition to the World Weather Watch (including improved management of services);

(b) Part B: an extension of the information services through flexible data discovery, access and retrieval services to authorized users, as well as flexible timely delivery services.

The Sixteenth World Meteorological Congress (Cg-16) in 2011 noted with appreciation that the regional WIS training workshops successfully hosted by Japan and China provided practical information on the new information system to many Asian countries. Congress stressed the necessity of more capacity development projects for WIS National Centres in developing countries, and the promotion of the use of WIS, together with WIGOS. Congress felt that the area of responsibility of each RA II GISC should be officially agreed upon at the next session of RA II in 2012. However, to allow the Members of RA II to benefit from the new system before this, Congress encouraged RA II to initiate the coordination and consultations as a tentative solution so that each National Centre should be linked to a principal GISC and to a secondary GISC, taking into account the efficiency of options, the cost effectiveness for both NCs and GISCs, data distribution capacity of the GISCs, and the current structure of the GTS.

Congress noted that WIS has moved from a development stage into an operational stage and WIS activities in 2012–2015 should be:

(1) Complete WIS implementation across all WMO Centres.

Congress noted and supported the following major activities and implementation target dates, and urged all Members and the Secretary-General to identify the necessary resources for reaching the objectives:

(a) Improving the knowledge and capabilities of Members to benefit from WIS functionality, in particular least developed countries, developing countries and small island states through regional workshops and information sessions: 2012–2013.

(b) Implementation of WIS at all NMHS national centres (NCs): 2012–2015.

(c) Implementation of remaining candidate GISCs: 2012–2013.

(d) Implementation of more DCPCs, i.e. WIS interfaces at WMO Programmes' centres: 2012–2015.

(e) Amendments to the Manual on WIS for enhanced operational arrangements of WIS centres, especially GISCs: 2014.

Congress noted that the structure of GTS is evolving to a two-level network architecture, invited the regional associations to coordinate the definition of area of responsibility for each GISC, in particular their Area Meteorological Data Communication Network (AMDCN), taking advantage of the improved performance of data exchange enabled by new technologies. Regional associations should consult with CBS when reviewing AMDCNs, being mindful of potential cost impacts on the remainder of WIS.

(2) Capacity-building to ensure support of all WMO Members.

(3) Leverage WIS advantages for all WMO Programmes.

(4) Take advantage of WIS in all WMO Data Management.

The Fifteenth Session of Regional Association II (RA II: Asia) in December 2012 recalled that Cg-16 stated that WIS has moved from a development stage into an operational stage and that WIS activities in 2012–2015 should be. The Association noted that capacity-building has been given an effective start through the contributions of China, Japan and the Republic of Korea by running international workshops on WIS, and through the successful incorporation of WIS into telecommunication-related training workshops undertaken by Regional Training Centres in the Islamic Republic of Iran and Turkey. The Association noted

that a training workshop on the BUFR and WIS matters was held (26–30 November 2012, Moscow) for Russian speaking countries. It emphasized that all Regional Training Centres should consider ways to incorporate WIS, to improve current training programmes, improve the trainers' understanding of WIS, and to ensure that the principles of WIS data management are taken up in other WMO Programme activities. The Association noted the initiatives of CBS for developing training strategies and encouraged Members to monitor this activity and to take advantage of CBS guidance and initiatives on capacity-building.

The Association recognized substantial improvement in upgrading GTS links and progress on WIS implementation through operational services of GISCs Beijing and Tokyo and trial operations at four conditionally-designated GISCs in Seoul, New Delhi, Tehran and Jeddah, as well as the development of a WIS Implementation Plan for RA II by the Coordinator of the Sub Group on WIS from Japan and two dedicated (Local Secondment) experts from China and Republic of Korea.

The Association reviewed the draft RA II Regional WIS Implementation Plan and expressed its appreciation to China, Japan and the Republic of Korea for their contributions to development of the plan. It agreed that fully implementing WIS in the Region was an essential step toward the efficient implementation of WIGOS, GFCS and other priority areas. The Association noted the effectiveness of having a virtual WIS Implementation Project Office, utilizing local secondments in Beijing and Seoul. It encouraged other centres, especially GISCs, to provide similar resources towards completing the implementation of WIS in all centres in the Region. The Association noted the draft plan and agreed that the virtual WIS Implementation Project Office should continue to refine the plan and assist the RA II Management Group to guide Members through the implementation process. It agreed that the aim was to have WIS implemented in all RA II Members' centres by the Seventeenth World Meteorological Congress (Cg-17) in 2015 and that it was important to regularly review the progress of WIS implementation, with a major review in mid-2014 with an aim to accelerating WIS implementation for those centres which are not likely to meet the 2015 target.

In accordance with the agreement and user reviews of initial draft, a new Task Team on developing RA-II WIS Implementation Plan (R2-WIS-IP) was established. The members of Task Team were nominated by the WIS focal points from each GISC/GISC candidate and some DCPCs/NCs in RA II. Coordinating by the RA-II co-coordinators of Expert Group on WIS, the Task Team is comprised of eleven nominations from GISC/GISC candidate Beijing, Jeddah, New Delhi, Seoul, Tehran, Tokyo and DCPC/NC Bangkok, Doha and Karachi.

In addition to capacity-building activities in RA-II, this RA-II WIS Implementation Plan (R2-WIS-IP) incorporating with Manual on WIS and WIS Demonstration Guidelines is a set of reference documents for RA II members at national and regional level to follow in order to achieve all objectives and requirements of WMO information system (WIS).

## 3. SCOPE AND PURPOSE OF THE RA II WIS IMPLEMENTATION PLAN

For the effective and efficient WIS system, the WIS implementation has three layers/criteria of scope: global, regional, national. The global WIS Project and Implementation Plan have been developed by WMO secretariat and provided task area or activities in global aspect. This plan is available online (WIS Project and Implementation Plan v1.2.1, August 2010[11] . The national plans will be focused on the identification and registration of relevant centres by each Member and partner international organizations, as well as on the capacity development for meeting the WIS requirements, defined in the related WMO technical regulations, and for making the full use of the WIS functionalities.

The regional plan ensures a harmonized and synchronous implementation by all regional members as well as inter-regional project. The RA II WIS implementation plan is based on guidelines, requirements and tasks. In particular, this plan includes:

- Functional Architecture;
- Status of WIS in RA II;
- Technical compliance Specification of the GISC, DCPC and NC;
- Governance Procedures for implement of WIS centres;
- Execution and timelines.

The purpose of the RII WIS Implementation Plan is to provide:

a) RA II members with overall technical guidance, assistance and support for the implementation of the WIS, which would coordinate the implementation of WIS including further improvement of GTS and optimize and achieve maximum compliance. In view of the foregoing, the RA II WIS Implementation Plan is aimed at assisting RA II Members to implement WIS functionality in their identified centres and become effective WIS users in a timely and harmonized manner. Therefore, it concentrates on the access to WIS by NMHSs as National Centres (NC). The requirements and procedures for other types of centres, like Global Information System Centres (GISC) or Data Production or Collection Centres (DCPC), are described in detail in the Manual on WIS (Manual on the WMO Information System [WMO-No. 1060]) and WIS Demonstration Guidelines, and therefore only briefly mentioned in this paper. However, in implementing and supporting WIS in RA II and monitoring its performance, GISCs will have to take on certain responsibilities described below. Information about the implementation of GISCs and DCPCs by RA II Members and international organizations is included in the Plan monitoring process in order to provide “one stop shop” with regard to the overall WIS implementation in Region II (Asia).

b) Strategic approaches to effective and efficient capacity building highlight some key issues on technical implementation and designation requirement for WIS centres. The Plan also provides practical guidance and a step-by-step approach towards the WIS implementation by Members in their National Centres. A primary task for the NMHSs is ensuring compliance with the WIS requirements established by the WMO regulatory material WMO Technical Regulations, Volume I (WNO-No. 49) and its Annex VII, Manual on the WMO Information System (WMO-No. 1060). In order to facilitate the implementation process, the GISCs should establish close contacts with the NCs in their areas of responsibility and act as “help desks” when assistance is needed. In particular, GISCs should plan for providing assistance to build the capacity of the NCs to handle the required discovery metadata.

[11] WIS Project and Implementation Plan (2010) - http://www.wmo.int/pages/prog/www/WIS/documents/WIS-ProjectPlan-v1-2-1.doc

## 4. DESCRIPTION OF WIS

WIS (WMO Information System) is the global infrastructure for data management and making it available to access weather, water and climate information. WIS provides an integrated approach to meet the requirements for routine collection and automated dissemination of observed data and products, as well as data discovery, access and retrieval services for all weather, climate, water and related data produced by centres and member countries in the framework of any WMO programme.

### 4.1 WIS Services

Since the WMO was founded, timely data exchange has been crucial. Like early telegraph and telephone systems, operators would route data messages over dedicated lines using systems dedicated to WMO. This is the WMO Global Telecommunication System (GTS). Now WMO is taking a step beyond managing data messages. WIS builds on and extends the GTS, and it is also a new approach to data discovery and data provision in the meteorological community. WIS goes far beyond providing telecommunication services, and offers new and modern data management services to its users. These are essentially the possibility to discover all data and products of the wider WMO community, as well as the means and information on how to obtain the data. For this purpose, all information within WIS is described by discovery metadata in accordance to the WMO Metadata Core Profile as described in Part V of the Manual on the WIS and its associated Appendix C. It is assumed that WIS by including the GTS and the Internet will have sufficient bandwidth/link capacity available to fulfil future user needs. To this end, in 2007, the WMO Congress stated that WIS is to provide three types of services:

- Routine collection and dissemination service: for time-critical and operation-critical data and products based on real-time “push” via dedicated telecommunication
- Data Discovery, Access and Retrieval service: based on request/reply “pull” via Internet
- Timely delivery service for data and products: based on delayed mode “push” via combination of dedicated and public networks

### 4.2 The structure of WIS

WMO Member countries will implement and operate WIS, using existing centres with some additional or modified capabilities. In operational terms, WIS encompasses three types of centres as well as the WIS data communication network.

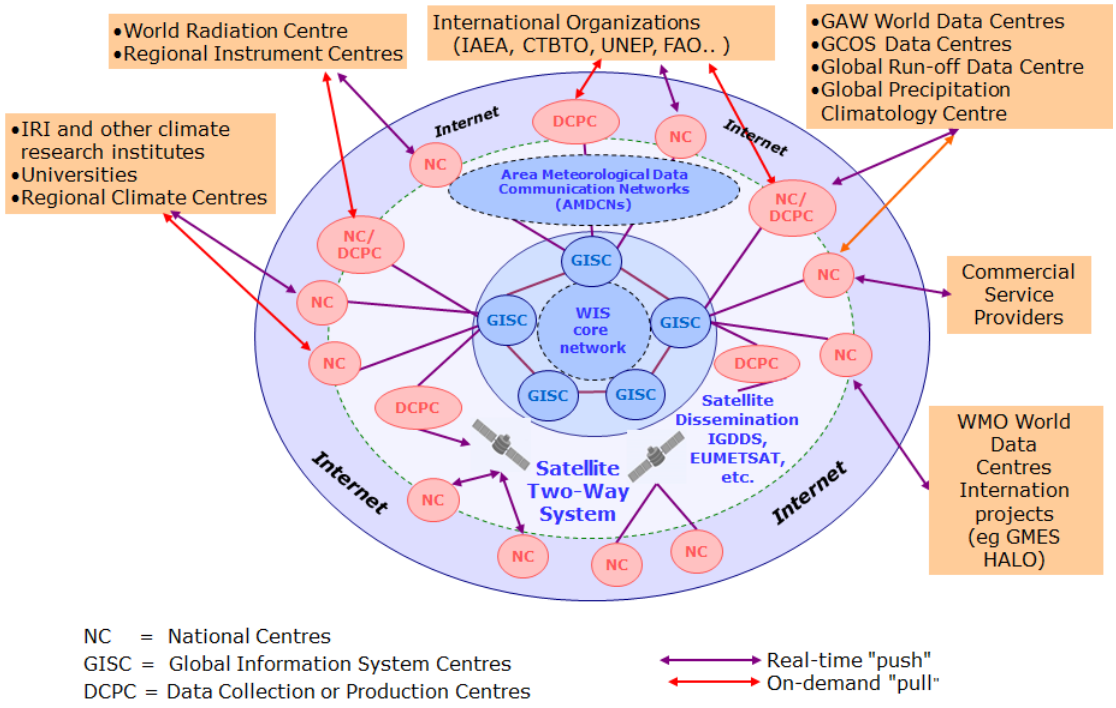
- Global Information System Centres (GISCs),
- Data Collection or Production Centres (DCPCs) and
- National Centre (NCs)
- Data networks

### 4.3 WIS Centres

**GISCs** collect and distribute information for routine global dissemination, such as GTS data. **GISCs** hold and distribute copies of at least 24 hours of WMO data and products intended for global distribution. They serve as collection and distribution centres in their areas of responsibility and they provide access points for any request for data held within the WIS. A WIS user accessing the web portal of any GISC will be able to browse any data catalogue of information available in WIS.

**DCPCs** collect, disseminate, add value to, and archive regional or programme-specific data and products. DCPCs maintain catalogues of their holdings and services, and appropriate parts of these catalogues update a comprehensive catalogue of WIS holdings, hosted by the GISCs.

**NCs** collect and distribute data on a national basis and coordinate or authorize the use of the WIS by national users, normally under a policy established by the respective Permanent Representative with WMO.

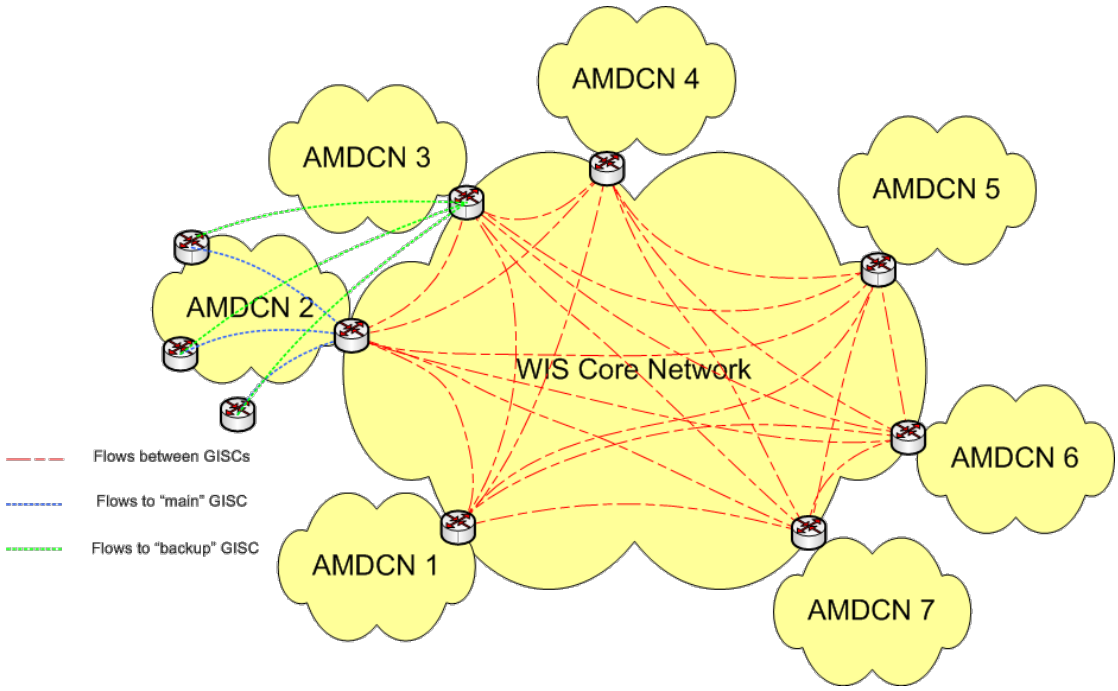



### 4.4 WIS data networks

The WIS network structure consists of a WIS Core Network connecting all GISCs to each other. The WIS real-time network would be composed of a number of Area Meteorological Data Communication Networks (AMDCNs) and a WIS core network interconnecting the GISCs and AMDCNs together. An NC or DCPC may be in multiple AMDCNs. The AMDCNs incorporate GTS infrastructure and may involve single, partial or multiple regional meteorological telecommunication networks.

The data communication networks that can be used in WIS include:

- The GTS Main Telecommunications Network (MTN) was significantly modified by the Improved MTN (IMTN) project that started at ET-IMTN meeting in Sep/Oct 1999. Its implementation has progressed in technical evolution process as the configuration of two clouds (i.e. Network I & Network II) until Sep 2009. By the end of 2009, all links via Network I have migrated to via Network II. CBS noted the completion of the IMTN Project at its 2010 Extraordinary Session in Namibia with the MTN operating on a single coordinated MPLS cloud based on the RMDCN.
- GISCs are also connected by the Internet, which presently is being used for discovery metadata synchronization.
- The GTS (MTN and RMTN) provides the dedicated network component of the AMDCNs, especially for meeting real-time exchange requirements and the all hazards network. Note that the GTS includes extensive use of Internet through Virtual Private Networks (VPN) in many areas where no alternatives exist.
- Satellite distribution and collection systems such as those described by the Integrated Global Data Dissemination Service (IGDDS) form an essential part of the GTS and therefore the WIS, especially for the support of remote areas where terrestrial communication systems do not effectively meet the need. This includes data collection systems for remote platforms as well as for distribution of data and products related to the WMO Space Programme.
- Terrestrial links or managed data network services.
- The Internet, either open or utilizing VPN, which will be used in the AMDCNs to increase bandwidth capacity to many centres as well as providing connectivity for non-GTS centres and for individual users accessing WIS.




### 4.5 Benefits of WIS:

As an integral part of WIS from the World Weather Watch Programme (WWW), the aim of the GTS is to ensure delivery of time-critical and operation-critical data, products and services for all WMO Programmes, including warnings to and from NMHSs. GTS realizes this through the "Routine collection and dissemination service for time-critical and operation-critical data and products".

Some benefits of WIS are as follows:

- WIS enhances the collection of critical data needed to monitor and predict aspects of the environment, including hazards;
- WIS catalogs the full range of data and products, simplifying search and assuring equitable access per WMO policies;
- WIS enhances the availability of time-critical data and products at centres in all nations, ensuring the effective provision of services to their populations and economies;
- WIS opens up WMO's private network (the GTS) to other types of environmental data so that all programmes have stronger infrastructure support; and

WIS exploits opportunities as they become available with technology innovation.

Existing centres within WMO Member States that comply with the required WIS functions and technical specifications will be designated as one of the three types of WIS centre. While Members can chose to apply for a type of centre matching their level of responsibilities and commitment, the expected mapping of current WWW centres into WIS centres remains to be:

| WWW Centre | WIS Centre |
|---|---|
| NMC | NC |
| RSMC | DCPC |
| WMC | DCPC and/or GISC |
| RTH | DCPC |
| RTH on MTN | DCPC and/or GISC |
| Others | NC and/or DCPC |

### 4.6 WMO information sources and regulations on WIS

Information on all aspects of WIS is available on the WMO website at: http://www.wmo.int/wis.

The implementation of the WIS is coordinated through a Global Project and Implementation Plan available at:
http://www.wmo.int/pages/prog/www/WIS/documents/WIS-ProjectPlan-v1-2-1.doc.

The technical regulations related to WIS are published in the WMO Technical Regulations (WMO-No.49), Volume 1, General Meteorological Standards and Recommended Practices, Part A3, and in Annex VII, Manual on WIS (WMO-No.1060). Practical guidance on the implementation of the technical regulations is provided in the Guide to WIS (WMO-No. 1061).

## 5. WIS IN REGION II (ASIA)

### 5.1 Current status of RA II telecommunication

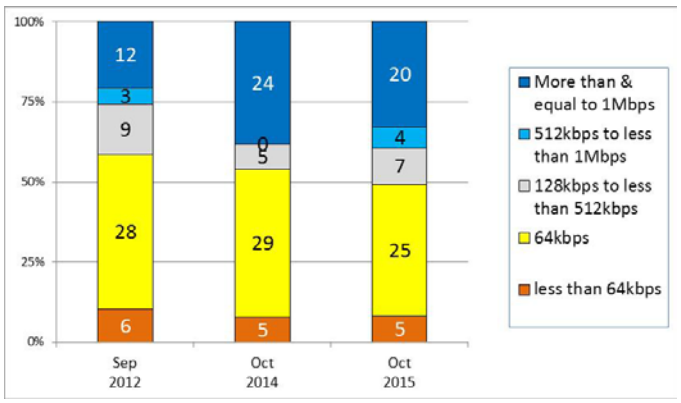
The Regional Meteorological Telecommunication Network (RMTN) is the communications and data management component that operates through the collection and distribution of the information critical to NMHSs operations. RMTN is also accompanied by very developed data management practices. These facilitate the orderly and efficient overall management of meteorological data and products of the World Weather Watch programme.

In the operation of WIS, the communication links enable the routine collection and dissemination of time-critical and operation-critical data and products. These, and the timely delivery of all other data and products, are the lifeblood of WMO activities. Communications links of WIS will be a core network connecting GISCs, (the GTS Main Telecommunication Network (MTN)) plus a number of communication networks connecting the various GISCs to DCPCs and NCs within each GISC's area of responsibility. This Area Meteorological Data Networks (AMDCN) will include technologies such as the GTS, Internet and satellite broadcast systems.

An overview of RMTN is given below.

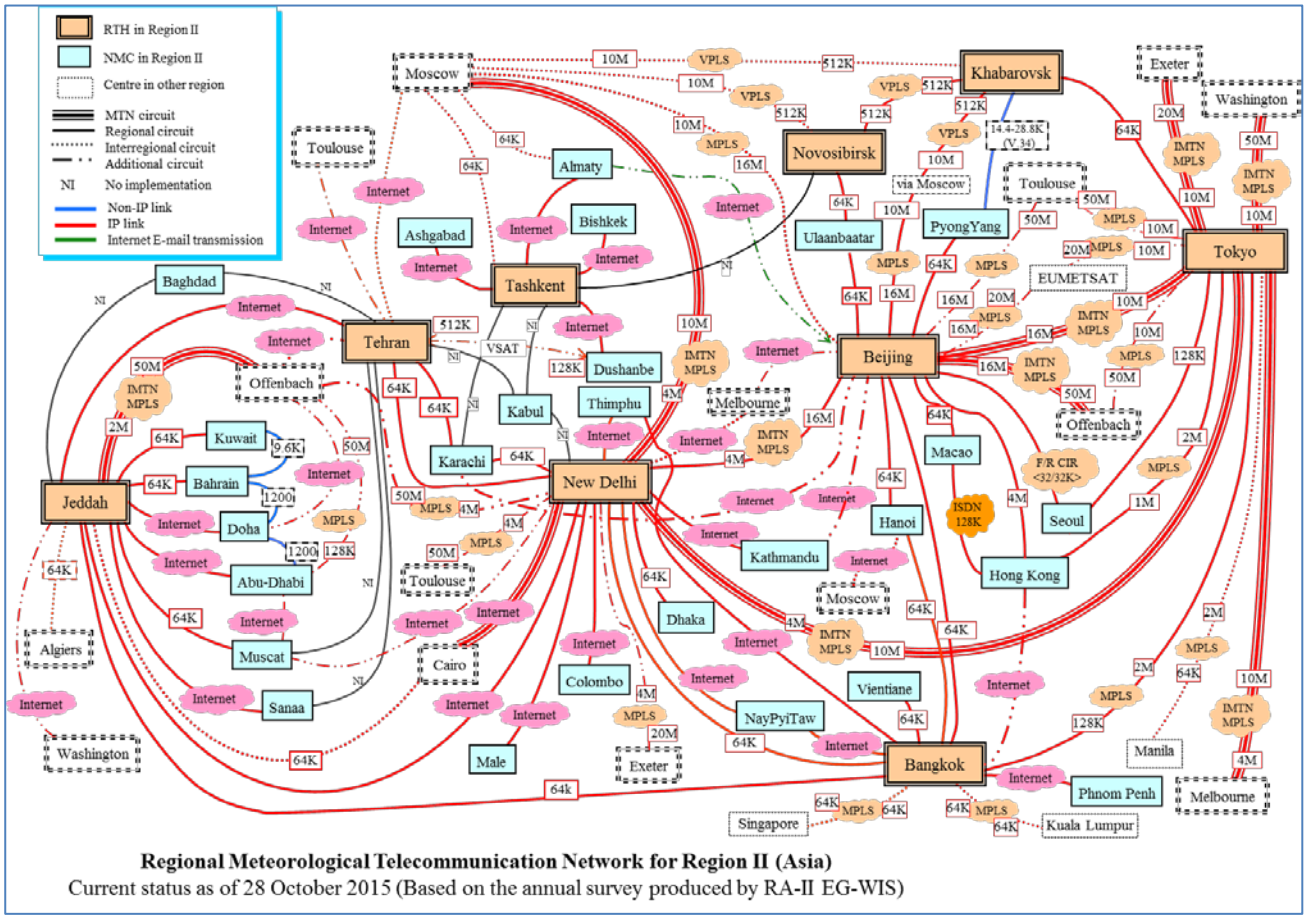
| | | Aug 2007 | Oct 2008 | Sep 2009 | Aug 2010 | Nov 2011 | Sep 2012 | Oct 2014 | Oct 2015 |
|---|---|---|---|---|---|---|---|---|---|
| The number of the circuits in operation | MTN circuits | 8 | 8 | 8 | 9 | 9 | 9 | 9 | 9 |
| | Regional circuits | 47 | 45 | 46 | 46 | 46 | 46 | 46 | 48 |
| | Interregional circuits | 12 | 12 | 13 | 13 | 13 | 13 | 13 | 13 |
| | Additional circuits | 10 | 10 | 11 | 12 | 12 | 13 | 20 | 20 |
| | Total | 77 | 75 | 78 | 80 | 80 | 81 | 88 | 90 |
| The number of the circuits not in operation | MTN circuits | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Regional circuits | 8 | 10 | 9 | 9 | 9 | 9 | 9 | 8 |
| | Interregional circuits | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Additional circuits | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Total | 11 | 13 | 11 | 11 | 11 | 11 | 11 | 10 |
| The number of circuits via the Internet | MTN circuits | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Regional circuits | 6 | 8 | 12 | 12 | 12 | 12 | 12 | 17 |
| | Interregional circuits | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Additional circuits | 7 | 7 | 7 | 7 | 7 | 8 | 10 | 10 |
| | Total | 14 | 16 | 22 | 22 | 22 | 23 | 25 | 31 |
| The number of IP-VPN circuits (MPLS VPLS) | MTN circuits | 5 | 5 | 5 | 8 | 8 | 8 | 8 | 8 |
| | Regional circuits | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 5 |
| | Interregional circuits | 1 | 1 | 4 | 4 | 4 | 4 | 4 | 6 |
| | Additional circuits | 2 | 2 | 3 | 4 | 4 | 4 | 9 | 9 |
| | Total | 10 | 10 | 16 | 20 | 20 | 20 | 25 | 28 |
| The number of circuits at each speed (exclude internet) | less than 64kbps | | | | | | 6 | 5 | 5 |
| | 64kbps | | | | | | 28 | 29 | 25 |
| | 128kbps - 511kbps | | | | | | 9 | 5 | 7 |
| | 512kbps - 999kbps | | | | | | 3 | 0 | 4 |
| | 1Mbps =< | | | | | | 12 | 24 | 20 |
| | Total | | | | | | 58 | 63 | 61 |
| Network type operation + non-operation | Internet | 14 | 16 | 22 | 22 | 22 | 23 | 25 | 31 |
| | Frame Relay | 9 | 9 | 3 | 1 | 1 | 1 | 1 | 1 |
| | MPLS, VPLS | 10 | 10 | 16 | 20 | 20 | 20 | 25 | 28 |
| | Leased Line, VSAT tec. | 44 | 40 | 37 | 37 | 37 | 37 | 37 | 30 |
| | Not in Operation | 11 | 13 | 11 | 11 | 11 | 11 | 11 | 10 |
| | Total | 88 | 88 | 89 | 91 | 91 | 92 | 99 | 100 |

Analysis of implementation status of RMTN depicts that




More than 90% circuits (bandwidth guarantee: total 60 links in 2015) are running at speed ≥ 64 kbps. For effective implementation of WIS, it was recommended in the Meeting of WMO RA II Working Group on WMO Integrated Observing System and WMO Information System (WG-IOS/WIS), Seoul, Republic of Korea, 30 November - 7 December 2011 that the circuits may be upgraded to 512 kbps because new sets of data like satellite and NWP products have significant contribution for operation critical activities and 512 kbps would help timely delivery of various sets of data to end users in minimal time.

However, at present only 40% of total circuits (bandwidth guarantee: total 60 links in 2015) operate at speed ≥ 512 kbps. Therefore there is a need to push NMHSs for upgrade of circuits. The number of circuits at each speed as of Oct 2015 (Revised categories since 2011)




Moreover, certain RMTN circuits like Karachi - Tashkent and Kabul -Tashkent are not logical networks and there is no chance of their revival in coming time. It would be appropriate to remind concerned NMHSs to either revive the linkages, implement Internet links or opt for their deletion from the network list. Pictorial representation of RMTN for RA II is appended above.

### 5.2 WIS centres in RA II

The procedures for the designation of the GISC, DCPC and NC of WIS centres are provided in the Manual on WIS (WMO No. 1060), Part II. After successful completion of the

designation procedure, the centre is included in Appendix B to the Manual, Approved WMO Information System Centres.

Note: Information on the current status of the designation of centres by Members is available on: http://www.wmo.int/pages/prog/www/WIS/centres/index_en.php.

At present, there are the three GISCs (Beijing, Tokyo, Seoul) in RA-II which are endorsed and are operational. The other three GISCs in RA II have been successfully audited by CBS are New Delhi, Tehran and Jeddah. GISC Moscow also services RA II. All are expected to become fully operational in near future.

| Member | Centre type | GTS Function | Principal GISC | Const. Body | Endorsement CBS | Congress/EC |
|---|---|---|---|---|---|---|
| China | GISC | RTH | Beijing | CBS | Endorsed by CBS | 2011/6/1 |
| India | GISC | RTH | New Delhi | CBS | Endorsed by CBS | 2011/6/1 |
| Iran, Islamic Republic of | GISC | RTH | Tehran | CBS | Endorsed by CBS | 2011/6/1 |
| Japan | GISC | RTH | Tokyo | CBS | Endorsed by CBS | 2011/6/1 |
| Republic of Korea | GISC | NMC | Seoul | CBS | Endorsed by CBS | 2011/6/1 |
| Saudi Arabia | GISC | RTH | Jeddah | CBS | Endorsed by CBS | 2011/6/1 |
| Russian Federation | GISC | WMC | Moscow | CBS | Endorsed by CBS | 2011/6/1 |

A list of links to the GISCs in RA II as follows:

- GISC Beijing : http://wisportal.cma.gov.cn/wis/
- GISC Tokyo : http://www.wis-jma.go.jp/
- GISC Seoul : http://gisc.kma.go.kr/
- GISC New Delhi : http://wis.imd.gov.in/MessirWIS/
- GISC Tehran : http://gisc.irimo.ir/
- GISC Jeddah : http://84.235.53.3:8080/MessirWIS
- GISC Moscow : http://portal.gisc-msk.wis.mecom.ru/

### 5.2.2 DCPCs

The table below provides information on the DCPCs that have been designated by the RA II Members with their planned functions.

| Member | Centre type | GTS Function | Principal GISC | WIMMS | Const. Body | Endorsement CBS | Congress /EC |
|---|---|---|---|---|---|---|---|
| China | DCPC | RTH | Beijing | | CBS | Endorsed by CBS | 2011/6/1 |
| China | DCPC | RSMC-Geographical (NMC) | Beijing | | CBS | Endorsed by CBS | 2011/6/1 |
| China | DCPC | RSMC-Activity-ATM (NMC) | Beijing | | CBS | Endorsed by CBS | 2011/6/1 |
| China | DCPC | RCC (Beijing NCC, - RA II) | Beijing | | CCl | Endorsed by CBS | 2011/6/1 |
| China | DCPC | NSMC | Beijing | | CBS | Endorsed by CBS | 2011/6/1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hong Kong, China | DCPC | WWIS | Beijing | Beijing | CBS | Endorsed by CBS | 2011/6/1 |
| India | DCPC | RTH | New Delhi | Tokyo | CBS | Under review by ET-GDDP | 2011/6/1 |
| India | DCPC | RSMC-Activity-TC | New Delhi | Tokyo | CBS | Under review by ET-GDDP | 2011/6/1 |
| Iran, Islamic Republic of | DCPC | RTH | Tehran | | CBS | Under review by ET-GDDP | 2011/6/1 |
| Japan | DCPC | WDC-GHG | Tokyo | | CAS | Endorsed by CBS | 2011/6/1 |
| Japan | DCPC | Satellite Centre | Tokyo | | CBS | Endorsed by CBS | 2011/6/1 |
| Japan | DCPC | RTH | Tokyo | | CBS | Endorsed by CBS | 2011/6/1 |
| Japan | DCPC | RSMC-Geographical | Tokyo | | CBS | Endorsed by CBS | 2011/6/1 |
| Japan | DCPC | RSMC-Activity-TC | Tokyo | | CBS | Endorsed by CBS | 2011/6/1 |
| Japan | DCPC | RSMC-Activity-ATM | Tokyo | | CBS | Endorsed by CBS | 2011/6/1 |
| Japan | DCPC | RCC (Tokyo NCC, RA II) | Tokyo | | CCl | Endorsed by CBS | 2011/6/1 |
| Japan | DCPC | GPC/LRF | Tokyo | | CBS | Endorsed by CBS | 2011/6/1 |
| Japan | DCPC | NICT (Space Weather) | Tokyo | | ICT-SW, (CAeM, CBS) | Endorsed by CBS | 2015/6/3 |
| Qatar | DCPC | Marine Meteorological Centre (MMC) | Jeddah | Tokyo | JCOMM | Endorsed by CBS | 2015/6/3 |
| Republic of Korea | DCPC | WAMIS | Seoul | | CAgM | Endorsed by CBS | 2011/6/1 |
| Republic of Korea | DCPC | NMSC | Seoul | | CBS | Endorsed by CBS | 2011/6/1 |
| Republic of Korea | DCPC | GPC / LC-LRFMME | Seoul | | CBS | Endorsed by CBS | 2011/6/1 |
| Russian Federation | DCPC | RTH/RSMC-Geographical (Novosibirsk) | Moscow | | CBS | Not submitted to ET-GDDP | 2011/6/1 |
| Russian Federation | DCPC | RTH/RSMC-Geographical (Khabarovsk) | Moscow | | CBS | Not submitted to ET-GDDP | 2011/6/1 |
| Saudi Arabia | DCPC | RTH | Jeddah | | CBS | Under review by ET-GDDP | 2011/6/1 |
| Saudi Arabia | DCPC | RSMC-Geographical (Jeddah) | Jeddah | | CBS | Not submitted to ET-GDDP | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Saudi Arabia | DCPC | RDMEC (Drought) | Jeddah | | CHy | Not submitted to ET-GDDP | |
| Thailand | DCPC | RTH | Tokyo | | CBS | Endorsed by CBS | 2015/6/3 |
| Uzbekistan | DCPC | RTH | Seoul | | CBS | Not submitted to ET-GDDP | |

### 5.2.3 NCs

In accordance with the Manual on WIS (WMO No. 1060), each WMO Member shall notify WMO of the name and location of its centre(s) that are to be designated as NC(s). It is therefore expected that each Member will have at least one NC in WIS (and for most of the Members, it is likely that one NC would be sufficient),

In February 2012, WMO circulated a letter to all Members inquiring information from the Permanent Representatives regarding: 1) nomination of a principle GISC which will be associated with the WIS centre(s) of the Member; and, 2) nomination of a focal point for WIS/GTS related matters).

The table below presents the current status of the designation of NCs in RA II with their principal GISC, WIMMS and Focal Point.

Note: The current status is based on the Resolution 5 of the Fifteenth session of Regional Association II (ASIA), Qatar Doha, December 2012.

| Member | NC | GTS Function | Principal GISC | WIMMS | Focal Point |
|---|---|---|---|---|---|
| Afghanistan | Kabul | NMC | Tehran | | Mr Mohammad Nasim Muradi<br>Afghan Meteorological Authority<br>Khwaga Rawash P.O. Box 425<br>KABUL<br>the Interim Administration of Afghanistan<br>Tel: 0093 (0) 700180705<br>Email: raket_nasim@yahoo.com |
| Bahrain | Manama | NMC | Jeddah | Beijing | Mr Nader Ahmed Abdulla<br>Bahrain Meteorological Service P.O. Box 586<br>BAHRAIN<br>Bahrain<br>Tel: +973 17321163<br>Fax: +973 17320630<br>Email: nader@caa.gov.bh |
| Bangladesh | Dhaka | NMC | New Delhi | Tokyo | Mr Abdul Matin<br>Bangladesh Meteorological Department<br>Meteorological Complex Abhawa Bhaban<br>Agargaon 1207<br>DHAKA<br>Bangladesh<br>Tel: +880-2-8116634<br>Fax: +880-2-9103908<br>Email: info@bmd.gov.bd ;<br>amatin2004@yahoo.com |

| | | | | | |
|---|---|---|---|---|---|
| Bhutan | Thimphu | NMC | New Delhi | | Mr Chimi Wangda<br>Council for Renewable Natural Resources Research, Ministry of Economic Affairs, Thimphu<br>Bhutan<br>Tel: 02 323703<br>Fax: 02 324 999<br>Email: chimwangs10@gmail.com |
| Cambodia | Phnom Penh | NMC | Tokyo | Tokyo | Ms Peou Phalla<br>Department of Meteorology<br>364, Preah Monivong Blvd, Chamkarmon<br>PHNOM PENH<br>Cambodia<br>Tel: +855-16-616-927<br>Fax: +855-23-213-490<br>Email: phallapeou1@gmail.com |
| China | Beijing | NMC | Beijing | | Ms Xiang Li<br>China Meteorological Administration<br>46 Zhongguancun Nandajie<br>BEIJING 100081<br>China<br>Tel: +86 10 6840 6275<br>Fax: +86 10 6218 6241<br>Email: lixiang@cma.gov.cn |
| Democratic People's Republic of Korea | Pyŏngyang | NMC | Beijing | | State Hydrometeorological Administration |
| Hong Kong, China | Hong Kong | NMC | Beijing | Beijing | Mr Lee Lap Shun<br>Hong Kong Observatory<br>134A Nathan Road<br>KOWLOON<br>Hong Kong, China<br>Tel: +852 2926 8416<br>Fax: +852 2311 9448<br>Email: lslee@hko.gov.hk |
| India | New Delhi | NMC | New Delhi | Tokyo | Dr L. R. Meena<br>India Meteorological Department<br>Mausam Bhavan Lodi Road<br>NEW DELHI 110003<br>India<br>Tel: 011 -2461 6051<br>Fax: 011- 2469 9216<br>Mobile: 91 - 98105 56531<br>Email: lr.meena@imd.gov.in; lrmeena@gmail.com |
| Iran, Islamic Republic of | Tehran | NMC | Tehran | Tokyo | Ms Farah Mohammadi<br>Islamic Republic of Iran Meteorological Organization<br>P.O. Box 13185-461<br>TEHRAN<br>the Islamic Republic of Iran<br>Tel: +989123842058<br>Fax: +982166070077<br>Mobile: +989123842058<br>Email: farahmohamadi@yahoo.com |

| | | | | | |
|---|---|---|---|---|---|
| Iraq | Baghdad | NMC | Tehran | | Mr Sallam S. Nadhim<br>Iraqi Meteorological Organization<br>Almansoor P.O. Box 6078<br>BAGHDAD<br>Iraq<br>Tel: +964 7702766948<br>Email: sallam_omery@yahoo.com |
| Japan | Tokyo | NMC | Tokyo | | Mr Kenji Tsunoda<br>Japan Meteorological Agency<br>Otemachi 1-3-4, Chiyoda-ku<br>TOKYO 100-8122<br>Japan<br>Tel: +81-3 3212 8341<br>Fax: +81-3 3211 8404<br>Email: tsunoda@met.kishou.go.jp |
| Kazakhstan | Almaty | NMC | Moscow | | B. S RAPIKOV<br>Kazhydromet<br>ul. Orynbor 11/1<br>010000 Astana<br>Kazakhstan<br>Tel: +8-7172-798399<br>Email: rapikov_b@kazhydromet.kz;<br>rapikov@gmail.com |
| Kuwait | Kuwait City | NMC | Jeddah | Tokyo | Mr Fahad Alnajadah<br>Department of Meteorology<br>P.O. Box 17<br>SAFAT 13001<br>Kuwait<br>Tel: +965 66808266<br>Fax: +965 24727326<br>Email: f.alnajadah@met.gov.kw |
| Kyrgyzstan | Bishkek | NMC | Moscow | | Dr Tatiana KOZHEVNIKOVA (Ms)<br>Main Hydrometeorological Administration<br>1, Karasuiskaya Street<br>GSP 720017 BISHKEK<br>Kyrgyz Republic<br>Tel: +(996 312) 314 605<br>Fax: +(996 312) 314 663<br>Email: usi@meteo.ktnet.kg |
| Lao People's Democratic Republic | Vientiane | NMC | Tokyo | Tokyo | Mr Singthong Pathoummady<br>Department of Meteorology and Hydrology<br>P.O. Box 811<br>VIENTIANE<br>Lao People's Democratic Republic<br>Tel: (+856) 21 21 5010<br>Fax: +856 21 223446<br>Mobile: (+856) 20 538 9651<br>Email: singthong_dmh@etllao.com;<br>p.singthong@yahoo.com |

| | | | | | |
|---|---|---|---|---|---|
| Macao, China | Macau | WSO | Beijing | | Mr Ian Vai Kei, Brian<br>Meteorological and Geophysical Bureau<br>Rampa do Observatório Taipa Grande<br>Caixa postal No.93<br>MACAU<br>Macao, China<br>Tel: +853 88986260<br>Fax: +853 28850557<br>Email: brianian@smg.gov.mo |
| Maldives | Malé | NMC | New Delhi | Tokyo | Mr Ali Shareef<br>Department of Meteorology<br>Orchid Building Orchid Magu<br>MALE 20-05<br>Maldives<br>Tel: +960 332 6200<br>Fax: +960 3320021<br>Mobile: +960 7771828<br>Email: admin@meteorology.gov.mv |
| Mongolia | Ulaanbaatar | NMC | Beijing | | Ms Davaasuren Tungalag<br>National Agency for Meteorology, Hydrology and Environment Monitoring<br>Khudaldaany Gudamj-5<br>ULAANBAATAR 46<br>Mongolia<br>Tel: +976-11-328 035<br>Fax: +976 11 329968<br>Email: tungalag@icc.mn/ tungalag@yahoo.com |
| Myanmar | Yangon | NMC | Tokyo | | Dr Hrin Nei Thiam<br>Department of Meteorology and Hydrology<br>Mayangon P.O. 11061<br>YANGON<br>Myanmar<br>Tel: 00 95 67 411031<br>Fax: 00 95 67 411449<br>Email: dg.dmh@mptmail.net.mm |
| Nepal | Kathmandu | NMC | Beijing | | Mr Kamal Prakash Budhathori<br>Department of Hydrology and Meteorology<br>G.P.O. Box 406 Babar Mahal<br>KATHMANDU<br>Nepal<br>Tel: +977 1 4255920<br>Fax: +977 1 4262348/ +977 1 4254890<br>Email: kp_budhathoki@yahoo.com |
| Oman | Muscat | NMC | Jeddah | Tokyo | Mr Ahmed H. Al Harthy<br>Department of Meteorology<br>P.O. Box 1, Code: 111 & P.O. Box 204, Code: 113<br>Muscat<br>Oman<br>Tel: +968-24-519360<br>Fax: +968-24-518360<br>Email: a.alharthy@met.gov.om |

| | | | | | |
|---|---|---|---|---|---|
| Pakistan | Karachi | NMC | Beijing | Beijing | Mr Azmat Hayat Khan<br>Pakistan Meteorological Department<br>Sector: H-8/2 P.O. Box 1214<br>ISLAMABAD<br>Pakistan<br>Tel: +92-51-9250598<br>Fax: +92-51-9250368<br>Email: dirndmc@gmail.com;<br>pakmet_islamabad@yahoo.com;<br>director@pmd.gov.pk |
| Qatar | Doha | NMC | Jeddah | Tokyo | Mr R. Monikumar<br>Qatar Meteorology Department<br>PostBoxNo.3000,<br>Doha,Qatar<br>Tel: 0097466812409<br>moni.kumar@caa.gov.qa<br>monikumar.r@gmail.com |
| Qatar | Doha | Aviation Centre | Jeddah | Tokyo | Mr R. Monikumar<br>Qatar Meteorology Department<br>PostBoxNo.3000,<br>Doha,Qatar<br>Tel: 0097466812409<br>moni.kumar@caa.gov.qa<br>monikumar.r@gmail.com |
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## 6. WIS PLANNING AND IMPLEMENTATION BY RA II MEMBERS

EC-65 confirmed all NMHS's National Meteorological Centres under the World Weather Watch as National Centres. See Resolution 13 (EC-65). In planning the WIS implementation at national level, Members should strive to comply with the relevant WMO technical regulations, that include procedures, specifications and functional requirements, provided in the WMO Technical Regulations (WMO-No. 49[12]), Volume I, Part A3, and the Manual on WIS, (WMO-No. 1060[13]). The Guide to WIS (WMO-No. 1061[14]) complements the technical regulations with additional description and explanation of the WIS, which would assist Members in their implementation actions.

### 6.1 Pre-requisites for use of WIS by an NMHS

Each WMO RA II Member must implement at least one NC; NMHS shall bring about an internal decision to join WIS in RA II. For an NMHS, there are several requirements to be met by a current GTS centre before it can start using WIS and thus become a compliant NC. They are mostly concerned with administrative issues and less with technical matters.

#### 6.1.1 WIS Focal Points

When a centre plans to use WIS, the PR of the country should nominate a "WIS Focal Point". The WIS Focal Point should be a member of staff who is familiar with the service, in particular the current GTS support. The person will receive all WIS related information with regard to the country on one hand, but is expected on the other hand to inform WMO and its relevant bodies about any progress or problems encountered when using WIS. He/she will attend training courses organized by WMO or WIS centres and serve as the national distributor of WIS knowledge, in particular metadata concepts. It is envisaged that the WIS Focal Point will provide the necessary monitoring information.

Since the structure of WIS assumes that an NC is connected to a GISC for its WIS functions and thus participates in the AMDCN organized by that GISC, it is necessary to set up the required administrative links with the GISC. In principle, an NC may belong to the users of any GISC, unless the network connectivity only allows one choice. In any case, an agreement should be reached between the NC and the GISC about their relationship, including identifying their "Principal GISC" for the purposes of managing discovery metadata, of which the WMO should be notified together with the nomination of the WIS Focal Point (see Appendix III).

#### 6.1.2 Principle GISC

Records of the list of NCs and their Principal GISC are maintained in Annex B Table 3 of the Manual on the WIS (WMO No 1060). The principal GISC will ensure within its AMDCN that all connected centres will receive all the data meant for them, be it globally distributed, additional or addressed data. It will also receive the data sent by them and distribute it in accordance with the distribution lists in either GTS or other formats, using the WIS data transfer options. It will maintain the WIS comprehensive metadata catalogue and provide means for its AMDCN centres to update those parts of the discovery metadata catalogue describing their data and products, possibly via Internet access.

The principal GISC is the organization to be contacted first by any of its connected centres about any issue related to WIS. It will organize regular meetings with the WIS Focal Points of the centres belonging to its AMDCN and provide training material and courses as required. It will support the metadata activities in its area of responsibility in a suitable manner and provide data for the regional WIS monitoring.

Besides the principal, associated backup GISC is required for operational continuity in case the principal GISC is not available for some reason. Each GISC shall identify a back up GISC for supporting centres in its AMDCN. The GISC will maintain business continuity plans and handover arrangements to ensure continued service to centres, especially for the collection and distribution of data and products.

[12] WMO No. 49 Volume 1 - http://library.wmo.int/opac/index.php?lvl=notice_display&id=14073
[13] WMO No 1060 Manual on the WIS - http://library.wmo.int/opac/index.php?lvl=notice_display&id=9254
[14] WMO No 1061 Guide to the WIS - http://library.wmo.int/opac/index.php?lvl=notice_display&id=6856

### 6.1.3 Backup and Associated GISCs

To guarantee at least the dissemination and collection of the globally distributed GTS data set, a communication connection has to be established with back-up GISC(s),. It should be chosen in collaboration with the principal GISC. Agreement needs to be reached on the network specific details. Regular tests should be carried out to ensure the availability of the back-up when suddenly required. Details of further back-up arrangements to be provided still need further work by the relevant CBS WIS expert teams. The choice of the principal, backup and associated GISC(s) may be influenced by the network "connectivity".

Although a centre can have only one GISC (and its backup) for the purposes of metadata management, any centre can have multiple associations with other GISCs for access to their services. Records of associated GISCs are maintained by the secretariat and available online at http://www.wmo.int/pages/prog/www/WIS/centres/index_en.php.

### 6.1.4 Connectivity

All the operational GISCs should establish their AMDCN (Area Meteorological Data Communication Networks) using the current RMTN connections as soon as they can. Taking into account the current structure of the RMTN, all the GISCs in RA-II should support at least four communication infrastructures, which are "dedicated leased line", "MPLS VPN", "satellite broadcast systems" and "Internet". This will be a fast way to establish an AMDCN and accelerate WIS implementation. In RA II, NMHS should set up a communication link to the principle GISC via AMDCN. Most NMHSs are connected to the Internet and can use this medium for less critical interactive access and file transfers. Although the Manual on WIS allows any country to any GISC regardless of Region, for RA II, if a country belongs to the RMDCN cloud, it may choose any RA II GISC or Moscow as its principal GISC, because all the GISCs in RA II would be connected to the RMDCN and this network allows any-to-any connectivity. If, however, only a dedicated link to an adjacent centre exists, a GTS RTH scenario, then the principal GISCs of these two centres should be the same to avoid unnecessary complications in traffic routing. The RTH in this context will act as a gateway between the principal GISC and the NC. Similarly, an NC or DCPC in a Member that is not the NMHS and not connected to the RMTN, can use its NMHS NC as the connection to the RMTN, or use the Internet to connect to the GISC.

### 6.1.5 Bandwidth

In contrast to the GTS where the dedicated network bandwidth between adjacent centres was limited and thus the traffic between any two centres had to be prioritized in advance, the WIS approach allows for the use of the Internet and allows for the combined the bandwidth of the Internet, satellite broadcast systems and dedicated network to be sufficient to support the intended data exchange between the GISC and the NC. As long as the data to be transmitted consists of only the globally distributed and additional data sets, a dedicated bandwidth of 64 kbps seems to be the minimum for RA II. If, however, specialized data sets like satellite or radar data are being considered, bandwidths in excess of 128 Kbps may have to be implemented. Depending on the local situation, it may be necessary to continue using GTS type dissemination until the network bandwidth, either RMDCN or Internet if appropriate, is sufficient for the intended use.

The major difference in the GTS before and after WIS is the need for discovery metadata records held by the GISCs for each data item being exchanged on the GTS. This is because WIS is an information based system and not only a communication system.

### 6.1.6 DAR Metadata

Whereas the GTS data is defined by its header or file name which is recorded in the relevant volumes, held by WMO, the data in WIS is described by a discovery metadata record in accordance to the WMO Metadata Core Profile and is stored in a metadata catalogue for each GISC and shared amongst all GISCs at regular intervals. It is the responsibility of the data owner to generate the corresponding discovery metadata record and to maintain it. However, in order to facilitate the initial deployment of WIS, Météo France generated metadata records for all data currently exchanged via the GTS. In the longer term though, these initial records have to be taken over by the relevant data owners and updated as required. In addition, if any new data is being considered for exchange, a corresponding discovery metadata record has to be generated and sent to the principal GISC in advance of the data. If

the data is to circulate on the GTS, relevant WMO publications (WMO No 9, Volume C1) also need to be updated by the receiving RTH or principal GISC if not coming through an RTH.

Each NC, therefore, requires personnel with metadata knowledge and responsibility. To train the staff of NCs in discovery metadata handling, their principal GISC will offer regular training courses in addition to WMO sponsored training events like the WMO WIS Centre Jump-Start Offer (WIS Jump Start [http://www.wmo.int/pages/prog/www/WIS/documents/JumpStartFlyer.doc]). Each NC should make sure that at least two staff are knowledgeable about the WMO Metadata Core Profile and are able to update its metadata records. RTH staff also need to be trained in metadata requirements and management.

### 6.1.7 Access to metadata editor

Each NC should decide whether the metadata editor should be supported locally or remotely by the GISC (WIMMS at the early stage). In view of this decision, the necessary software environment should be set up: either by installing the editor on a local server or by setting up an Internet connection to the GISC for the editing. Each NC should make registration and apply for the metadata management authorization to its principal GISC. Verify the metadata information from the URLs and update then appropriate in cooperation with its principal GISC. If an NC is willing to maintain its own metadata, it could have its own system installed for metadata functions. If the metadata is maintained in the GISC or DCPC (RTH), this can be arranged by creating a user registration at the GISC or DCPC and by maintaining the NCs metadata there.

### 6.1.8 Designation of National Centres

Each RA II member shall notify WMO of the current name and location of each of its centres that is to be designated as a National Centre in WIS. The NCs designated by members will then be registered in the WIS section of the WMO Country Profile Data Base (see 8.5). Compliance with WIS will be demonstrated by the successful completion of the test cases provided in Attachment IV of this document.

## 6.2 Pre-requisites for use of WIS by other centres

There may be other WIS centres besides the NC of an NMHS within a country. For example, the NMHS might also operate one or more DCPCs for specialized data or there may be multiple NCs run by different organizations like hydrology and oceanographic centres.

### 6.2.1 DCPC

As stated earlier, a DCPC provides Programme-specific data for WIS, e.g. GTS data as an RTH. Therefore, it has to be sponsored by a WMO Programme and connected to a GISC in the region with sufficient bandwidth. In addition, special software to support the planned operation of a DCPC has to be installed at the centre. Once this has been achieved, the relevant PR or Director of the Organization may submit a proposal to WMO for the DCPC to be accepted, nominating a staff member responsible and stating the commitment to operate the DCPC after its validation.

In accordance with the Manual on WIS, a number of certifications and tests will subsequently be carried out by WMO and, in particular, the CBS expert team designated for this role. When all operational and administrative requirements have been met successfully, CBS will propose to the EC that the DCPC becomes part of WIS. Of course, the staff of the DCPC will in the meantime have gained sufficient knowledge of the special software and the WMO Metadata Core Profile to support the activities of the centre's new WIS functionality.

### 6.2.2 NC

Any NC additional to that of the NMHS will have to adhere to the same procedures as stated above. Its WIS centre Focal point should work closely with the national WIS Focal point of the NMHS who will be the main WIS interface of the country or area.

## 7. RISKS ASSOCIATED WITH WIS IMPLEMENTATION

### 7.1 General WIS acceptance

The main objectives of WIS are:

- To enhance GTS services by making it available to wide range of users through public domain (internet),
- To add new products and make them available to users through the public domain. According to these objectives WIS is expected to be used by three different groups of users:
- WMO related programs' users ;
- Operational data users ; and
- Other users (researchers & industry)

A wide range of acceptance is necessary to achieve above objectives. All RA II GISCs should consider all kinds of users, encouraging them to make use of WIS effectively. Users of WMO related programs should also be encouraged to use WIS as their basic source of information. Each operational GISC should train WIS staff of their area of responsibility and urge them to participate in relevant WMO-sponsored courses. Operational GISCs should announce their available products and services to users. A need exists to frequently update regional researchers and industry users on data/products of their interest and encouraging them to use WIS as search engine for weather related products. A need exists to urge Data Collection or Production Centres (DCPCs) to generate user-tailored products for WIS.

### 7.2 Lack of staff resources for operational WIS centre

The implementation of WIS puts stress on established consultation and information processes. The success of the projects and tasks are expected to be at risk without the availability of WIS focal points or metadata knowledge. Lack of Members` understanding about WIS may also impacts on resources allocation or the giving of priority to WIS activities.

In general, staff knowledge and background criteria would differ between WIS Centres (GISC, DCPC, NC). GISC and DCPC staff should be educated enough about metadata, DAR and WIS related software. NC's staff could manage WIS related activities. RA II GISCs and GISC candidates should enhance their staff training as well as the staff of their area of responsibility. They should ensure the availability of adequate communication systems and give the necessary consultation and cooperation with all Members, to improve their functions, including the establishment of routine RA II WIS long/short-term training programs capable of giving effective communications links.

### 7.3 Lack of DAR Metadata knowledge

Lack of DAR metadata knowledge poses a real risk to WIS success, in particular, at the beginning of its evolution. RA II should take proper measures to face DAR metadata knowledge risks on the basis of WMO requirements and plan to solve this problem through training at three different levels:

At Level 1: Each GISC should take responsibility of training its staff and staff of area of responsibility on regular basis.

At Level 2: RA II should arrange DAR metadata training courses for the region staff.

At Level 3: WMO should have a leading role in tackling this risk by customizing training courses that addresses all WIS knowledge, especially DAR metadata issue.

Each WIS centre (GISC, DCPC, NC) should establish its own training plan and encourage its staff members to actively participate in different WIS related courses.

### 7.4 Insufficient bandwidth of communication links

Telecommunication links bandwidth of RA II region could pose a curb on WIS efficiency. In general, 80% of RA II links work at less than 1Mb/s (September 2012 status). To overcome this risk, all GISCs in RA II should be invited to analyze their telecommunication links with their area of responsibility (AMDCN) in term of data volume exchange (currently and

in the future) and compare it with the available bandwidth, making technical and financial plans to smooth the migration from current GTS status to WIS permanent .

The plan should address communication links redundancy as well, in order to avoid any service interruption.

# 8. RA II WIS IMPLEMENTATION PLAN - EXECUTION AND TIMELINE

## 8.1 Regional coordination and monitoring

The regional coordination of the WIS implementation by the RA II Members was initiated at the workshop on WIS implementation in Tokyo, Japan (22-24 October 2012), reviewed the analysis of traffic volume of a 64 Kbps GTS circuit and the results of the survey over the current status at each centre. To meet the growing demand of data and product volume, including satellite products, the workshop recommended updating the minimum requirement for GTS links to be 128 Kbps. The workshop also reviewed the progress on management of discovery metadata in WIS. It noted that WIS metadata management has started in some DCPCs operated by JMA associated to GISC Tokyo. Participants noted with satisfaction that an Excel-based WIS metadata creation tool developed by JMA is proving to be a useful solution for collecting information needed for populating WIS discovery metadata. The workshop supported further refinement of this tool and requested that the development should be part of WIS Application Pilot Project. All comments and suggestions have been incorporated. CBS teams supported the use of the tool noting that it is important that such usage does not lose any modifications to existing metadata records that would have to be re-entered by the Member.

The workshop discussed a draft regional implementation plan that should allow all RA II Members to join WIS in a synchronous and harmonized manner. This includes different forms of assistance to those Members that will need to build their capacity for becoming WIS users. An important aspect of the regional approach is the monitoring of the implementation actions that would allow quick identification and response to observed problems and deficiencies. Without monitoring, there is a high risk that the implementation of WIS in some parts of Region II would be delayed. The monitoring procedures will be defined to include regular information flow between RA II WIS Focal Points and the Secretariat. GISCs and DCPCs will play an important role in the GISC performance monitoring as described in 8.8 below.

## 8.2 RA II WIS Implementation Focal Point

To assist in monitoring the WIS implementation a major component of the RA II WIS Implementation by the RA II Members will be to ensure training for all RA II Members in the use of WIS, with a priority being the use and management of DAR Metadata. GISCs Tokyo, Beijing and Seoul have already held International Workshops for RA II Members in 2010, 2011 and 2012 respectively demonstrating the important role of GISCs in capacity building activities. GISC Tehran utilized the Regional Training Centre Iran in collaboration with the WIS Jump Start offer to develop a training course on WIS in 2011 and will be working with other Regional Training Centres to share their experience. Regional Training Centre Turkey, which supports some RA II Members, incorporated training on WIS to its 2010 and 2012 International Workshops on Meteorological Telecommunications and METCAP Software. GISC New Delhi had also planned a workshop for 2012 but this had to be postponed until 2013. The CBS Expert Team on WIS Centres is developing a training strategy that will also be usable by Regional Associations (See Report[15] on ET-WISC 5th session, paragraphs 4.4 and 4.5 and Document 4.3 of ET-WISC[16]). Training and implementation of WIS has included many WIS Jump Starts being provided by the Secretariat. Experts from WIS centres are encouraged to participate in the WIS Jump Start initiative supporting other centres in their Region.

## 8.3 National implementation plans

Members are expected to develop their own national WIS Implementation Plans by end of 2013. The national WIS Focal point should communicate to the Secretariat and to the RA II WIS Implementation Focal Point (see paragraph 8.3) the target dates for the planned WIS centres to become operational (this information will be registered in the WIS section of the WMO Country Profile Data Base to allow measuring of progress). The national plans should be coordinated with the principal GISC and should be in agreement with the RA II WIS Implementation Timeline.

[15] http://www.wmo.int/pages/prog/www/ISS/Meetings/ET-WISC_Melbourne2012/FReport-ET-WISC2012.doc
[16] https://wiswiki.wmo.int/tiki-download_wiki_attachment.php?attId=869

### 8.4 RA II WIS member database

The principal source of information on the WIS implementation by Members should be the WMO Country Profile Data Base (CPDB[17]), maintained by the WMO Secretariat. The CPDB WIS section should contain (as a minimum) the following WIS-related information from Members:

- Contact information (national WIS Focal point(s))
- Network connection details and traffic patterns
- Local implementation plan details and results
- Specification of problem areas and failures

The data to be stored in the database is needed to monitor the proper implementation of the plan and to allow appropriate interventions and assistance to be provided to Members, as required. The WIS Focal points of the countries and the DCPCs will play crucial role in keeping the information up-to-date and to highlight any specific problems.

*Note: Procedures for interacting with the CPDB, including login and inserting information by the WIS FPs will be provided in due course.*

### 8.5 Capacity building – training courses and WIS users' meeting

Starting at the latest in the 4th quarter of 2013, the GISCs in RA II should hold regular users' meetings and organize metadata training courses for the members of their AMDCN. The frequency of these meetings should be agreed with the likely participants and be in accordance with the RA II Implementation timeline.

### 8.6 Goals and timeline

After laying the foundations for a successful implementation of the plan in 2013-2014, the main implementation effort should be carried out throughout 2013. The RA II Management Group meetings should review the progress. It will be essential to monitor for and identify Members that are falling behind the implementation schedule and to arrange suitable assistance from other Members as required.

### 8.7 Performance Monitoring

When looking at the monitoring of WIS, one has to distinguish between the network and the users. CBS-15 requested OPAG-ISS to prepare an effective plan for monitoring the WIS by October 2013, and to invite designated GISCs and DCPCs to participate in pre-operational implementation to test its effectiveness, and to report progress to CBS-Ext.(14).

It is highly recommended that the GISCs in RA II hold regular meetings, at least annually, to coordinate their work and to share experiences. These meetings could be held in conjunction with the global GISC meetings planned by CBS, including TT-GISC meeting.

[17] WMO Country Profile Database - http://www.wmo.int/cpdb

## APPENDIX I

### WIS Implementation Plan for NMHS with RMTN Connection in RA II (NC)

1. Bring about an internal decision to join WIS in RA II.
2. Choose a staff member to be nominated as the WIS Focal Point. The person should be knowledgeable about the current GTS transmissions.
3. Check the communication network connectivity, in particular the bandwidth to the current RTH and the Internet access.
4. Check the traffic pattern for the GTS data and ensure that the bandwidth is sufficient to send and receive all data without undue delays. If this is not the case, either plan an increase in bandwidth or stay with GTS data transmissions and have additional data via other means such as via the Internet.
5. Determine which GISC should become the principal GISC and communicate with the chosen GISC to gain its approval.
6. Inform WMO by letter from the PR about the decision to become an NC, the choice of the principal GISC and the nomination of the WIS Focal point.
7. Develop a national implementation plan in agreement with the principal GISC and report it to the Secretariat and RA II WIS Implementation Focal Point for inclusion in the WMO Country Profile Data Base.
8. Set up a communication link to the principal GISC via RMTN and create an user account at the GISC for administrative matters.
9. Decide whether the metadata editor should be supported locally or remotely by the GISC. In view of this decision, set up the necessary software environment: either by installing the editor on a local server or by setting-up a connection to the GISC for the editing.
10. Train a staff member and a back-up in the WMO metadata Core Profile by sending them to training courses organized by WMO or the GISC. It is also possible to ask for local support via the WMO Jumpstart Offer.
11. Take over responsibility for the metadata records describing the data submitted by the NMHS and modify if necessary the initial metadata records provided by GISC Tokyo JMA/ GISC Beijing CMA.
12. Start using the WIS functionality for sending and receiving data with their appropriate metadata descriptions.
13. Join the user group of the GISC by attending meetings and other organised events.
14. Support the monitoring of the regional WIS by regularly updating the member's records in the WMO Country Profile Data Base including availability of service, traffic figures, errors and other comments.

## APPENDIX II

### WIS Implementation Plan for DCPC in RA II

1. Bring about an internal decision of the organization to join WIS in RA II as a DCPC.
2. Choose a staff member to become the WIS Focal point. The person should be knowledgeable about communications protocols and the WMO Metadata Core Profile.
3. Gain the support of a WMO Programme for the special data to be made available as a DCPC. In case of a current RTH who wishes to become a DCPC, the NCs to be connected to the new DCPC for data collection and distribution services should be contacted for support, expressed by the relevant PR's.
4. Determine which GISC in the region should become the principal GISC and communicate with the chosen GISC to gain its approval.
5. Check the communication network connectivity, in particular the bandwidth to the chosen GISC and the interactive access.
6. Check the planned traffic pattern for the data and the interactive load, assuming full DCPC operations. Ensure that the bandwidth is sufficient to send and receive all data without undue delays. If this were not the case, make sure that an upgrade of the communication network is planned prior to starting operations as a DCPC.
7. In accordance with the mandatory services to be provided by a DCPC as described in the Manual on WIS, select the necessary special software and install it locally. Make sure that it passes all the tests for DCPCs which have been published by WMO.
8. Inform WMO, in particular CBS, by letter from the Director of the Organization about the wish to become a DCPC, the supporting WMO Programme, the choice of the principal GISC and the nomination of the WIS Focal point.
9. In accordance with the Manual on WIS, collaborate with the relevant CBS ET's to pass all the necessary tests for a DCPC.
10. Once the tests have been passed successfully and the centre has been endorsed by WMO Congress / EC, set up operations as a DCPC.
11. Join the user group of the GISC by attending meetings and other organised events.
12. Support the monitoring of the regional WIS by regularly updating the organization's records in the WMO Country Profile Data Base including availability of service, traffic figures, errors and other comments.

## APPENDIX III

### Sample Letter

To: the Secretary-General

Subject: Proposal for designation of National Centre

Dear Secretary-General

According to the Manual on the WMO Information System (WMO-No. 1060) I have the pleasure in requesting that the NC [city] is designated as a part of the WIS centre of [name of NMHS]. I believe that NC [city] will be continuously complied with WIS requirements and harmonized with WIS implementation. I would like to inform you that the principal Global Information System Centre (GISC) associated to NC [city] should be [GISC name] and secondary GISC be [GISC name]. For coordinating WIS activities, I hereby nominate Mr/Ms [name, position, email, address] as the national WIS Focal Point.

Yours sincerely,

Permanent Representative of [NMHS]

## APPENDIX IV

## WIS Test Cases for NCs

| **Test Case Name: NC Demonstration Test Case 1** | |
|---|---|
| Uploading of Discovery Metadata for Data and Products into DAR catalogue | |
| **Test Case ID** | NC-TC1 |
| **Component** | Metadata Management |

**Purpose of test**

Validate the function of adding, updating and deleting metadata records from NC to the Principal GISC.

All metadata records must be checked against the relevant schemas. (e.g. The record should be rejected if not fitting the schema)

Note 1: The term "upload" refers to the movement of metadata records between a National Centre that provides the metadata and the Principal GISC that manages the DAR catalogue. It can actually be implemented as a "pull" initiated from the DAR catalogue site, or as a "push" initiated by the metadata provider.

Note 2: this functionalities can be implemented as:

- A web interface allowing registered users to manage their metadata interactively
- A machine-to-machine interface allowing automated batch processing of metadata.

All GISCs support both methods (GISC Beijing, Tokyo and Seoul provide WIMMS). The NC may choose one or both methods.

**Relevant technical specifications**

- Tech specs 1 (Uploading of metadata)
- Tech specs 8 (DAR Catalogue Search and Retrieval)

**Precondition**

1. Have network connection (dedicated and/or public connection) exists between the NC and Principal GISC
2. The Principal GISC has a file upload facility for collecting metadata from NCs
3. The Principal GISC has a fully functional DAR catalogue
4. The Principal GISC has a registered user/process that is authorized to manage metadata of a given NC
5. The Principal GISC has a web interface to the DAR catalogue that allow searches (see WIS-TC6 -> http://www-db.wmo.int/WIS/centres/guidance.doc)

**Test Steps**

| | Description | Expected Results | Actual Results |
|---|---|---|---|
| **1** | A user/process adds a new valid metadata record to the DAR catalogue | The metadata record must be found when browsing/searching the DAR catalogue | |

| | | | |
|---|---|---|---|
| **2** | A user/process modifies an existed record from the DAR catalogue, | The modification should be immediately visible when browsing/searching the DAR catalogue | |
| **3** | A user/process deletes an existed record from the DAR catalogue, | The deleted record should not be found when browsing/searching the DAR catalogue | |
| **...** | An authorized user/process attempts to upload an invalid metadata record | The user/process must be notified of the fact that the metadata record is invalid. The addition/update operation is aborted. The DAR catalogue is unchanged. | |
| **...** | An authorized user/process attempts to upload a record with a unique identifier that is already in the DAR catalogue | The DAR catalogue should not contain record with duplicate identifiers. Either:<br>1. The new metadata record replaces the old metadata record. The old metadata record should not be present in the catalogue. The new metadata record must be found when browsing/searching the catalogue<br>2. The user/process must be notified of the fact that the record is a duplicate. The addition/update operation is aborted. The DAR catalogue is unchanged.<br>Note: it is essential to ensure an update is an edit and not an accidental duplication | |
| **...** | Access control - No unauthorized addition 1 | A non-authorized user/process should not be able to add a metadata record to the DAR catalogue | |
| **...** | Access control - No unauthorized addition 2 | A user/process should not be able to add a metadata record to the DAR catalogue representing data from another WIS centre | |
| **...** | Access control - No unauthorized modification 1 | A non-authorized user/process should not be able to modify a metadata record from the DAR catalogue | |
| **...** | Access control - No unauthorized modification 2 | A user/process should not be able to modify a metadata record from the DAR catalogue that belongs to another WIS centre | |
| **...** | Access control - No unauthorized deletion 1 | A non-authorized user/process should not be able to delete a metadata record to the DAR catalogue | |
| **...** | Access control - No unauthorized deletion 2 | A user/process should not be able to delete a metadata record from the DAR catalogue that belongs to another WIS centre | |

| | | | | | |
|---|---|---|---|---|---|
| **Centre** | | **Organization** | | **Country** | |
| **Test Date** | | | | | |

| **Test Case Name: NC Demonstration Test Case 2** |
|---|
| Uploading and downloading of data between NC and other WIS Centres |

| | |
|---|---|
| **Test Case ID** | NC-TC2 |
| **Component** | |

**Purpose of test**

Validate the upload and download of data and products and association with metadata

**Requirements Covered**

- Tech specs 2 (Uploading of data and products)
- Tech specs 10 (Downloading file via dedicated network)
- Tech specs 11 (Downloading file via non-dedicated network)
- Tech specs 12 (Downloading file via other methods)

**Precondition**

1. Have network connection (dedicated and/or public connection) between the NC and other WIS centre (Principal GISC) (includes via RTH where relevant)
2. Have file upload and download facilities (FTP/SMTP/HTTP client…)
3. Have data available for upload or download
4. Have DAR facilities available at GISC.

**Test Steps**

| | Description | Expected Results | Actual Results |
|---|---|---|---|
| **1** | a. upload a file which is associated with a metadata record in the DAR catalogue of the NC to a GISC centre<br>b. use DAR facilities to search the metadata then retrieve the file, using any download facilities | a. The uploaded file has been delivered to the GISC and match with the corresponding metadata<br>b. The file can be downloaded | |

| | | | | | |
|---|---|---|---|---|---|
| **Centre** | | **Organization** | | **Country** | |
| **Test Date** | | | | | |

| Test Case Name: NC Demonstration Test Case 3 | | | |
|---|---|---|---|
| Maintenance of users, roles, authorization and authentication | | | |
| **Test Case ID** | NC-TC3 | | |
| **Component** | Management of users and access | | |
| **Purpose of test** | | | |
| Create and exercise a variety of user types<br>Note: A centre may utilize GISC user control interface | | | |
| **Relevant Technical Specifications** | | | |
| • Tech specs 4 (Maintenance of User Identification and Role Information)<br>• Tech specs 6 (Authentication of a User)<br>• Tech specs 7 (Authorization of a User Role)<br>• Tech specs 13 (Maintenance of Dissemination Metadata) | | | |
| **Precondition** | | | |
| 1. The Centre has authority to provide access to user (ie PR approval from users country)<br>2. A process is in place between the NC and the Principal GISC to authorize its users to use the GISC with appropriate access levels.<br>3. The user interface is via the internet (i.e. web page) | | | |
| **Test Steps** | | | |
| | **Description** | **Expected Results** | **Actual Results** |
| **1** | Provide access for an external user to search metadata | Temporary user can search metadata, but not access data from the GISC or cache, or subscribe to data. | |
| | a) User goes to search web page<br>b) User makes metadata search<br>c) Tries to access data | a) User has access to search page<br>b) User finds metadata<br>c) User tries to access data and is referred to authorization page at data source. Cannot access data without validating in an authorized user role | |
| **2** | Create accounts with access to WIS metadata and data for a WMO centre authorized user | Two users are created. One with access to metadata only, the other with the ability to access the Centre subscription service or ad hoc request from the cache | |
| | a) User goes to registered user web page<br>b) User is required to login or create account<br>c) User registers account and selects role of valid WMO member with authority to access WIS data (eg is from WMO NC)<br>d) User enters login details<br>e) User makes metadata search<br>f) Tries to access WMO globally available data from the centre<br>g) User tries to access additional data at | a) User has access to login page<br>b) New user, so has to create an account<br>c) User account is validated as a WMO NC member and account is created. The user receives a user login (eg code via email or encrypted symbol)<br>d) User is logged in. As user us validated as WMO NC member, he is allocated access to search and access to download data from cache and to subscription services<br>e) User finds metadata<br>f) User successfully accesses data from centre<br>g) User receives advice that he is not authorized to access | |

| | | | |
|---|---|---|---|
| | centre that he is not authorized to access<br>h) Tries to access data or product at another site<br>i) User subscribes to data for future delivery from centre<br>j) User returns on another session and reuses login to search or subscribe<br>k) User edits subscription details<br>l) User cancels a subscription<br>m) User logs out or leaves centre's site and tries to return to a bookmarked page at a later date and access data | this data and referred to access page where he can request change in user role or re-login as another user<br>h) User is referred to authorization page at other site.<br>i) User receives scheduled data via agreed method at agreed time<br>j) User maintains successful access with same access rights<br>k) Users subscription details are updated and reflected in subsequent deliveries<br>l) Users subscription details are updated and receives no further deliveries<br>m) Attempting to use a bookmarked page from earlier session to access data, directs the user to the registered user login page. | |
| **3** | User checks status of account and subscriptions | User can view his account and subscription details, including historic and future transactions, and the status of current transactions | |
| **...** | | | |

| | | | | | |
|---|---|---|---|---|---|
| **Centre** | | **Organization** | | **Country** | |
| **Test Date** | | | | | |

## APPENDIX V

## List of acronyms

| | |
|---|---|
| AMDCN | Area Meteorological Data Communication Network |
| CBS | Commission for Basic Systems |
| DAR | Discovery, Access and Retrieval |
| DCPC | Data Collection or Production centre; Part of the WIS |
| GISC | Global Information System Centre; Part of the WIS |
| GTS | Global Telecommunication System |
| IMTN | Improved Main Telecommunication Network |
| MG | Management Group of RA II |
| MPLS | Multiprotocol Label Switching |
| MTN | Main Telecommunication Network (of the GTS) |
| NC | National Centre; Part of the WIS |
| NMC | National Meteorological Centre |
| NMHS | National Meteorological and Hydrological Service |
| R2-WIS-IP | Regional Association II WIS Implementation Plan |
| RMTN | Regional Main Telecommunication Network |
| RSMC | Regional Specialized Meteorological Centres |
| RTH | Regional Telecommunication Hub |
| TCP/IP | Transmission Control Protocol / Internet Protocol |
| VPN | Virtual Private Network |
| WIMMS | WIS Interim Metadata Management Services |
| WIS | WMO Information System |
| WMC | World Meteorological Centre |
| WMO | World Meteorological Organization |
| WWW | World Weather Watch |

**ANNEX V**

## Private-Public Engagement

## Summary and Recommendations from RECO-7

The RA Members shared experiences and views on risks, opportunities, lessons and concerns of public-private engagement in RA II.

The meeting emphasized the following key points:

a) Private engagement in weather, climate and water enterprise is a rapidly increasing and the Secretariat and Members need to keep abreast of developments and have a realistic understanding of the evolving nature of the weather, climate and water enterprise and the risks and opportunities provided by private sector engagement therein;

b) Regulatory role of WMO is fundamental foundation for the entire weather, climate, and water enterprise and to ensure quality of data and services;

c) Private sector in the data provision, data processing and information services could become a major concern and the opportunities and threats need to be better identified,

d) A structured to dialogue at all levels, including global, regional and national is necessary;

- WMO should engage / organize an ongoing dialogue at the Global level to stay informed of developments in the private sector in the weather climate and water enterprise,

- RA II members, with the support of the Secretariat, need to reach out proactively and look for opportunities for engagement and at the same time identify the risks/threats,

e) WMO policy on public-private engagement is required. A high-level policy document (e.g., Congress Declaration or Resolution) could be useful to establish roles and responsibilities and promote win-win approaches. Policy Framework (and a Declaration/Resolution) should be adopted by Cg-18;

f) WMO Secretariat should develop guidance material for Members relevant and useful for all weather, climate, and water enterprise stakeholders including the private sector, in particular with relation to free and unrestricted exchange of data and build up a compendium of case studies to illustrate the various current and potential models for public-private partnerships;

g) Members should consider putting in place adequate legislation that clearly defines relative roles in the market space including the authoritative voice of the NMHS in provision of warning services and if possible also defining a regulatory role of the NMHS with respect to 3rd party weather and climate information service providers that provide for validation of accuracy and quality of forecasts provided and action to be taken if quality standards are not adhered to.

**Private-Public Engagement**

**Annex to draft Decision 6.1/1 (RA II-16)**

The RA II Members shared experiences and views on risks, opportunities, lessons and concerns of public-private engagement in RA II. The meeting emphasized the following key points:

(1) Private engagement in weather, climate and water enterprise is a rapidly increasing and the Secretariat and Members need to keep abreast of developments and have a realistic understanding of the evolving nature of the weather, climate and water enterprise and the risks and opportunities provided by private sector engagement therein;

(2) Regulatory role of WMO is fundamental foundation for the entire weather, climate, and water enterprise and to ensure quality of data and services;

(3) Private sector in the data provision, data processing and information services could become a major concern and the opportunities and threats need to be better identified;

(4) A structured to dialogue at all levels, including global, regional and national is necessary;

   (a) WMO should engage/organize an ongoing dialogue at the Global level to stay informed of developments in the private sector in the weather climate and water enterprise;

   (b) RA II members, with the support of the Secretariat, need to reach out proactively and look for opportunities for engagement and at the same time identify the risks/threats;

(5) WMO policy on public-private engagement is required. A high-level policy document (e.g., Congress Declaration or Resolution) could be useful to establish roles and responsibilities and promote win-win approaches. Policy Framework (and a Declaration/Resolution) should be adopted by Cg-18;

(6) WMO Secretariat should develop guidance material for Members relevant and useful for all weather, climate, and water enterprise stakeholders including the private sector, in particular with relation to free and unrestricted exchange of data and build up a compendium of case studies to illustrate the various current and potential models for public-private partnerships;

(7) Governments should consider the value of establishing legislation that clearly defines relative roles in the market space including the authoritative voice of the NMHS in provision of warning services and if possible also defining a regulatory role of the NMHS with respect to third party weather and climate information service providers that provide for validation of accuracy and quality of information and action to be taken if quality standards are not adhered to.

**ANNEX VI**

## Management Skills

## Summary and Recommendations from RECO-7

Successful management of a typical NMHS has to be seen in the context of ensuring that the functions of the institution are geared towards ensuring its optimum possible contribution to sustainable development, reduction in loss of life and property, scientific development and technological advancement. Hence, in order to build an effective management capability for a typical NMHS, it is important that its manager:

i) Operates in the realm of the provisions made by appropriate national legislative and institutional frameworks;

ii) Makes the institution relevant to national policy development and implementation;

iii) Organizes an assemblage of dynamic training programme and facility that could guarantee continuous education for a critical mass of competent and well informed human resources that are motivated for delivery of quality Service, in forms that are useful for national needs and development aspiration;

iv) Ensures provision and maintenance of a robust infrastructure for observation and data exchange;

v) Takes into account the changing user requirements as well as political and socio-economic situations;

vi) Maintains a mutually beneficial relationships with all stakeholders at national and international levels;

vii) Ensures availability of adequate financial resources; and

viii) Puts in place an appropriate facility to cater for effective internal information and public outreach.

In order to address a full-range of issues relating to enhancement of management skills in NMHSs, it is necessary for all stakeholders to consider the following actions and initiatives, which are not mutually exclusive.

a) Given the need to ensure existence and sustainability of appropriate management skills in NMHSs, it is essential to put in place training and related initiatives aimed at enhancing the management capacity of officials of NMHSs in key areas such as strategic planning, human resource management, policy development, resource mobilization, maintenance of adequate infrastructure, intergovernmental coordination, international relations and communications. WMO through its Regional Training Centres could play an important role in this endeavour by offering specific management related training opportunities at national and regional levels, through its Regional Training Centres and when possible via means of WMO Roving Seminars;

b) Managers of NMHSs need to, at national level, provide adequate and sustainable facility to enhance professional skill and management capacity of their staff and ensure appropriate checks and balances are put in place for the purpose of ensuring good governance. WMO could work interested Members to stimulate the interest of bilateral and multilateral development partners in enhancing management capability of needy NMHSs;

c) Managers need to constantly update their level of awareness of the issues within the area of responsibility and mandate of their institutions, for example, through regular

survey of staff and customer satisfaction. Outcomes of such surveys should be taken on board through periodic management review exercise aimed at improving efficiency of work, as well as quantity and quality of products. Members are encouraged to make this part of their regular management duties;

d) NMHSs need to strengthen their collaboration by enhancing the framework for regular exchange of information on well documented best management practices that exemplify good service delivery. This in essence calls for institutionalization of knowledge management system for appropriate reference at national and international levels. WMO Secretariat is requested to cooperate with Members to achieve this objective through continuation of its programme on Familiarization Visit for newly appointed Permanent Representatives, and support to initiatives such as Study Tour, national and regional seminars on management issues;

e) It is necessary for managers to see NMHSs as an aggregate part and parcel of a holistic, though complex, national institutional setting aimed at attaining a common goal of maintaining national security, socio-economic progress and environmental protection. On the basis of this, NMHSs should therefore ensure that they operate in tandem with the goals, aspirations and operations of other national institutions, particularly those with close sectoral objectives such as water resources, agriculture, energy, environmental management, transport and aviation, oceanography, seismology, tourism and so on. This is a policy issue which should be further explored;

f) Where applicable, managers of NMHSs should take advantage of new opportunities to demonstrate their relevance as strategic part of a consortium of national institutions working to contribute to efforts aimed at dealing with issues of national importance such as natural disasters, pollution management, recurrent and future economic plans, environmental protection, implementation of bilateral and multilateral agreements, etc.

## Management Skills

## Annex to draft Decision 4.8(2)/1 (RA II-16)

Effective management of an NMHS ensures that the functions of the institution are oriented towards ensuring its optimum possible contribution to sustainable development, reduction in loss of life and property, scientific development and technological advancement.

Hence, in order to build an effective management capability for a typical NMHS, it is important that its manager:

(1) Should ensure that the NMHSs operates in tandem with the goals, aspirations and operations of other national institutions, particularly those with close sectoral objectives such as water resources, agriculture, energy, environmental management, transport and aviation, oceanography, seismology, tourism and so on.

(2) Work within / puts into place appropriate national legislative and institutional frameworks and considers the relevancy of the role and activities of the NMHS to national and international policy environment;

(3) Ensure that a comprehensive forward looking and long term development / business plan is in place;

(4) Ensure availability of adequate financial resources as much as is possible;

(5) Take into account the changing user requirements as well as political and socio-economic situations;

(6) Maintain a mutually beneficial relationships with all stakeholders at national and international levels;

(7) Put in place appropriate mechanism to ensure effective internal and external communications and public outreach;

(8) Ensure that a comprehensive human resource capacity development and transition strategy is in place in key areas such as strategic planning, human resource management, policy development, resource mobilization, maintenance of adequate infrastructure, intergovernmental coordination, international relations and communications;

(9) Undertake regular staff and customer satisfaction reviews.

**ANNEX VII**

**Seventh Regional Conference on Management of National Meteorological and Hydrological Services (RECO-7) in Regional Association II**

**10–11 February 2017, Abu Dhabi, United Arab Emirates (UAE)**

**LIST OF PARTICIPANTS**

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| President of Regional Association VI | Ivan CACIC |

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| Assistant Secretary-General | Wenjian ZHANG |
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