

REGIONAL ASSOCIATION II (ASIA)

Eleventh Session of the RA II Management Group

Abu Dhabi, United Arab Emirates

7 – 8 December 2016

FINAL REPORT



WORLD METEOROLOGICAL ORGANIZATION

ELEVENTH SESSION OF THE RA II MANAGEMENT GROUP
(Abu Dhabi, United Arab Emirates, 7–8 December 2016)

1. ORGANIZATION OF THE SESSION

1.1 The eleventh session of the RA II Management Group (MG-11) was held at Dusit Thani Hotel, Abu Dhabi, United Arab Emirates, from 7 to 8 December 2016. Mr Abdulla Al-Mannai, president of RA II and chair of the Management Group opened the session. The Group adopted the provisional agenda as given in [Annex I](#).

2. MATTERS ARISING FROM THE TENTH SESSION

2.1 The Group recalled that the tenth session of the RA II Management Group (MG-10: Geneva, 15 June 2016) focused mainly on the review of the progress report of the Working Groups; preparation of the sixteenth session of Regional Association II (RA II-16); and the RA II Operating Plan for 2016–2019.

2.2 The Group requested the Secretariat to make arrangements so that the updated progress report of WGs including activities to be conducted in 2016 would be submitted by the chairs of WGs to RA II-16 for review by RA II Members.

2.3 The Group was pleased to endorse the RA II OP 2016–2019 and requested the Secretariat to submit the endorsed RA II OP 2016–2019 for inclusion in the WMO-wide Operating Plan 2016–2019.

2.4 The Group recommended that the new subsidiary body structure be developed for more effective and efficient operations in the Region. The Group requested the chairpersons of WGs/ICTs to submit the proposals on the new structure for the next intersessional period, in consultation with the co-coordinators of Expert Groups as well as the technical departments of the WMO Secretariat, to the preparatory MG meeting for consideration.

3. REVIEW OF THE ACTIVITIES OF THE RA II SUBSIDIARY BODIES

3.1 The Group was briefed on the activities of the RA II subsidiary bodies including: Working Group on Weather Services (WGWS), Working Group on Climate Services (WGCS), Working Group on Hydrological Services (WGHS), Working Group on WIGOS/WIS (WG-WIGOS/WIS), Implementation Coordination Team on Service Delivery (ICT-SD) and Implementation Coordination Team on Disaster Risk Reduction (ICT-DRR). The Group also noted that the highlights of the achievements of WGs and ICTs during the inter-sessional period as given in [Annex II](#).

3.2 The Group was also briefed on the status of the RA II Pilot Projects. The draft final reports of the RA II Pilot Projects are attached in [Annex III](#).

3.3 The Group expressed its appreciation to the chairpersons of WGs/ICTs and co-coordinators of Expert Groups for the comprehensive reports on the WG activities and the contributions and achievements made by the subsidiary bodies during the inter-sessional period. The working group reports for the inter-sessional period from 2013 to 2016 are attached in [Annex IV](#).

3.4 The Group endorsed the draft final reports with recommendation of further refinements for the submission to RA II-16.

4. ORGANIZATION OF THE SEVENTH REGIONAL CONFERENCE (RECO-7) IN REGIONAL ASSOCIATION II

4.1 The Group reviewed and endorsed the provisional programme ([Annex V](#)), tentative work plan ([Annex VI](#)) and concept note ([Annex VII](#)) of the seventh Regional Conference (RECO-7) in Regional Association II.

4.2 The Group was informed of the outcomes and recommendations of the Special Session on Public-Private Partnerships at EC-68 and acknowledged that EC-68 requested the President of WMO and presidents of regional associations to lead the development of the Strategy, in consultation with the broader WMO community, for the consideration of EC-69, and in particular to pay attention to the following aspects:

- (a) Assess experience, good practices, opportunities and risks associated with private sector engagement;
- (b) To develop draft principles for private sector engagement based on the key issues;
- (c) To propose mechanisms and structures to foster dialogue and consultations, taking into consideration global, regional and national specifics; and
- (d) To propose options for future governance of public-private partnerships and directions for development of WMO guidance to Members.

4.3 The Group agreed that the RECO-7 will discuss the public-private partnership and produce a statement to be submitted and reviewed at the RA II-16. In this connection, the Group was of opinion that a draft statement should be prepared and shared with MG members well in advance of the RA II-16 to secure time for review.

4.4 The Group agreed that the RA II Pilot Projects would also be reported by the chairpersons of the relevant Working Groups. The Group was also agreed that a WIGOS project on radar composite in Southeast Asia would be introduced at the RECO-7 as an example of successful implementation of the RA II WIGOS projects.

4.5 The Group noted with appreciation a proposal of a new RA II Pilot Project on impact-based forecast made by the Republic of Korea. The Group requested the Republic of Korea to introduce the project at the RECO-7 and submit a summary paper on the project to be included in the RA II-16 document.

4.6 The Group agreed to include the brief presentation of the activity reports of the Working Groups during the RECO-7.

4.7 The Group was briefed on the survey on the basic capability of NMHSs in RA II (Asia). The survey was conducted online from October to November 2016 with the participation of 32 Members in the Region. The Group was pleased to note that the final report of the survey will be made available on the WMO website and the results of the survey will be reported at the RECO-7.

4.8 The Group expressed its appreciation to Mr L.S. Lee (Hong Kong, China), Lead of this Survey, for his contribution to the development of this report in cooperation with the Secretariat.

5. ORGANIZATION OF THE SIXTEENTH SESSION OF REGIONAL ASSOCIATION II

5.1 Review of provisional program, work plan and side events

5.1.1 The Group was pleased to confirm that RA II-16 will be held at the Dusit Thani Hotel in Abu Dhabi, United Arab Emirates, from 12 to 16 February 2017 preceded by the seventh session of the Regional Conference on Management of National Meteorological and Hydrological Services (RECO-7) from 10 to 11 February 2017.

5.1.2 The Group noted with appreciation the efforts by the Secretariat to make the session more effective and efficient including the shortening of the duration of the session from seven days to five days.

5.1.3 Dr Wenjian Zhang, Assistant Secretary-General of WMO informed the Group that the upcoming RA II-16 needs to pay particular attention to documentations to deal with highly strategic issues. The Group also noted that the improvement of governance of the Regional Association is important for the enhancement of connection between experts under technical commissions with those under regional Associations; priorities of the region which are in line with the WMO strategic priorities; more responsive to the need to be reflected in the next four-year plan; and consideration of how to increase the supervision and monitoring of the activities of the plan.

5.1.4 The Group agreed on the proposed provisional agenda and annotated provisional agenda as given in Annexes VIII and IX, respectively, and endorsed the Tentative Work Plan as given in Annex X.

5.1.5 The Group further agreed that all items should be discussed in Plenary meetings, as in the past, with General Plenary to be chaired by the president and the vice-president.

5.1.6 The Group considered that *Plenary A* could be co-chaired by Dr Ghulam Rasul, Pakistan and *Plenary B* by Dr Ayman Ghulam, Saudi Arabia and Dr K.J. Ramesh, India.

5.1.7 The Group agreed that Credential Committee and Drafting Committee will not be established. The Group agreed in principle that the Nomination Committee would be composed of the principle delegates of China, Kazakhstan and Maldives. The Principal delegate of Japan would serve as Rapporteur on Review of the previous resolutions and recommendations. The Group noted that the Coordination Committee would consist of the president and vice-president; Chairpersons of Working Group; Secretaries of the Plenaries and some Secretariat representatives.

5.1.8 The Group agreed on the proposed side meetings during the session for defining the composition and terms of reference of the new subsidiary bodies of the Association. The Group also noted that eight side events were tentatively scheduled to provide the members of relevant background information of the key documents for efficient discussion during the session. It agreed that a videoconference could be organized with the WMO Secretariat. The Group requested the Secretariat to continue to work for the plan of side events.

5.1.9 The Group noted that a website for RA II-16 is being created for information and documents. In this connection, the Group further noted that the pre-session documents would be prepared in Arabic, Chinese, English and Russian, and the in-session documents in English only.

5.1.10 The Group confirmed that working hours could be 09:30 to 12:30 and 14:30 to 17:30. Side meetings and ad hoc group meetings can be organized outside the above working hours in English without interpretation.

5.2 Regional priorities 2020–2023

5.2.1 The Group recalled the Decision 16.2(2)/1 (EC-68) — Preparation of WMO Strategic and Operating Plans 2020–2023.

5.2.2 The Group agreed to establish a task team consisting of the following members with a view to drafting the Regional Priorities 2020–2023 for submission to RA II-16: Dr Ghulam Rasul (Pakistan, Chair), Mr B.L. CHOY (Hong Kong, China), Mr Yuki HONDA (Japan), Mr Akihiko SHIMPO (Japan), Dr Sung KIM (Republic of Korea), and Mr Yongqing CHEN (China).

5.3 Subsidiary bodies of the Association: future working mechanism

5.3.1 The Group was briefed on the views of the technical departments of the Secretariat on the possible effective working mechanism of RA II.

5.3.2 The Group was informed of a proposal to change the naming of the following Expert Group:

- Expert Group on Public Weather Services Delivery to Expert Group on Service Delivery including Disaster Risk Reduction.

5.3.3 The Group noted the addition of the following two expert groups under the Working Group on Hydrological Services:

- (a) Expert Group on Measurements, Monitoring and Inforsystems; and
- (b) Expert Group on Hydrological Applications.

5.3.4 The Group reviewed the proposed working structure in the context of the more effective future working mechanism of the Association and agreed the structure should, in principle, remain as the current mechanism for continuity with management group and four working groups on weather services, climate services, hydrological services, and WIGOS/WIS. The Group endorsed the proposed future working structure of the subsidiary bodies of RA II, as given in **Annex XI** and recommended further improvements on the proposed Working Groups' Terms of References for submission to RA II-16.

5.3.5 The Group also recommended that:

- (a) the Association should continue to play an important and active role in the implementation of WMO Programmes and activities in the Region in the fields of weather, climate and water; and
- (b) the Association through its future working mechanism should continue to enhance and establish strong linkage with Technical Commissions.

5.3.6 The Group requested the Secretariat to initiate the nomination procedures for the membership of the Working Groups including WG chairs, the EG coordinators, and experts in consideration of strong linkage with Technical Commissions for the endorsement by RA II-16.

5.4 RA II planned meetings and activities for 2017–2020

5.4.1 The Group was informed of the planned meetings and activities in RA II for 2017–2020 proposed by the Secretariat as given in [Annex XII](#).

5.4.2 The Group discussed the efficient and effective ways to carry out the planned activities for better cooperation and capacity development of the NMHSs in the region.

5.5 Review of key documents for discussion and decision

5.5.1 The Group was briefed by the Secretariat on the key documents to be submitted for decisions by RA II-16 including Regional WIGOS Centre in RA II; Regional WIGOS Implementation Plan in RA II; Regional Disaster Risk Reduction Roadmap Implementation Plan in RA II; and Polar and High Mountain Regions - Polar Regional Climate Centres.

5.6 Logistical arrangements

5.6.1 The Group was informed by the host country of RA II-16, United Arab Emirates, on the recent progress of logistical arrangements for the RA II-16 and the Regional Conference.

5.6.2 The Group noted with pleasure that RA II-16/INF. 1 – Material Arrangements for the Session was finalized in collaboration with the Local Organizing Committee and will be posted on the RA II-16 website. The Members were encouraged to make arrangements with the National Center of Meteorology and Seismology (NCMS, Local Coordinator) for visa application and hotel reservations.

5.6.3 The Group requested the Local Coordinator to ensure the smooth arrival and transportation arrangements for the participants through setting up of an Information/Help Desk at the arrival area of Abu Dhabi International Airport.

6. OTHER BUSINESS

No issues were raised.

7. CLOSURE OF THE SESSION

7.1 Mr Abdulla Al-Mannai, president of RA II, thanked all the participants for their fruitful discussion and expressed his satisfaction with the outcomes made in the session. He also thanked the Secretariat for the arrangements of the session.

7.2 The eleventh session of the RA II Management Group was closed at 15:30 on 8 December 2016. The list of participants is attached as [Annex XIII](#) to this report.

ELEVENTH SESSION OF THE RA II MANAGEMENT GROUP
(Abu Dhabi, United Arab Emirates, 7–8 December 2016)

AGENDA

- 1. Organization of the Session**
 - 2. Matters arising from the Tenth Session**
 - 3. Review of the activities of the RA II subsidiary bodies**
 - 4. Organization of the Seventh Regional Conference (RECO-7) of Regional Association II**
 - 1) Review of provisional programme, work plan and concept note
 - 2) Recommendations on private sector engagement
 - 3) Survey on the Basic Capability of NMHSs in RA II (Asia)
 - 5. Organization of the Sixteenth Session of Regional Association II (RA II-16)**
 - 1) Review of provisional agenda, work plan and side events
 - 2) Regional priorities 2020-2023
 - 3) Subsidiary bodies of the Association: Future working structure
 - 4) RA II planned meetings and activities for 2017-2020
 - 5) Review of key documents for discussion
 - 6) Logistical arrangements
 - 6. Other Business**
 - 7. Closure of the Session**
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Summary of the highlights of the WG/ICT achievements

<WGWS>

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 improvement is being planned for 2016.

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.

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.

- The EG-PWS will collect and share Members' experience and best practices in service delivery and quality management in 2016. In 2016, the EG-PWS will request Members for the provision of PWS technical contact and update the list of PWS focal point.

<WGCS>

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.

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.

<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 panelists 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 analyze 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.
- Most of work programmes are being conducted as scheduled and the third session of WGHS is scheduled in first half of 2016.

<WG-WIGOS/WIS>

EG-WIGOS

- Regarding implementation of WIGOS, all seven projects have made progress. Two projects have been going well, which are 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. Unfortunately, project No.III.2 -Observing systems integration for supporting disaster risk reduction - Capacity Building in Radar Techniques in the Southeast Asia is very difficult to continue the transboundary radar composite network planned in the R-WIP due to Malaysia's withdrawal from the joint project of ASEAN Radar Composite between Thailand and Malaysia. Next actions are planned to be taken to implement these projects.
- 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".

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 2015, Uzbekistan 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 and started receiving meteorological data through RTH New Delhi in March 2015. 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.
- According to the statistics collected every three months from January 2013 to October 2015, notable progress has been seen with the migration of SYNOP data since October 2014, and the number of BUFR TEMP report increased by about 50 in the first half of 2014, which is attributed to India's BUFR TEMP reports. For CLIMAT data, as of November 2015, ten Members were reporting CLIMAT data in BUFR format. The number of Members has increased by two since 2013.
- In accordance with the decision of Cg-17, Volume II of the Manual on GTS (Regional Aspects) will be discontinued and replaced by web-based documentation. EG-WIS agreed to organize a Task Team (TT) in December 2015 to proceed and create the web-based document. This task will be completed in the second quarter of 2016.

<ICT-SD>

Several events have been organized to encourage and facilitate working experience exchange in RAII members on Meteorological Service Delivery. The 45th China Study Tour jointly organized by CMA and WMO (15-22 October 2015) was attended by officials from 12 NMHSs(including those from Iran, Thailand, Nepal, Pakistan, Myanmar, Sri Lanka, Bangladesh, Tajikistan, Maldives, Vietnam). Participants were high impressed by the meteorological service delivery.

Report on the RA II Pilot Projects

RA II Pilot Project (1)

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:	<p>Short-term:</p> <ol style="list-style-type: none"> (1) To promote sharing of experience and expertise in post-processing of NWP products, modelling and data assimilation; (2) To assist recipient Members in accessing and using NWP products <p>Long-term:</p> <ol style="list-style-type: none"> (1) To assist NMHSs in Region II in development and operation of NWP model and data assimilation systems; (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) 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.
Deliverables:	<ol style="list-style-type: none"> (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 (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) <i>e.g.</i> targeted observation and data assimilation for tropical cyclones, post-processing of ensemble prediction systems output for probabilistic and extreme weather event forecast. (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

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RA II Pilot Project (2)

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:	<p>Short-term:</p> <p>(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.</p> <p>Long-term:</p> <p>(1) To contribute to the successful implementation of GFCS by sharing information mentioned above;</p> <p>(2) To support the consideration of future work to facilitate the utilization of climate information.</p>
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:	<p>(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.</p> <p>http://ds.data.jma.go.jp/tcc/pilot/</p>
Project Links:	http://ds.data.jma.go.jp/tcc/pilot/
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 :	
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RA II Pilot Project (3)

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:	<p>Short-term:</p> <ol style="list-style-type: none"> (1) To share experience among NMHSs in setting up and operating AMDAR programme; (2) To conduct best practice workshop(s) on the setting up of AMDAR programme; (3) To share experience among NMHSs on the application of AMDAR data, including in aerodrome forecast and in forecast for the Terminal Area; (4) To assist NMHSs in Region II, especially developing country Members, in establishing their own AMDAR programme; (5) To assist NMHSs in Region II in decoding, processing and visualization of AMDAR data; <p>Long-term:</p> <ol style="list-style-type: none"> (1) To promote sharing of AMDAR data from different AMDAR programmes; (2) To promote the application of AMDAR data in Terminal Area Forecast and Service (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; (4) To identify and explore means to optimize the collection of AMDAR data;
Partners/Participants:	China Meteorological Administration (CMA) (Co-coordinator) Civil Aviation Administration of China(CAAC) (Co-coordinator) 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
Deliverables:	<ol style="list-style-type: none"> (4) Survey report on RA II Members' readiness to collect and apply AMDAR data (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 (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: Name: Organization: Address: Telephone: Fax: E-mail:	Mr. Xu Jiangliang Civil Aviation Administration of China Deyuanjiuhe Plaza , Hongyan Road , Chaoyang District, Beijing, China 8610-87922183 8610-87922084 xujl@atmb.net.cn
Contact Person2: Name: Organization: Address: Telephone: Fax: E-mail:	Mr. Zhang Qiang ¹ China Meteorological Administration, CMA 46 Zhongguancun Nandajie, Haidian District, Beijing, China +86 10 68407032 +86 10 62173225 zhangq@cma.gov.cn
Contact Person3: Name: Organization: Address: Telephone: Fax: E-mail:	Mr. Choy Boon-leung Hong Kong Observatory 134A Nathan Road, Tsim Sha Tsui, Kowloon, Hong Kong, China +852 2926 8350 +852 2375 2645 blchoy@hko.gov.hk

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

RA II Pilot Project (4)

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:	<p>Short-term:</p> <ol style="list-style-type: none"> (1) To identify the current capacity and limitations in NMHSs in providing medium range weather forecasts; (2) To identify reliable sources of NWP products to support NMHSs in providing medium range weather forecasts; (3) To explore and identify means on post-processing of NWP products to better support NMHSs in providing medium range weather forecasts; <p>Long-term:</p> <ol style="list-style-type: none"> (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; (2) To identify methods and assist NMHSs in verification and validation of NWP-based weather forecasts; (3) To promote sharing of experience in NWP product application, post-processing techniques among RA II Members especially developing country Members; (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) 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.
Deliverables:	<ol style="list-style-type: none"> (1) Survey report on RA II Members' readiness to apply NWP products and post-processing methods in providing medium range weather forecasts; (2) Where possible, training workshop on the application of NWP models and post-processing methods for medium range weather forecasts; (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

	<p>products.</p> <p>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.</p> <p>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.</p>
Date of Last Update:	19 November 2016
<p>Contact Person 1:</p> <p>Name:</p> <p>Organization:</p> <p>Address:</p> <p>Telephone:</p> <p>Fax:</p> <p>E-mail:</p> <p>Contact Person 2:</p> <p>Name:</p> <p>Organization:</p> <p>Address:</p> <p>Telephone:</p> <p>Fax:</p> <p>E-mail:</p>	<p>Mr. WONG Wai Kin</p> <p>Hong Kong Observatory</p> <p>134A Nathan Road, Tsim Sha Tsui, Kowloon, Hong Kong, China</p> <p>+852 2926 8416</p> <p>+852 2375 2645</p> <p>wkwong@hko.gov.hk</p> <p>Mr. SHIN Hyun Cheol</p> <p>Korea Meteorological Administration</p> <p>61 Yeoeuidaebang-ro 16-gil, Dongjak-gu Seoul 156-720, Korea</p> <p>+82-2-2181-0544</p> <p>+82-2-2181-0908</p> <p>sinhyo@korea.kr</p>

RA II Pilot Project (5)

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:	<p>First phase:</p> <ul style="list-style-type: none"> (1) To share experiences in data formats for tropical cyclone warnings/advisories among RA II Members; (2) To identify challenges to be solved for converting tropical cyclones warnings/advisories of RA II Members into a common data format; (3) To seek potential benefits from using a common data format for tropical cyclone warnings/advisories; <p>Second phase after completing first phase:</p> <ul style="list-style-type: none"> (1) To assess the feasibility of developing a common data format for severe weather warnings/advisories by RA II Members; (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:	<ul style="list-style-type: none"> (1) Survey report on data format of tropical cyclone warnings/advisories currently in use by RA II Members (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: Name: Organization: Address: Telephone: Fax: E-mail:	<p>Mr. Cheng Yuen-chung Armstrong Hong Kong Observatory 134A Nathan Road, Tsim Sha Tsui, Kowloon, Hong Kong, China +852 2926 8358 +852 2311 9448 yccheng@hko.gov.hk</p>

**WMO Regional Association II (Asia)
DRAFT FINAL REPORTS of WORKING GROUPS**



DECEMBER 2016

LIST OF DRAFT FINAL REPORTS OF THE RA II WORKING GROUPS

ANNEX IV-1 Report of the RA II Working Group on Weather Services

ANNEX IV-2 Report of the RA II Working Group on Climate Services

ANNEX IV-3 Report of the RA II Working Group on Hydrological Services

ANNEX IV-4 Report of the RA II Working Group on WMO Integrated Global Observing System and WMO Information System

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

B.L. Choy
Hong Kong Observatory

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 2015-16.

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 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;

4. Membership

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
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-Coordinator	Mr Lap-shun Lee	Hong Kong, China
	Dr Muhammad Hanif	Pakistan
	Dr Evgeny 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)

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):
 - “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
 - “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 staff 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:
 - training of internal auditors at specialized education centers in accordance with QMS programs compliant with the ISO 9001:2015 requirements;
 - alignment of documented procedures and Regulations on QMS with the ISO 9001:2015 requirements;
 - conduct of internal audits at subdivisions in order to control QMS AMS preparedness to ISO 9001:2015 and certification audits;
 - 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)

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 and IV-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 heavy 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)

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. 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.

SURVEY QUESTIONS

Regarding Emergency Response Activities (ERA) in Regional 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:

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.

2.2.1 User satisfaction

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

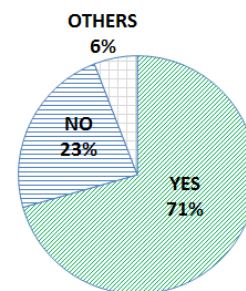
A total of 12 Members (71%) reported "yes" to this question. Some of such Members planned to use the services in the future, while others indicated specific current usage in their domestic coordination. Four Members (23%) reported not using RSMC products.

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

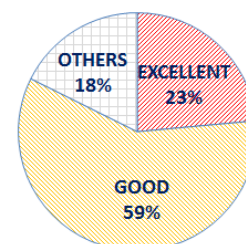
A total of 10 Members (59%) rated the current ERA service as good, and 4 (23%) rated it as excellent. No ratings of fair, not good, or poor were given. Accordingly, the overall level of satisfaction with the current service can be taken as good or higher. It should be noted that negative answers from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



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



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

coordination. The data suggest that the majority of current service users believe the current exercise frequency is generally appropriate.

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 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.

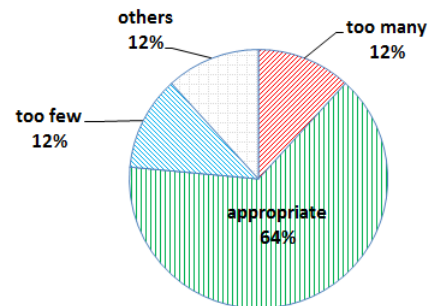
2.2.3 Service Provision Measures

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

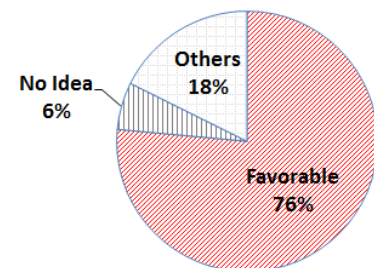
CBS has focused on a gradual migration from facsimile transmission to email and web based services for ATDM prediction. This question probed user preferences regarding service provision measures. A total of 8 Members (47%) reported no longer needing facsimile transmission, while 7 respondents (41%) indicated 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?

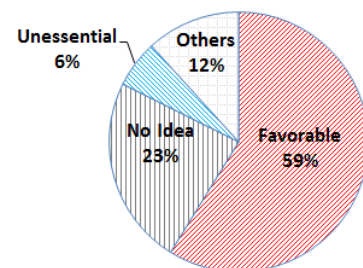
A total of 11 Members (65%) responded that the service through the common – mirrored web pages is good, with 2 (12%) giving a rating of “excellent.” Overall satisfaction with the current web service appeared high. It should be noted that one of the respondents opted for two alternative options, and was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



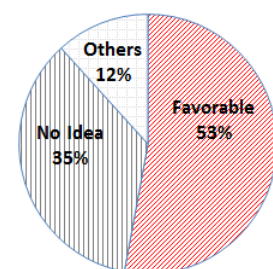
2 c) What does your organization think regarding the current exercises on the EER service?



3.a.i) Time of Arrival products



3.a.ii) Fixed legend products



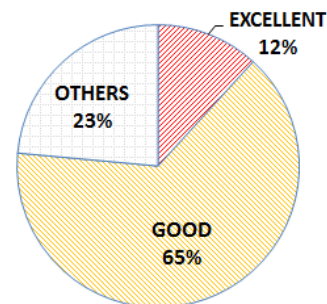
3.a.iii) Transfer Coefficient Matrix analysis with the ATDM model ensemble

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.



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

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.

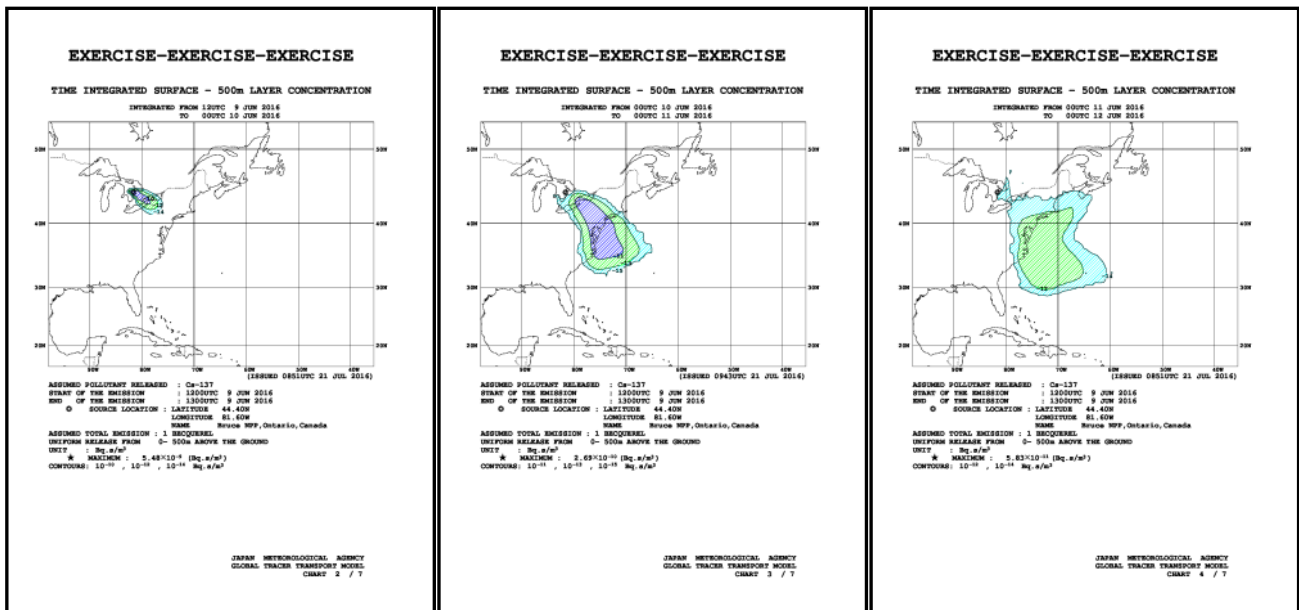
ToA presents a different perspective, and is designed to predict the earliest arrival time of a specific air concentration. Details of the product are as yet undecided (e.g., whether concentration should be instantaneous or time-integrated concentration). Presentation of six-hour colored hatched arrival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

2.3.2 Fixed legend products

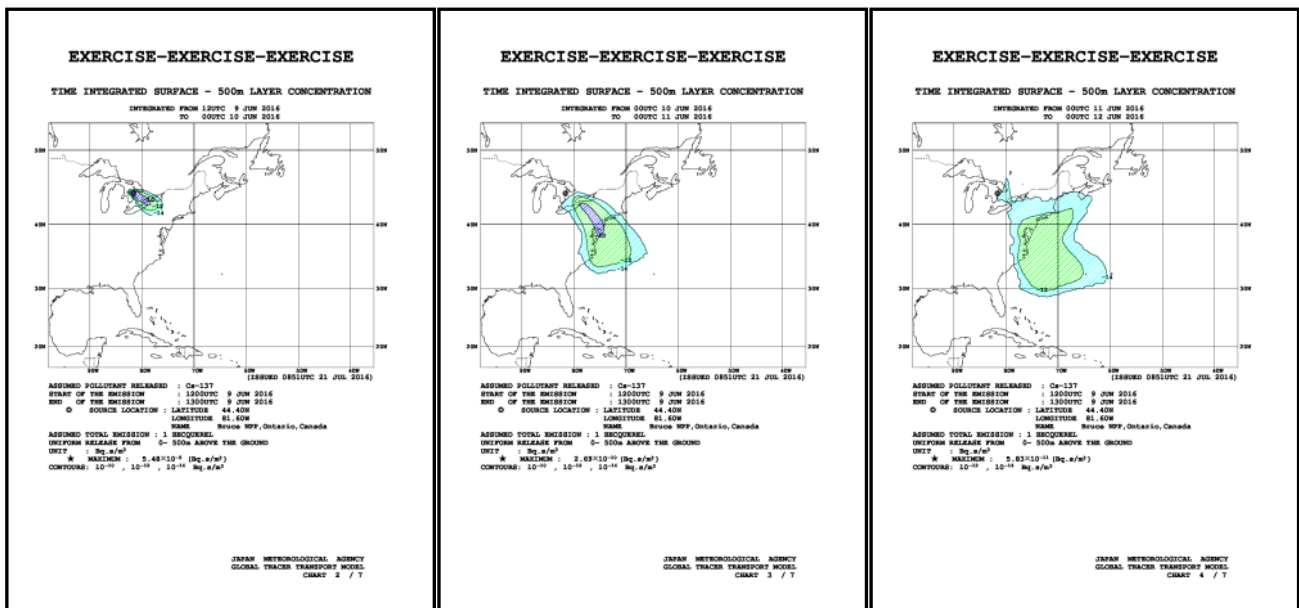
Appendix II-7 of WMO (2010) describes:

“(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/m³ for the left and right panels, but 10^{-11} , 10^{-13} , and 10^{-15} Bq s/m³ 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/m³

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 NWP 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 NWP 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 ATDM 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_fdnp.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.

References

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- WMO, 2015: Seventeenth World Meteorological Congress, Geneva, 25 May – 12 June 2015 *WMO-No. 1157*.
http://library.wmo.int/opac/index.php?lvl=notice_display&id=18648#.WDKgnH3Qhbs

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

Akihiko Shimpo
Chair of the Working Group on Climate Services,
Tokyo Climate Center, Japan Meteorological Agency

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

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

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 (CCI) 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-Coordiators	(~2014) Mr Ryuji Yamada (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-Coordinator	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 (CCI) 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) Agrometeorology 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 (CCI) and RA II activity

The Management Group of the WMO Commission for Climatology (CCI-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 CCI-MG, so that the Chair of WGCS in RA II participated in the meeting. At the meetings, it is recognized that sharing information among CCI 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
FOCRAlI-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
FOCRAlI-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
FOCRAlI-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
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(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 (followed by SASCOF-6)	19-20, April	Dhaka, Bangladesh	IMD	Experts of NHMSs from South Asian countries
International Training Course on Short-term	14-22, May	Beijing, China	RTC Beijing	25 experts of 18 NMHSs including those from 9 Members in RA II

Climate Prediction Methods (followed by FOCRAII-11)				(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	Organizer	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)**

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6	Drought Preparedness and Management Strategies
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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, Sri Lanka, 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 crore 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.

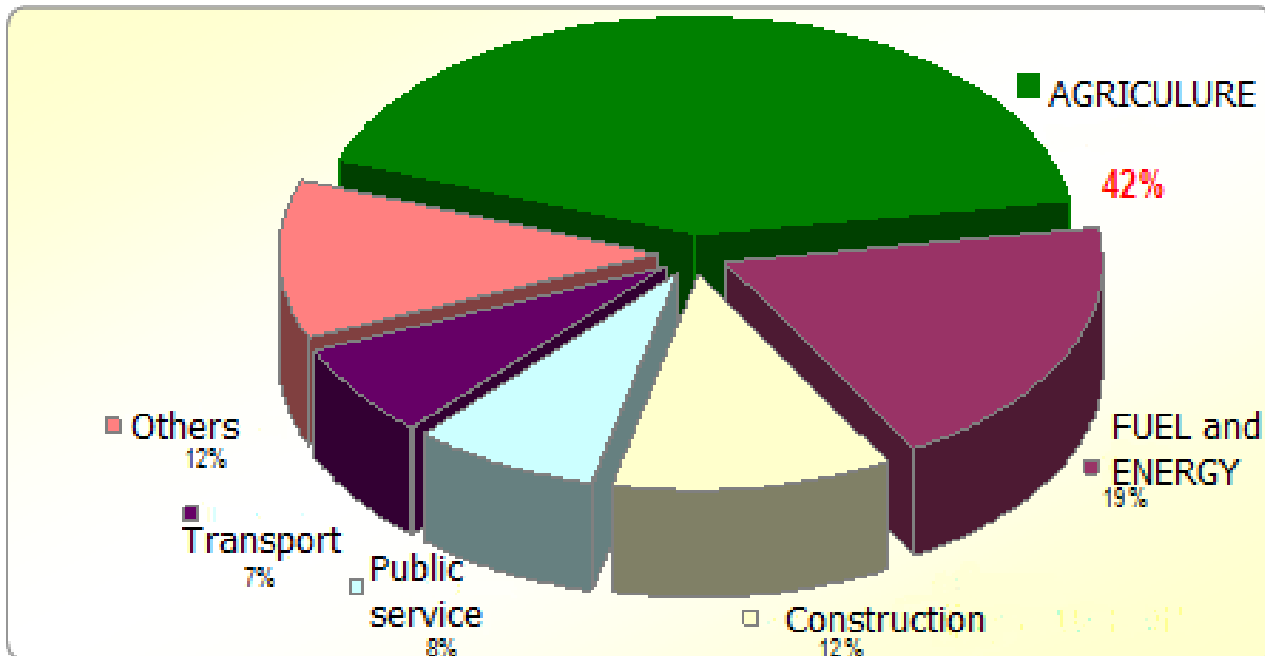


Figure 1 - Distribution of losses from weather

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.

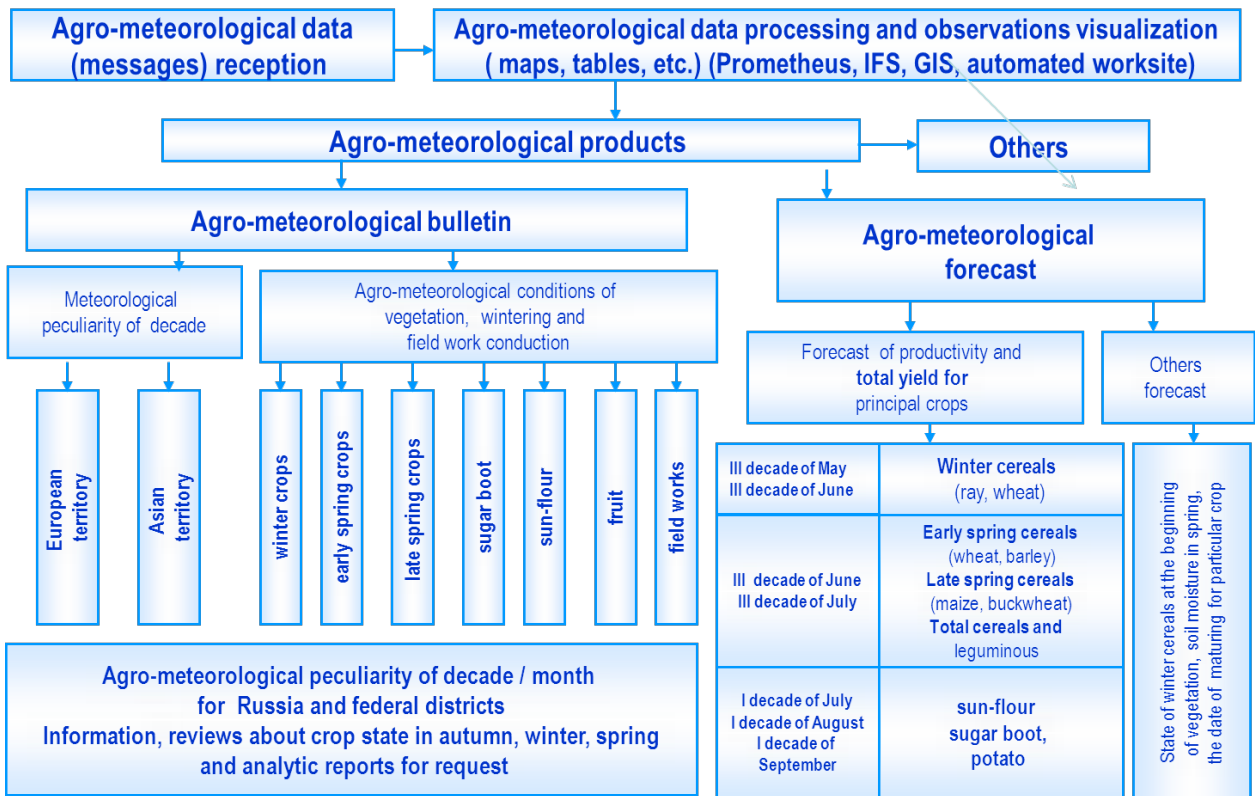


Figure 2 - Agro-meteorological support of Russian agriculture on federal level

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.

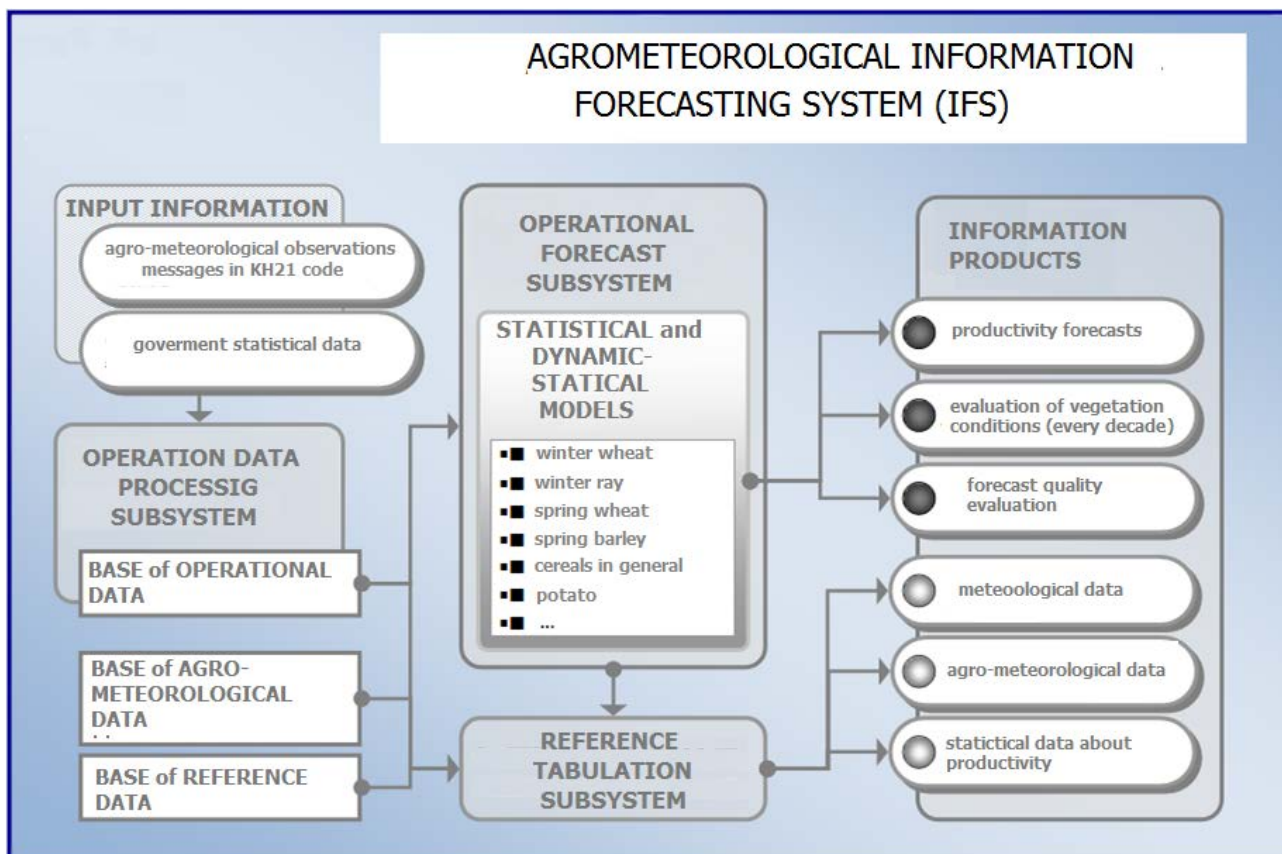


Figure 3 – Agrometeorological information forecasting system (IFS)

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.

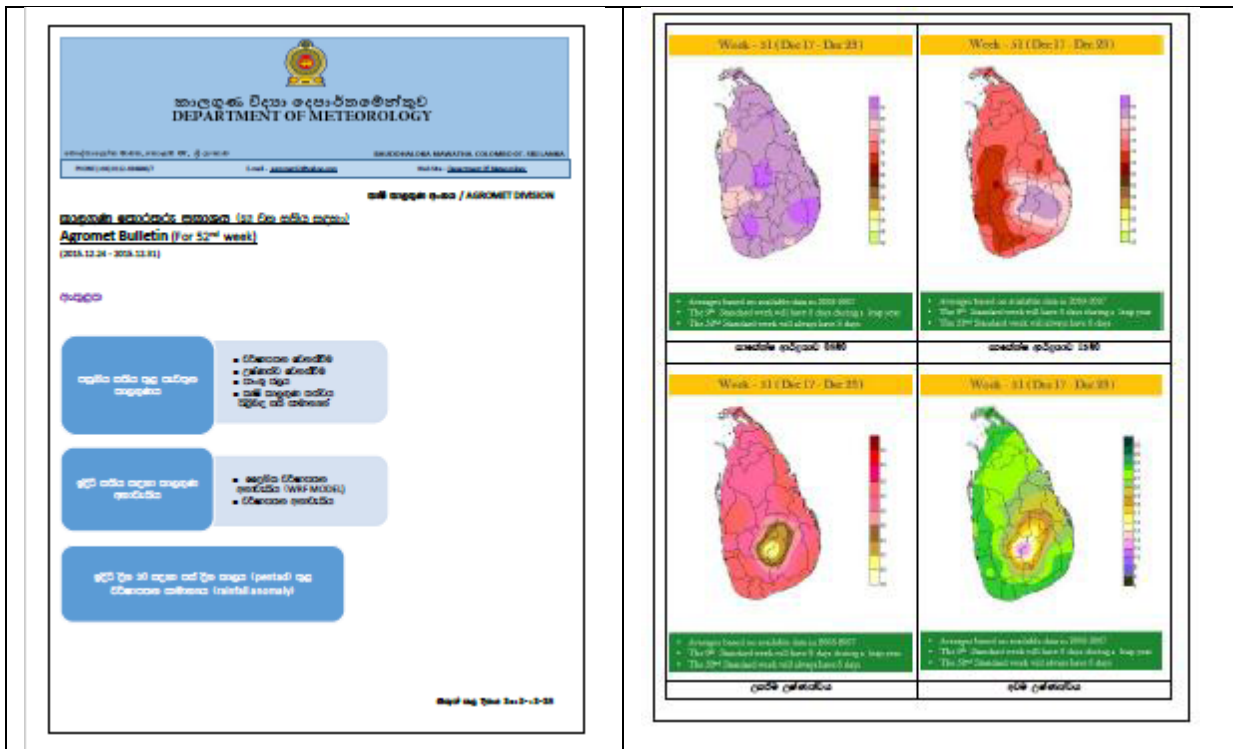


Figure 4. Agro meteorological information in Sri Lanka

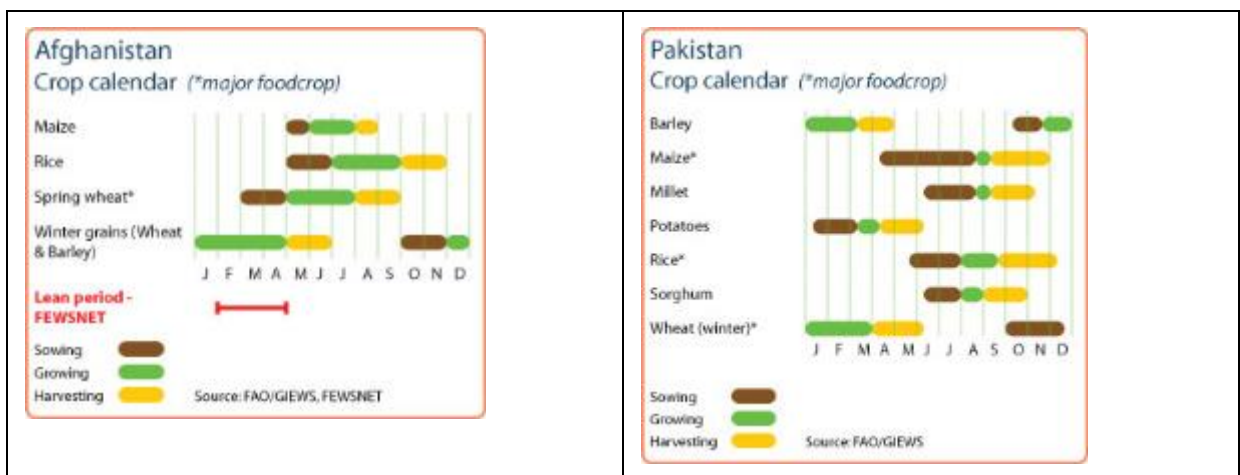
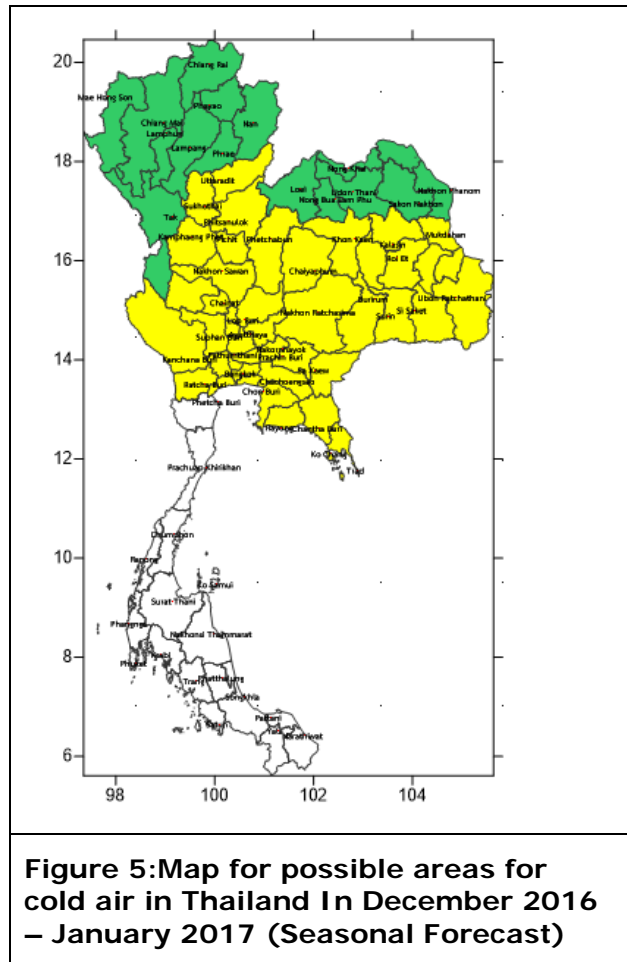
The following recommendations are made to strengthen operational agrometeorological Services in Regional Association II:

- 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.



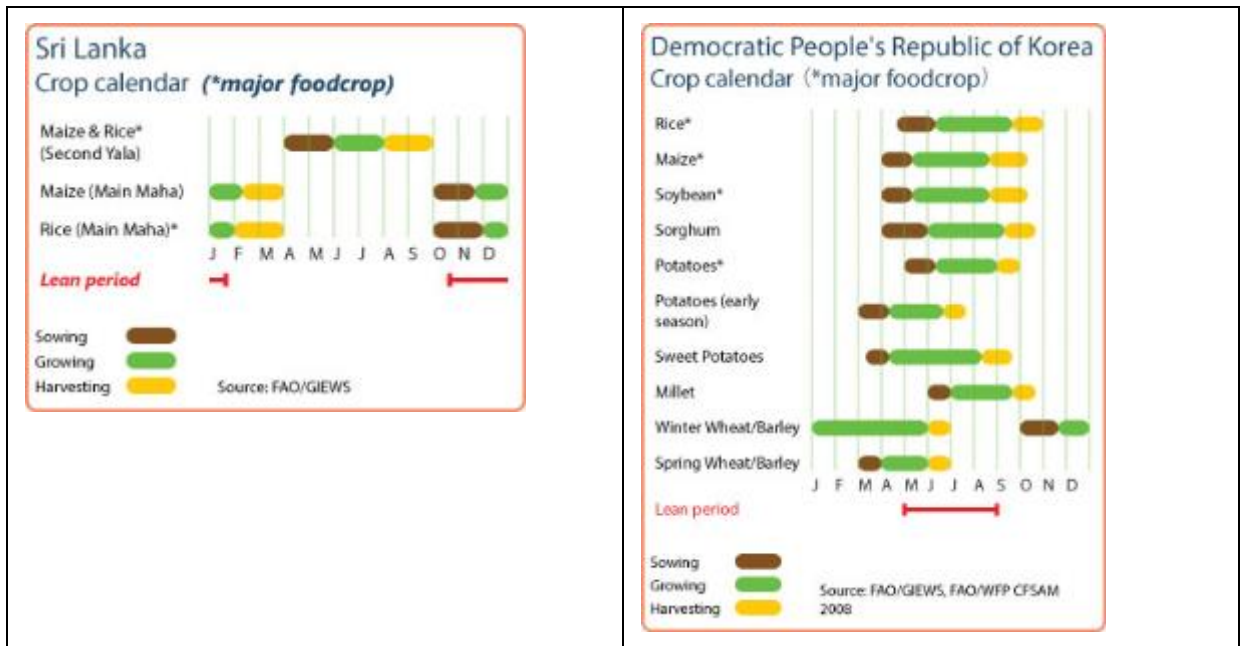


Figure 6: Crop Weather Calenders

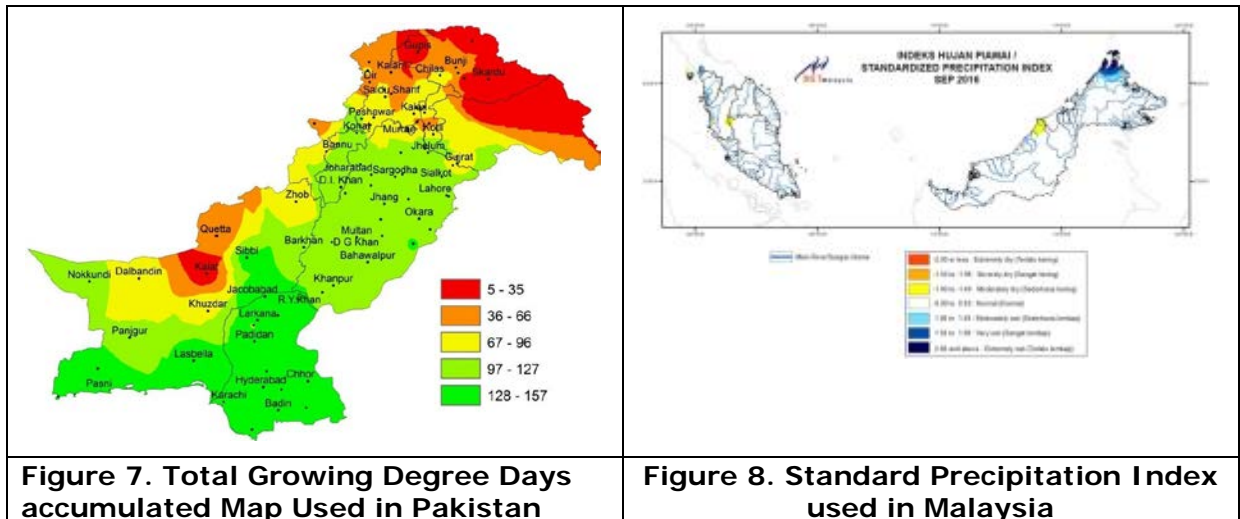


Figure 7. Total Growing Degree Days accumulated Map Used in Pakistan

Figure 8. Standard Precipitation Index used in Malaysia

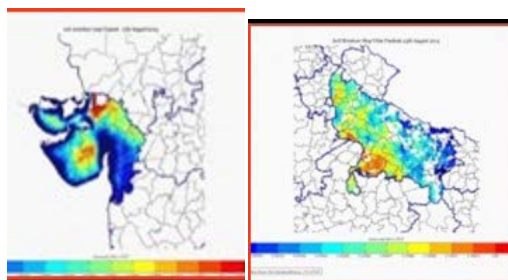


Figure 9: Satellite based Soil Moisture

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 atmospheric drought 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.

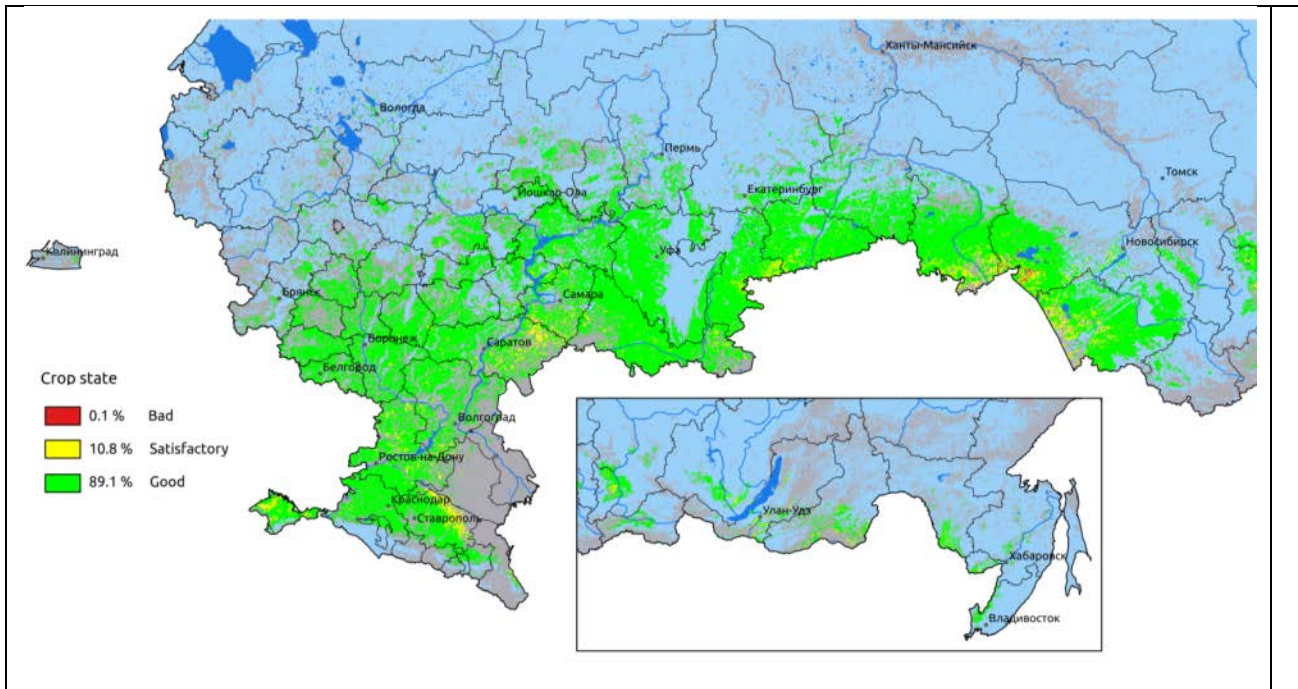


Figure 10 – Crop state at the mid of June 2016

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.

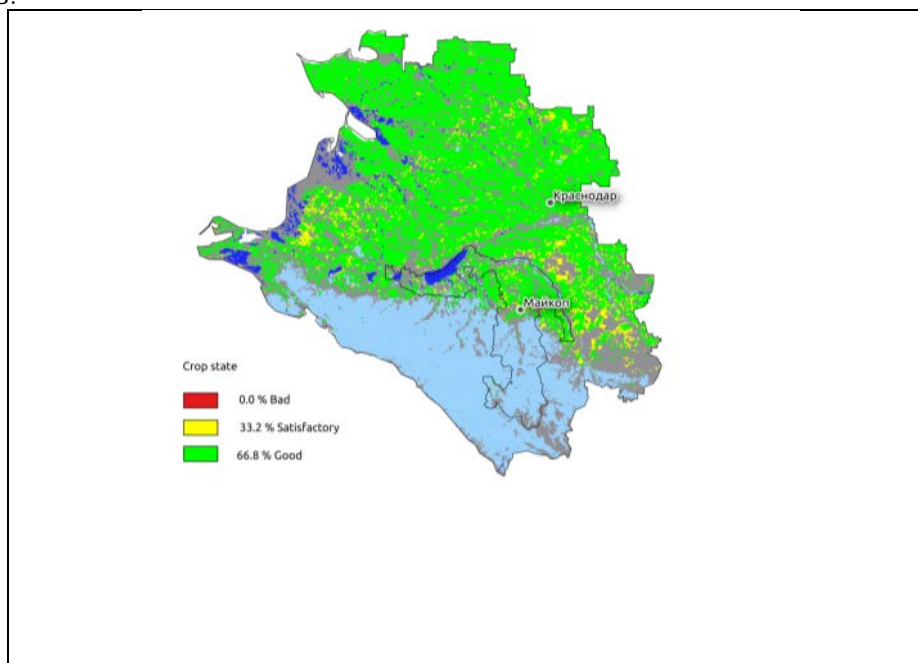


Figure 11 – Crop state at the beginning of June 2016(Krasnodar Krai)

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.

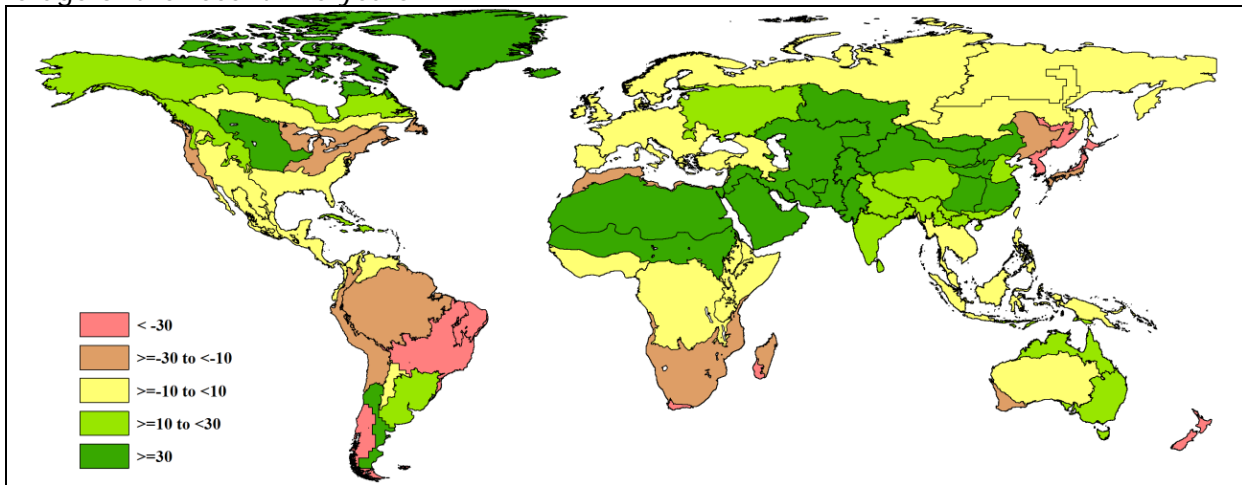


Figure 12 Global map of April-July 2016 rainfall anomaly (as indicated by the RAIN indicator) by MRU, departure from 15YA (percentage)

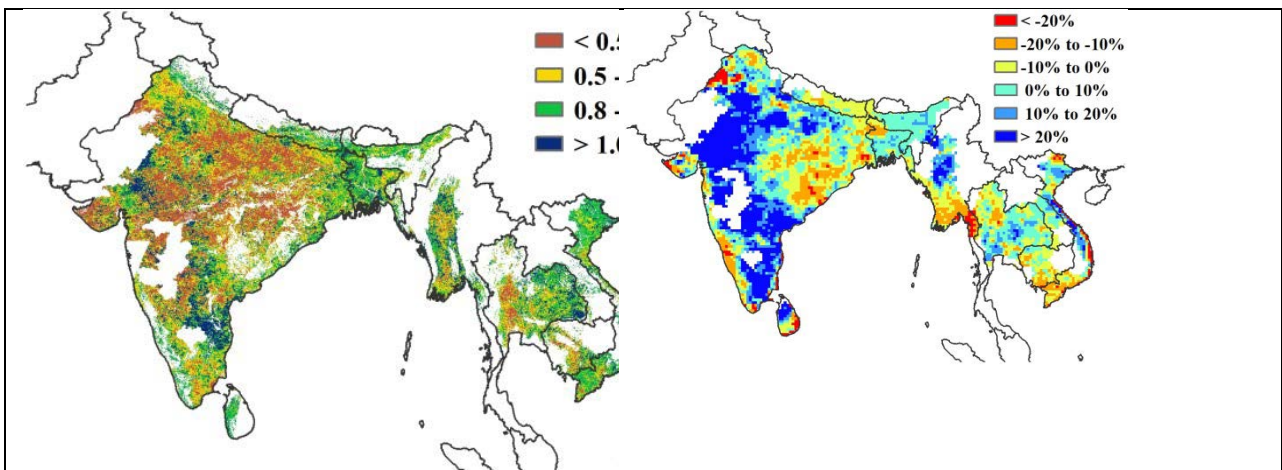


Figure 13. Spatial distribution of rainfall profiles vegetation condition index

Figure 14. Biomass accumulation potential departure

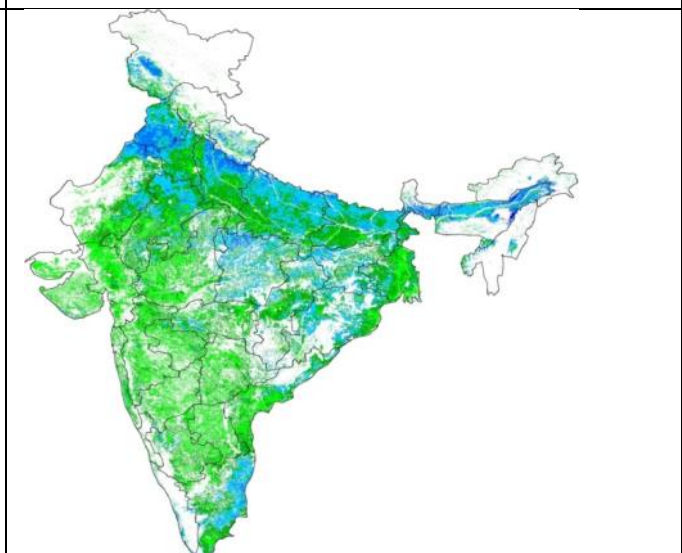
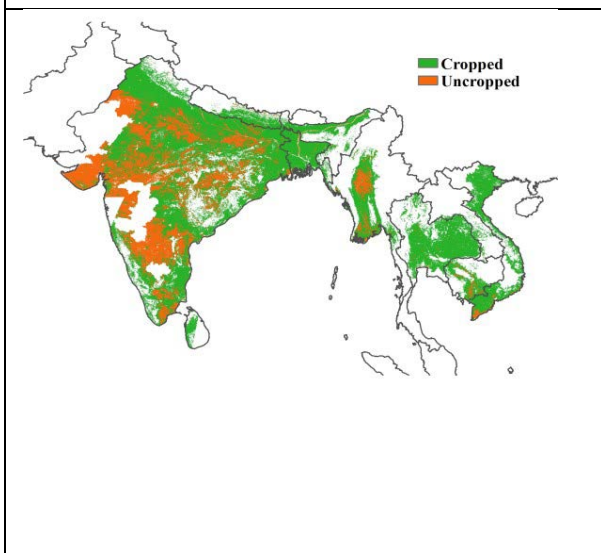


Figure 15. Cropped arable land

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

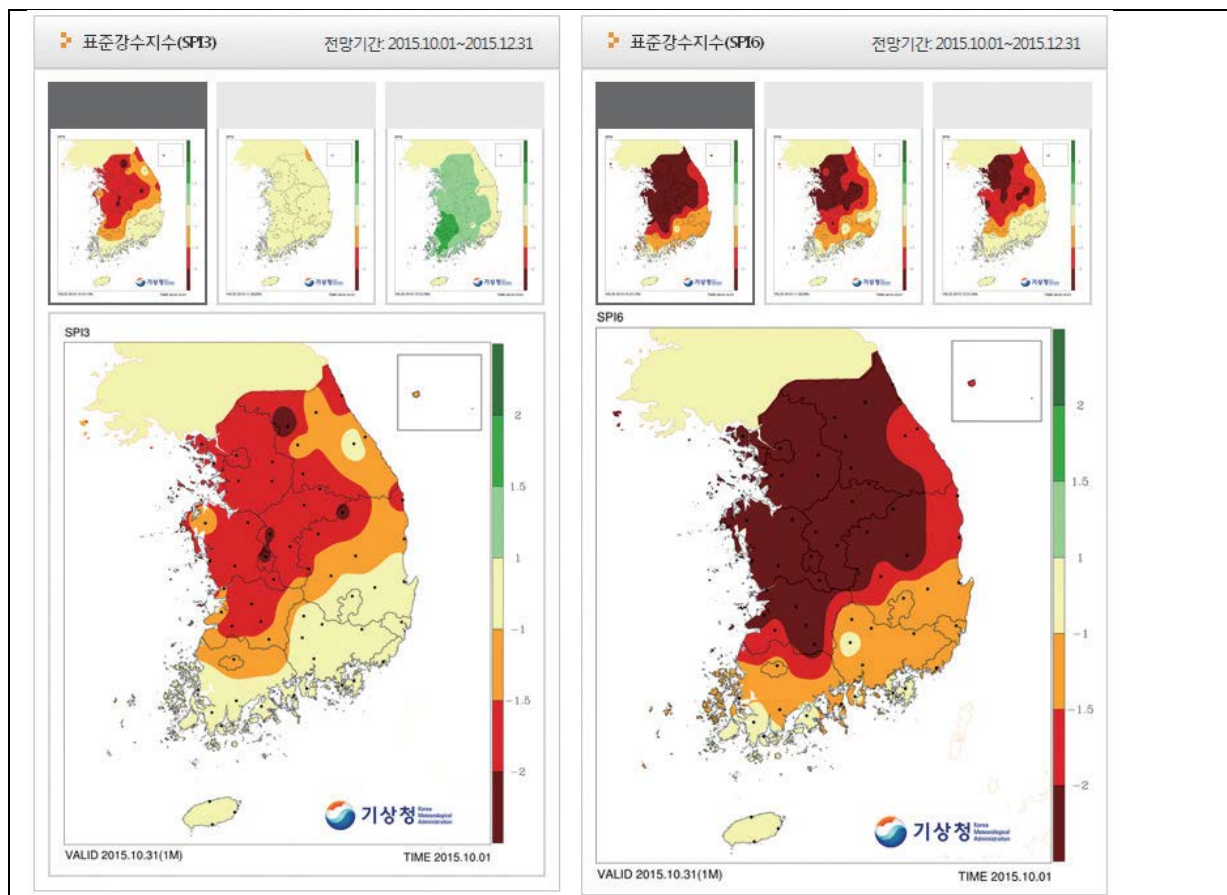


Figure 17. 1-month and 3-month Drought Outlooks of Republic of Korea

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 through 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 through postgraduate specialties: 11.00.07. surface hydrology, water resources, hydrochemistry 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 agro-advisories 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 organized 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 Yield 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 Agrometeorological Organisations/Institutes/Universities in India and other countries. The training would be conducted at Meteorological Training Institute, India Meteorological Department, Dr. Homi Bhabha 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.

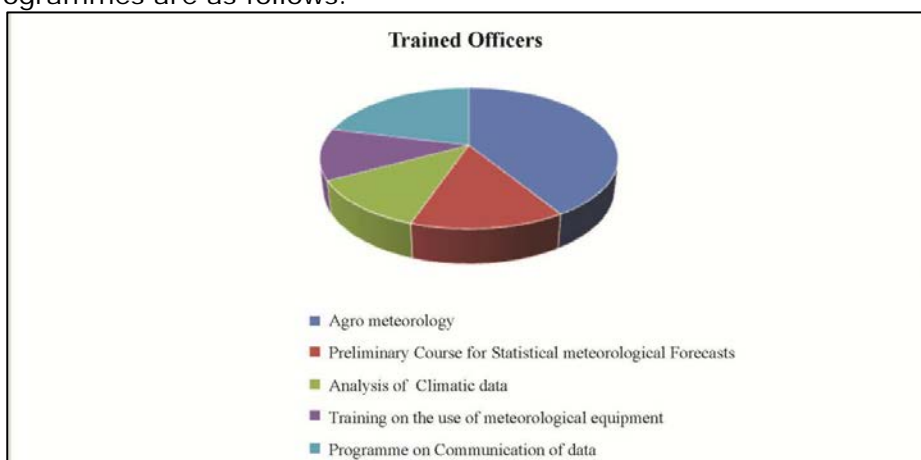


Figure 18. Status of Trained officers

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 issues bulletin based on the climate and seasonal weather forecast of the area or province. They also advise 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 Narendra Modi, 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 International Development (USAID), Washington DC, USA jointly organized international workshop on "Improving Climate Services 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

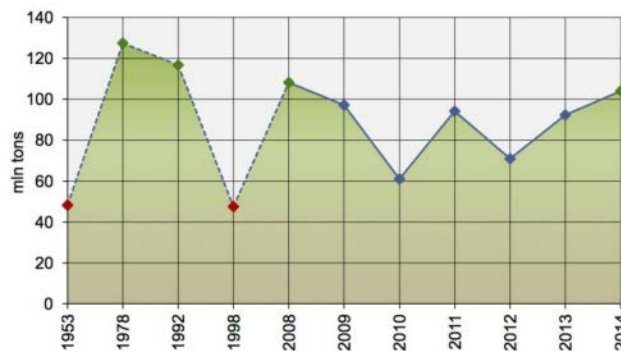


Figure 19 – Total yield of grains and beans in Russia (mln tons)

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 Republks 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, Kyrgyzstan, 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.

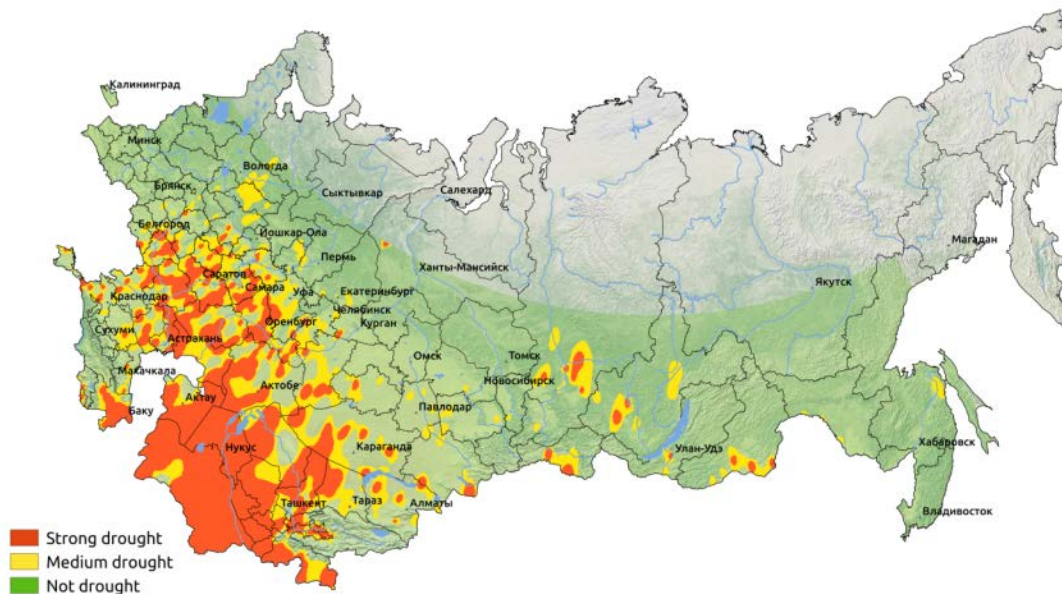


Figure 20– Atmosphere drought at the mid of July 2016

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)

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/hwrrp/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/hwrrp/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**



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1. Opening of The Meeting
 2. Adoption of The Agenda and Organization of Work
 3. Review and Adjustment of Work Programme
 4. Description of Progress Made during the Intersessional Period
 5. Workshop for the Dynamic Water Resources Assessment Tool (DWAT)
 6. Future Work Plan
 7. Adoption of the Report and Closure of the Meeting
- Annex 1 List of Participants - RA II (Asia) Working Group
- Annex 2 Final Meeting Agenda

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 Hajoong 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/hwrrp/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	<ul style="list-style-type: none"> • Represent WGHS as and when required, (eg at MG and EC) • Attend meetings of chairpersons of Working Groups • Other duties as required of chairpersons WGHS (see General Regulation 168 (b)) 	<ul style="list-style-type: none"> • Hydrology and Water Resources issues remain a key aspect of the work of RAII • NMHSs are assisted in fulfilling their roles and responsibilities. • WGHS is adequately represented within the RAII environment. 	<ul style="list-style-type: none"> • Resources are provided to meet the needs of the theme leaders in doing the work of the Working Group. • Secretariat support 	<ul style="list-style-type: none"> • Meetings and other activities according to the WMO Schedule of meetings. • Report at WGHS meetings • Report at MG Sessions • Report to RAII-16 (2016). 	<ul style="list-style-type: none"> • WGHS • RAII • MG • EC 	<ul style="list-style-type: none"> • Attended RA II Management Group meetings • Attended RA II Chairs Meetings (2014, 2015) • 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	<ul style="list-style-type: none"> • Chair theme leaders meetings of the WGHS to develop implementation plan • Report to MG meeting for consultation • Submit report 	<ul style="list-style-type: none"> • WGHS implementation plan 	<ul style="list-style-type: none"> • Resources are provided to meet the needs of the theme leaders in doing the work of the WGHS 	<ul style="list-style-type: none"> • WGHS meeting (Sept. 2014) • WGHS implementation plan (Oct 2014) • Report at MG Sessions for consultation and submit a report to RAII president (2014) 	<ul style="list-style-type: none"> • WGHS • RAII • MG 	<ul style="list-style-type: none"> • Develop WGHS work plan and reported and updated (2013, 2014, 2015, 2016) • 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 Hydrology and other regional Working Groups on Hydrology	<ul style="list-style-type: none"> • Attend EC meeting if required • Develop WGHS work plan in consideration of CHy and other regional WGHS activities • Organize WGHS meeting 	<ul style="list-style-type: none"> • Meeting report • WGHS implementation plan 	<ul style="list-style-type: none"> • Resources are provided to meet the needs of the theme leaders in doing the work of the WGHS 	<ul style="list-style-type: none"> • WGHS meeting (Sept. 2014) • WGHS implementation plan (Oct 2014) • Report at MG Sessions for consultation and submit a report to RAII president (2014) 	<ul style="list-style-type: none"> • WGHS • RAII • MG 	<ul style="list-style-type: none"> • Attended EC65, EC68 • Attend Hydrological Advisors Meeting during EC meeting (2013, 2016) • Report of WGHS and implementation plan
4. To submit to the president	<ul style="list-style-type: none"> • Develop WGHS 	<ul style="list-style-type: none"> • WGHS activity 	<ul style="list-style-type: none"> • Resources are 	<ul style="list-style-type: none"> • Submit annual report 	<ul style="list-style-type: none"> • WGHS 	<ul style="list-style-type: none"> • Organize WGHS

Activities	Actions	Outputs	Resources	Milestones	Linkages	Progress
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	activity report with input from theme leaders	report	provided to meet the needs of the WGHS theme leaders	to RAI president and WMO Secretariat (Dec 2014, Dec 2015) <ul style="list-style-type: none"> • Submit final report to RAI president and WMO Secretariat (2016) 	<ul style="list-style-type: none"> • RAI • WMO 	meetings and submitted report (2013, 2014, 2015, 2016) <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Chairperson • Theme Leaders • RA II Secretariat • CHy 	Not specified	<ul style="list-style-type: none"> • Chairperson • Theme leaders • RA II Secretariat • CHy 	• On-going
3. To review and develop the Hydrological Parts of S.O.P.	Review if required	Review report	<ul style="list-style-type: none"> • RA II strategic operation Plan • 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	<ul style="list-style-type: none"> • Theme Leaders reports in RA II • CHy report 	Submission of report by 2016	RA II WGHS 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 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)	<ul style="list-style-type: none"> 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) 		<ul style="list-style-type: none"> RA II 		<ul style="list-style-type: none"> RA II CHy 	
2. Assessment of basin-wide water resources availability, including use of climate predictions (3.3.2)	<ul style="list-style-type: none"> Set up knowledge base to adapt to changes in water resources availability (trends, outlook) (Priority A) 	<ul style="list-style-type: none"> Report related to the case studies 	<ul style="list-style-type: none"> RA II Research documents Han River Flood Control Office(HRFCO), Ministry of Land, Transport and Infrastructure(MOLIT), Republic of Korea Korea Institute of Civil engineering Technology (KICT), Republic of Korea 	<ul style="list-style-type: none"> Develop new system by Dec 2016 Collection case studies by the end of 2016 Evaluate model performance by Dec 2016 Final case study report on new model in Jan. 2017 	<ul style="list-style-type: none"> RA II AWG 	<ul style="list-style-type: none"> Case studies being collected 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)	<ul style="list-style-type: none"> Provide guidance materials for WRA linking to Climate extended range prediction <ul style="list-style-type: none"> Downscaling monthly and seasonally prediction WRA models WRA (Priority B) 	<ul style="list-style-type: none"> Guidance for WRA 	<ul style="list-style-type: none"> China Korea 	<ul style="list-style-type: none"> Provide draft technical report by the end of 2016 Provide draft technical manual of Dynamic Water Resources Assessment Tool by the end of 2016 Provide Final user's Guidance of DWAT system by the end of in Mar.2017 	<ul style="list-style-type: none"> RAII 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)	<ul style="list-style-type: none"> Provide training material for a training course related to the advances in WRA: <ul style="list-style-type: none"> Downscaling methods for extended range prediction Data collection WRA methods WRA Information system (Priority B or C)	<ul style="list-style-type: none"> Training Course 	<ul style="list-style-type: none"> WMO Regional Training Center in Nanjing 	<ul style="list-style-type: none"> 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)	<p>(a) To prepare recommendations on the use of numerical weather prediction outputs in flood forecasts (Priority A)</p> <p>(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)</p> <p>(c) Use WMO FFI as platform [for a and b above] (Priority A)</p> <p>(d) Organize training course for Members (Priority C)</p> <p>(e) Organize training course for Members (Priority C)</p>	<p>(a) Recommendations on the use of NWP outputs in flood forecasting systems</p> <p>(b) Document on the approaches to establishing the deterministic error in NWP outputs and for their use in establishing enhanced accuracy of hydrological forecasts</p>	HMC of Russia	<p>(a) Gathering of background material and documents on the FFI and associated activities - January 2015</p> <p>Preparation of Draft Recommendations – June 2015</p> <p>(b) Gathering of materials - September 2015</p> <p>Preparation of Draft Report on procedures – February 2016</p>	OPACHE's International Flood Initiative - WMO	<p>At the 26/10/2016</p> <ol style="list-style-type: none"> <i>Recommendations for the development of forecast methods for the spring floods forecasting on the base of meteorological information (the experience of Roshydromet)</i> – S.Borshch, A. A. Gelfan, Y. Motovilov, Kristoforov, Y. Simonov, V. Belchikov, C. Leontieva and others, - Moscow, 2016, 65 p. (in Russian) <i>Guidelines for verification of hydrological forecasts.</i> – S.Borshch, A. Khristoforov, C. Lieontieva. – Moscow, 2016, 84 p. (In English) <i>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.</i> 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. <i>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.</i> – S. Borshch, A. Khristoforov, Y. Simonov and others. – Moscow, 2016, 81 p. (in Russian)
2. Issuance of flood, flash and urban warnings and constantly	(a) To document experiences in the use of the Flash Flood Guidance System	(a) Report documenting experiences, including recommendations on approaching	(a) Working meeting with hydrologists	(a) Background material and documents on the FFGS and associated	NMHSs OPACHE's WMO Hydrological	1. <i>Flood forecasting and early warning system for rivers of the Black Sea shore of Caucasian region and the Kuban river basin</i> (S.V.

<p>improving upon them (2.2.5)</p>	<p>(FFGS) in various countries by reviewing use of the Flash Flood Guidance System (FFGS) in the various countries (Priority A)</p> <p>(b) To investigate the potential use of FFGS in Central Asian countries and facilitate its understanding by operational hydrologists in the region (Priority A)</p> <p>(c) To develop recommendations on use of hydrological forecasts (including probabilistic forecasts) in flood management (Priority A)</p> <p>(d) Develop user-oriented flood forecasting products (Priority C)</p> <p>(e) Conduct mission visit(s) to Members in developing countries or least developed countries (Priority C)</p>	<p>implementation of FFGS and its use</p> <p>(b) Recommended path forward for advancing the adoption of the FFGS in Central Asia.</p> <p>(c) Conduct kick-off meeting of senior meteorologists and hydrologists within Central Asia on the FFGS project</p> <p>(d) Report containing recommendations on use of hydrological forecasts (including probabilistic forecasts) in flood management, based on experiences of Roshydromet</p>	<p>and meteorologists of the Central Asia countries on use the FFGS in operative hydrological practice</p> <p>(b) Funding for kick-off meeting for Central Asia FFGS</p>	<p>activities - April 2015</p> <p>Preparation of Draft Document – June 2015</p> <p>(b) Discussions with potential collaborating NMHSs in Central Asia - March 2015</p> <p>Preparation of Draft Recommendations – March 2015</p> <p>Conduct kick-off meeting - May 2015</p> <p>(c) Report prepared by February 2016</p>	<p>Research Center in San Diego (USA)</p>	<p>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)</p> <p>Main aspects, methodology, principles 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.</p>
<p>3. Improvement in capacity for water-related disaster management (hydrological extremes) [with theme on hydrological droughts] (2.1.3)</p>	<p>(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</p>	<p>(a) Increased capacity for water-related disaster management</p>	<p>(a) Resources to conduct necessary workshop(s) through collaboration with APFM and IDMP</p>	<p>Training session on Integrated Flood Management dealing with development of community capacity - July 2016</p> <p>Training session on Integrated Drought Management dealing with development of community capacity</p>	<p>APFM IDMP NMHSs WMO</p>	

	and disaster management groups] (Priority B)			- November 2016		
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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: <ul style="list-style-type: none"> - Collection, analysis and systematization of data to identify indicators for the determination of the onset of hydrological droughts - Identify the types of Hydrological drought is characteristic of the Asian region - Study of the conditions of formation of hydrological drought (Priority A) 	<ul style="list-style-type: none"> • Report on the Indicators for the determination of the onset of hydrological droughts 	<ul style="list-style-type: none"> • Centre of Drought Monitoring of Uzbekistan • Uzbekistan experts • Materials for IDMP • Materials for HMNDP 	<ul style="list-style-type: none"> • Preparing of the data and information to develop indicators for the determination of the onset of hydrological droughts - Oct 2015 • Draft Report – Dec 2015 • Report – November 2016 	<ul style="list-style-type: none"> • OPACHE's • WGHS • RAI • WMO 	<ul style="list-style-type: none"> • Report prepared on review of potential drought indices leading to selection of Pedyu 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. • 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. • 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. • 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 : <ul style="list-style-type: none"> - Gathering information about the status of drought monitoring networks in Asian region - Identification of gaps and needs of the national hydrometeorological services to improve the drought monitoring networks (Priority B) 	<ul style="list-style-type: none"> • Guidance materials for the development of drought monitoring networks 	<ul style="list-style-type: none"> • WGHS RAI • OPACHE Uzbekistan experts • Materials for IDMP • Materials for HMNDP 	<ul style="list-style-type: none"> • Information for the development of drought monitoring networks – April 2016 • Draft Report – November 2016 	<ul style="list-style-type: none"> • OPACHE's • WGHS • RAI • WMO 	<p>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 in the region.</p>

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
<p>1. Improvement in adaptation capacity of water resources systems in a changing climate (2.1.2)</p> <p>2. Assessment of basin-wide water resources availability, including use of climate predictions (3.3.2)</p> <p>3. Improvement in capacity for water-related disaster management (Hydrological extremes) (2.1.3)</p>	<p>1) Assessment of changes in climate</p> <ul style="list-style-type: none"> - Data and method of climate study: Data inventory, climate variables, methods – (Priority A) - Trend of some climate variables: temperature, rainfall and other extremes – (Priority A) - Changes in atmospheric circulation affecting climate extreme: e.g., Monsoon, typhoon and tropical depression, El Nino and Southern Oscillation – (Priority C) - Change in climate affecting natural physical environment: e.g., drought, extreme rainfall, flood, sea water level – (Priority C) 	<p>Assessment report on climate change for participating countries</p>	<ul style="list-style-type: none"> • WGHS • WMO Secretariat • NHRI, China • CMA, China • IMHEN, Vietnam • Other countries 	<ul style="list-style-type: none"> • Report to be submitted (May 2015) • Reports to: AWG-II • Documents as required • Workshop if needed 	<p>WGHS RA2 WMO Secretariat CHY</p>	<ol style="list-style-type: none"> 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. 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) 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) 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 5. Journal papers are as follows: <ul style="list-style-type: none"> • 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. <i>Advances in Meteorology</i>. http://dx.doi.org/10.1155/2016/7986568 • Binqun Li, Zhongmin Liang, Jianyun Zhang, and Guoqing Wang. 2016. A revised drought index based on precipitation and pan evaporation. <i>International Journal of Climatology</i>. DOI: 10.1002/joc.4740 • Guoqing Wang, Cuishan Liu, Sicheng Wan, Zhenxin Bao and Yanli Liu. 2016. Variability in stream flows of the Xiang River in a changing climate. <i>Int. J. Global Warming</i>. http://www.inderscience.com/info/ingeneral/forthcoming.php?jcode=ijgw • G.Q. Wang, J.Y. Zhang. 2015. Variation of water resources in the Huang-huai-hai areas and adaptive strategies to climate change. <i>Quaternary International</i> 380-381 (2015) 180-186. http://dx.doi.org/10.1016/j.quaint.2015.02.005 <p>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. <i>Journal of Geophysical Research: Atmosphere</i>, 2014, 119(19): 11250-</p>

Activities	Actions	Outputs	Resources	Milestones	Linkages	Progress
						11271
	2) Conduct climate projections – (Priority A) - Statistical downscaling - 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) 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
	3) Assessment of potential hydrological impacts of climate change on water resources of some selected river basins – (Priority A) - Temperature - Rainfall - Evapotranspiration - Flood and inundation - Drought - 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 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 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 4. Journal papers are as follows ● 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 ● 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 ● 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 Guoqing Wang, Jianyun Zhang, Junliang Jin, Josh Weinberg, Zhenxin Bao, Cuishan Liu, Yanli Liu, Xiaolin Yan, Xiaomeng Song,

Activities	Actions	Outputs	Resources	Milestones	Linkages	Progress
						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) • Case study for a selected	Report of case study		Report to be submitted (Feb 2016)		1. <i>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)</i> <i>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)</i>
4. Development of national and regional capacity building programmes and related training activities for hydrological service (3.3.4)	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 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. 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)	<p>a) Provide guidance on the use of appropriate instruments and methods of observation in diverse conditions (Priority A)</p> <ul style="list-style-type: none"> • Collection of existing technical information in IRDMIS <ul style="list-style-type: none"> ➢ Measurement instrumentation (ADVM) ➢ Methods of discharge calculation ➢ Construction and operation of IRDIMS • Case study on measurement by IRDMIS (52 sites) <ul style="list-style-type: none"> ➢ Measurement of tidal influenced discharge ➢ Measurement under backwater conditions caused by weirs, sluice gates, and river junctions ➢ Evaluation of measurement results ➢ Development of index velocity ratings • Writing Technical report about construction and management by field characteristics 	<ul style="list-style-type: none"> • Technical report of related to IRDIMS With case studies in various conditions • Collection of the existing technical information of IRDIMS • Development for index rating • Installation and operation • Procedure on development of index rating • Development of Software tools to develop index rating 	- Republic of Korea(ROK)	<ul style="list-style-type: none"> • Technical report and guideline with case studies • Software System (EDpad, MCDpad) 	CHy - ROK	Translating Korean technical report into English version - <i>Technical information of IRDIMS</i> - <i>Installation and operation</i> - <i>Discharge calculation including development of index rating</i> - <i>Software tool for development of index rating</i> - <i>Case study on various conditions</i> <i>1st draft by DEC 2016</i> <i>Final ver. will be completed by Feb 2017</i> Development of Software tools have been completed,

Activities	Actions	Outputs	Resources	Milestones	Linkages	Progress
						and its manual will be ready by DEC. 2016
	b) Improve sediment measuring techniques (Priority B) <ul style="list-style-type: none"> • Collection of existing technical information <ul style="list-style-type: none"> ➢ The status of existing sediment measurement techniques ➢ The status of new technologies and their applications ➢ The status of analysis methods • Case studies on sediment measurements under various conditions (15 - 20 sites) <ul style="list-style-type: none"> ➢ Analysis of river construction effect on characteristics of sediment load, focused on 4 major river projects in Korea ➢ A comparative analysis on sediment load by sequence of rainfall event • Writing Technical report about sediment measurement method and analysis of field characteristics 	<ul style="list-style-type: none"> • Technical report on sediment measurement methods and with case studies in various conditions - Analysis on characteristics of sediment load during rising & falling water level(Loop) - Analysis on river construction effect on characteristic of sediment load, focused on 4major river project in Korea - A comparative analysis on sediment load by sequence of rainfall event. 	- Republic of Korea(ROK)	<ul style="list-style-type: none"> - Provide technical report and guideline with case studies <p>DEC 2016</p>	- CHy - ROK	Translating Korean technical report into English version <ul style="list-style-type: none"> - <i>Technical information of sediment measurement</i> - <i>Case study on sediment measurement various conditions</i> <p>1st draft by DEC 2016 Final ver. will be completed by 2017</p>
	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) <ul style="list-style-type: none"> - Collection of existing technical information <ul style="list-style-type: none"> ➢ On major procedures for rating curve development ➢ On tools for rating curve development - Case analysis with various field conditions <ul style="list-style-type: none"> ➢ On development of rating curves when backwater conditions exist (weir, junctions) 	<ul style="list-style-type: none"> • Report on methods to develop rating curves - <i>Status of flow measurement the past 3 years</i> - <i>Procedure of H-Q rating development</i> - <i>Software tools to develop & to manage of H-Q rating curve</i> - <i>Case study on</i> 	- Republic of Korea(ROK)	<ul style="list-style-type: none"> - Provide Technical report and guideline with case studies <p>DEC 2016</p>	- CHy - ROK	Translating Korean Technical Report into English version <ul style="list-style-type: none"> • <i>Status of flow measurement the past 3 years</i> • <i>Procedure of H-Q rating development</i> • <i>Software tools to develop & manage of H-Q</i>

Activities	Actions	Outputs	Resources	Milestones	Linkages	Progress
	- Writing technical report on rating curve development	<i>development of H-Q rating curve in various conditions and its guideline (backwater by weir, bed change, vegetation)</i>				<i>rating curve</i> <ul style="list-style-type: none"> • Case study on development of H-Q rating curve in various conditions and its guideline • (backwater by weir, bed change, vegetation) • 1st draft by DEC 2016 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
<p>1. Issuance of landslide/debris flow warnings and consistently improving upon them</p>	<ul style="list-style-type: none"> • Collect and disseminate materials for assessment of sediment disasters (Priority A) • Investigate warning technologies based on adaptive concepts (Priority B) • Generate sediment disasters risk map (Priority C) 	<ul style="list-style-type: none"> • Actual example for implementation of adaptive sediment disasters risk management tools with identification, reduction and evacuation 	<ul style="list-style-type: none"> • Republic of Korea (ROK) • National Disaster Management Institute (NDMI) 	<ul style="list-style-type: none"> • Case study report for present systems for sediment disasters management - May 2015 • Analyzing models for the integrating system - Oct 2015 • Report for adaptive sediment risk management tools - Aug 2016 	<ul style="list-style-type: none"> • SOP 2.2.6 • RA II • WMO Secretariat • ROK (MPSS) 	<ul style="list-style-type: none"> • <u>Governmental research reports</u> <ol style="list-style-type: none"> 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) 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) 3. National Disaster Management Institute (2014) Improvement of design element based on empirical experiments, NDMI-PR-2014-07-09-01, 262p. (in Korean) 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) 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) 6. National Disaster Management Institute (2015) Establishment of foundation for regional urban flood response system, NDMI-PR-2014-07-02-01, 156p. (in Korean) • <u>Professional research papers</u> <ol style="list-style-type: none"> 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. 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. 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. 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. 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. 6. Song, Y.K., Kim, Y.U., Kim, K.J., and Lee, K.S. (2016). "Countermeasures on Safety Management of Deceprit Reservoir

Activities	Actions	Outputs	Resources	Milestones	Linkages	Progress
						<i>Based on the Comparative Analysis for Its Collapse Accidents.", Crisisonomy Vol. 12, No. 7, pp. 615-623.</i>
2. Improvement in capacity for sediment disaster management (2.1.3 in OP)	<ul style="list-style-type: none"> Attend seminars on sediment disasters in order to communicate and cooperate among member countries (Priority A) Share and bring related technologies to developing countries (Priority B) 	<ul style="list-style-type: none"> Workshop on the provision of sharing knowledge for sediment disasters (e.g. attend workshop of TC DRR) ODA projects which transplant knowhow to developing countries 	<ul style="list-style-type: none"> Republic of Korea (ROK) National Disaster Management Institute (NDMI) WMO/ESCAP Typhoon Committee, Disaster Risk Reduction (TC DRR) 	<ul style="list-style-type: none"> Report for feasibility survey for ODA projects by April 2016 Attend Workshop of TC DRR on May 2015 Attend International Workshop among Korea, Taiwan, and Japan 	<ul style="list-style-type: none"> SOP 2.1.3 RA II WMO Secretari at TC DRR ROK (MPSS and KOICA) 	<ul style="list-style-type: none"> <u>Governmental research reports</u> <ol style="list-style-type: none"> National Disaster Management Institute (2014) <i>Construction of Forecasting and Warning System for Disaster Mitigation in the Philippines-II</i>, NDMI-ODA-2014-1, 150p. (in Korean and English) National Disaster Management Institute (2014) <i>Regional Peer Learning Forum for Disaster Risk Reduction Capacity Building of Central Asia</i>, NDMI-ODA-2014-02-01, 121p. (in Korean) National Disaster Management Institute (2014) <i>Development of NDMI's Roadmap for Its International Cooperation Work: Through Promoting international research and ODA project</i>, NDMI-PR-2015-03-02-07, 176p. (in Korean) National Disaster Management Institute (2015) <i>Technical applicability analysis on disaster risk reduction technology transfer to strategic priority countries (I)</i>, Disaster risk assessment system in Korea, NDMI-PR-2014-07-02-01, 313p. (in Korean) <u>International cooperation</u> <ol style="list-style-type: none"> Regional forum on space technology applications for drought monitoring and early warning, UN-ESCAP, July 1-2, Colombo, Sri Lanka, 2014. Expert mission for UNESCAP/WMO Typhoon Committee members, Oct. 21-25, 2014. MOA bet. NDMI-ESCAP, Oct. 20-24, 2014. NDMI Regional Peer Learning Forum (PLF) for Central Asia, Nov. 17-22, 2014. The 47th UNESCAP/WMO Typhoon Committee General Meeting, Thailand, Feb. 9-13, 2015. Expert mission for automatic rainfall warning system in Philippines Apr. 26-May 1, 2015. 2015 UNESCAP/WMO Typhoon Committee Working Group on Disaster Risk Reduction meeting, May 19-20, 2015. Establishment of automatic rainfall warning system in Laos, Sept. 4-6, 2016. ADRC annual meeting, Thailand, Mar. 25-26, 2016. The 48th UNESCAP/WMO Typhoon Committee General Meeting, Hawaii, Feb. 22-25, 2016.

Activities	Actions	Outputs	Resources	Milestones	Linkages	Progress
3. Optimization of disseminating sediment disasters related information	<ul style="list-style-type: none"> Collect and analyze disseminating methodologies and related policies for sediment disasters information that alarm people not to be involved to the designated areas 	<ul style="list-style-type: none"> Actual example for sediment disasters information by public broadcasting system and other media (e.g., Facebook, Twitter, etc.) 	<ul style="list-style-type: none"> Republic of Korea (ROK) National Disaster Management Institute (NDMI) 	<ul style="list-style-type: none"> Summary report for present disseminating codes and regulations by June 2015 Report about the effective disseminating framework by Dec. 2015 	<ul style="list-style-type: none"> Above SOP RA II WMO Secretariat TC DRR ROK (MPSS) 	<ul style="list-style-type: none"> <u>Governmental research reports</u> <ol style="list-style-type: none"> 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) 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) 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) <u>Public services</u> <ol style="list-style-type: none"> App for foreigners, Safety First, released, Nov., 2014. 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 adaptation 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: Pedy drought index; Standardized Precipitation Index (SPI); and the Drought index for snow storage (Sw). Using the Pedy 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 ADVN 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 from 23 km² to 1,000 km². It was noted that the computational time step could vary from 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	PRORAMME	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, CCI	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

RA II Operating Plan for 2016-2019 Working Group on Hydrological Services (WGHS)

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 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 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 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.

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

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

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World Meteorological Organization

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

SEOUL, REPUBLIC OF KOREA
25 TO 27 OCTOBER 2016

**ANNEX 2
RA II - WGHS/Doc. 1**

Submitted by: Secretariat
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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

Tuesday 25 October (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 HRFCCO 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 HRFCCO)

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

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

CHEN Yongqing
chairperson, of WG-WIGSO/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.

Some activities have been carried out by the working group since RA II -15.

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-CS and EG-AgM 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 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-Coordinator	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 Chunfan	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-Coordinator and some Theme Leaders and Volunteer Experts. Mr. Yongqing Chen (China) and Dr. Jaegwang Won (Republic of Korea) were approved to be Co-Coordinator 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 RAIL 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 will be developed in 2015
- (b) Portal to share progress EGOS IP implementation in RA II will be available in 2015
- (c) A portal on standards and best practices will be available in 2015
- (d) Collaborative working mechanism toward integrated surface-based remote sensing observations in the East Asia for operational monitoring and forecasting severe weather will be established.
- (e) Technical support for instrument maintenance and calibration by experts from RICs will be provided.
- (f) ISO/IEC 17025 certification will 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 will be available.
- (i) Capacity in use of satellite data/products and facilitation of training datasets and tool boxes will be improved.
- (j) The systematic Near Real Time monitoring of sand and dust storm will be carried out in SDS-WAS Asia Node.
- (k) RBSN and RBCN will 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-IOIS/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. Dr. 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
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 ($\text{kg}\cdot\text{m}^{-2}$)

Dust concentration at the surface ($\mu\text{g}\cdot\text{m}^{-3}$)

Dust optical depth at 550 nm (-)

3-hour accumulated dry and wet deposition ($\text{kg}\cdot\text{m}^{-2}$)

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 0.5×0.5 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 GISCs² (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

² 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.

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, 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://mon.wis.cma.cn/WCD>
- GISC Tokyo: <http://www.wis-jma.go.jp/wcd/v1/top.html>

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-Coordinator		
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)

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

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	<p>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:</p> <ul style="list-style-type: none"> ● Encourage RA II Members to appoint National Focal Points and submit EGOS National Reports annually, ● Identify gaps and prioritize actions listed in EGOS-IP through reviewing the progress of EGOS-IP in RA II, ● Develop a Portal to share the progress of EGOS-IP Implementation of RA II Members.
Aim(s)	<ul style="list-style-type: none"> ● To identify gaps and prioritize actions listed in the EGOS-IP through reviewing the progress of the Evolution of Global Observing Systems (EGOS), ● 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	<ul style="list-style-type: none"> ● Technical assistance by CBS, ● 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	<ul style="list-style-type: none"> ● A list of RA II EGOS National Focal Points, ● Prioritized actions listed in the EGOS-IP, ● 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
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 Meteorological Observation Center, China Meteorological Administration (CMA) China Tel: +86 10 68407934 Fax: +86 10 68400936 E-mail: gjxaoc@cma.gov.cn
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Project No. II

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)	<ul style="list-style-type: none"> ● To develop a Standard and Best Practise Portal, ● To establish regional standard and best practices documentation (regional practices database) for enhanced observational data/products utilization, including data/metadata management, ● 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 Korea Meteorological Administration (KMA) Republic of Korea

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Project No. III.1

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	<p>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.</p> <p>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:</p> <ol style="list-style-type: none"> 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. 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. 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. <p>To proceed with this project, existing frameworks such as CMA-JMA-KMA NWP meeting will be expanded to include this project into its agenda.</p>
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. 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 development requirements	Workshop(s) on better utilization (decision making & assimilation)
Partners/Participants	CMA, JMA, KMA
Relationship with existing project(s)	<ol style="list-style-type: none"> 1. WMO Workshop on the Impact of Various Observing Systems on Numerical Weather Prediction. 2. CMA-JMA-KMA joint workshop on NWP (The 1st CMA-JMA-KMA joint workshop on NWP was held in September 2011). 3. WMO/CIMO Radar Quality Control and Quantitative Precipitation Estimation Intercomparison (RQOI).
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	<ol style="list-style-type: none"> 1. Establishment of collaborative working mechanism toward integrated surface-based remote sensing observations in the East Asia for operational monitoring and forecasting severe weather. 2. Solutions to identify issues to be solved for integration of surface-based remote sensing observations at sub-regional level and their solutions. 3. Impacts on capacities of NMHSs in severe weather monitoring and forecasting through utilization of surface-based remote sensing observations.
Main risk(s)	<ol style="list-style-type: none"> 1. Limited exchange of observational data, for instance, due to data policies of providers. 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 Office of International Affairs Japan Meteorological Agency (JMA)

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Contact Person 2	<p>Dr Jaegwang WON Korea Meteorological Administration (KMA) Republic of Korea Tel.: +82-2-2181-0694 Fax: +82-2-2181-0709 E-mail: wonjq@kma.go.kr, ecotus37@korea.kr</p>
Contact Person 3	<p>Mr LI Feng Meteorological Observation Center China Meteorological Administration (CMA) China Tel.: +86 10 68409293 Fax: +86 10 68400936 E-mail: liflif04@cma.gov.cn</p>

Project No. III.2

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	<p>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.</p> <p>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.</p> <p>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:</p> <ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> (a) overview of the current radar systems, (b) organization (department, division, staff, and budget), (c) specification of radar systems, (d) maintenance of equipment, (e) data processing (QC, calibration, and composite technique), (f) radar products, (g) details of current technical problems associated with (a) to (f), (h) lessons learnt from the past experiences, (i) recent progress, (j) future development plans. <p>The reports will be submitted to the 35th SCMG meeting (2013).</p> 2) The other ASEAN member countries will also develop their national reports in the same format as that of <u>Thailand and Malaysia</u>, 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. 3) During the period of the project, all the above Members will be

	<p>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.</p> <p>*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 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.</p> <p>*SCMG set up a new agenda item for discussion on the progress of this project.</p>
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)	<ul style="list-style-type: none"> - Radar composite map in Southeast Asia, one of the on-going projects under the Meteorological Working Group of the WMO/ESCAP Typhoon Committee, - Severe Weather Forecasting Demonstration Project (SWFDP) for Southeast Asia, - 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	<ul style="list-style-type: none"> - National reports in the Southeast Asia toward operational rainfall estimation/forecasting based on radar data, - Regional strategic plan on development of the radar network.
Main risk(s)	<ol style="list-style-type: none"> 1) Failure of development of national reports by participating organs. 2) Lack of available experts. 3) Lack of funds available.
Website	Not to be established
Date of the update	21 November 2012
Contact Person 1	Dr.Somchai Baimoung Deputy Director-General/Acting Director-General

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Contact Person 2	Mr A. Kamiluddin Hj Ibrahim Director, Radar Meteorology Division Malaysian Meteorological Department Malaysia Tel.: +603 7967 8154 Fax: +603 7955 0964 E-mail: kamiluddin@met.gov.my

Project No. IV

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	<p>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.</p> <p>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.</p> <p>1. Improvements of data quality at RBCN/RBSN stations</p> <p>(a) Monitoring Data Quality</p> <p>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:</p> <ul style="list-style-type: none"> • Questionnaire on the Surface, Climate, and Upper-air Observations and Quality Management in Regional Association II (Asia) (conducted in July 2010), • Questionnaire on meteorological instruments, calibration and training in Regional Association II (Asia) (conducted in January 2012), • 6-monthly monitoring reports by the Lead Centre for monitoring the quality of land surface observations in Region II. <p>(b) Survey on status on QA/QC procedures and site managements for the network of RBCN/RBSN stations, and report the results.</p> <p>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:</p>

	<ul style="list-style-type: none"> - CMA, HKO, JMA, and KMA for Southeast Asia, - IMD for South Asia, - Roshydromet for Central Asia, - Kuwait for Middle East. <p>2. Enhancement of RIC's Services</p> <p>RICs plan to implement the following action items for further enhancement of their services in capacity building and calibration during the project:</p> <ul style="list-style-type: none"> (a) Organization of a training workshop to improve understanding of calibration and maintenance of 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)", (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), (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, (d) Development of RIC's Websites, (e) Intercomparison between RIC-Tsukuba and RIC-Beijing, (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) Lead Centre for monitoring the quality of land surface observations
Key Regional Player	JMA (Coordinator), and Members of Coordination Group Technical Mission: <ul style="list-style-type: none"> - CMA, HKO, JMA, and KMA for Southeast Asia, - IMD for South Asia, - Roshydromet for Central Asia, - Kuwait for Middle East.
Capacity development requirements	<ol style="list-style-type: none"> 1. Workshop on maintenance, field inspection, etc. (basic level), 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	<ol style="list-style-type: none"> 1. Provision of technical support for instrument maintenance and calibration by experts from RICs. 2. Holding a RIC's training workshop for RA II Members. 3. Development of training materials (to be prepared for publication as an IMOP technical document). 4. Obtaining ISO/IEC 17025 certification. 5. Portal Website to share outcomes of this project. 6. Report on status on QC/QA procedures and site management in RA II. 7. Reports on status on meteorological instruments, calibration and training in Regional Association II.
Main risk(s)	<ul style="list-style-type: none"> • Lack of funding for technical missions by RICs, • 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, • 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	<p>Mr Yoshihisa NAKAMOTO Senior Coordinator for Observation Planning Administration Division, Observations Department Japan Meteorological Agency (JMA) Japan Tel.: +81 3 3211 6018 Fax: +81 3 3211 7084 Email: nakamoto@met.kishou.go.jp</p>
Contact Person 2	<p>Mr He Xiaolei Meteorological Observation Center China Meteorological Administration (CMA) China Tel: +86 10 68409767 Fax: +86 10 68400936 E-mail: hxlaoc@cma.gov.cn</p>

Project No. V

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	<p>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.).</p> <p>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:</p> <ul style="list-style-type: none"> • 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, • Regional Centre (RC: China) will provide a portal website with a function for sharing the observation data and announce it to the Node members, • At the beginning, experimental observation data sharing will be conducted in off-line basis (not NRT) for the sand/dust storms (SDS) seasons, • For the data exchange, the ad-hoc working group will propose appropriate data format and parameters, • 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, • 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)
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. ZHOUQingliang National Meteorological Center China Meteorological Administration (CMA) China Tel.: +86 10 68406184 Fax: +86 10 68408454 E-mail: zhouql@cma.gov.cn
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Contact Person 1	Dr Youngsin Chin Korea Meteorological Administration (KMA) Republic of Korea Tel.: +82 70 7850 6752 Fax: +82 2 831 4930 E-mail: hwangsa@korea.kr

Project No. VI

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	<p>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).</p> <p>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:</p> <ul style="list-style-type: none"> ● 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, ● Facilitating the timely provision of satellite-related information by satellite operators themselves to users via the project web page, newsletters, etc., and ● Aligning with VLab activities to optimize assistance to NMHSs in RA II and coordinating training activities on use of satellite data/products).
Aim(s)	<ul style="list-style-type: none"> ● To encourage NMHSs in RA II to make a kind of self-help effort to improve the flow of satellite-derived information, ● 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	<ul style="list-style-type: none"> ● Assistance (or support) of WMO VLab activities and other regional training activities, ● Assistance of satellite operators, ● Liaison with EGOS-IP.
Partners/Participants	Members of the Coordination Group members: Japan (Co-

	<p>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)</p> <p>All other RA II Members can be nominated as the Group members.</p>
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	<ul style="list-style-type: none"> ● Reports on requirements of NMHSs regarding satellite imagery, data and products, ● Improvement on access to information on satellite data/products, ● 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	<p>The portal site of the project is operated on JMA's web server.</p> <p>http://www.jma.go.jp/jma/jma-eng/satellite/ra2wigosproject/ra2wigosproject-intro_en_jma.html</p>
Summary	The project will encourage NMHSs in RA II to make a kind of self-help effort to improve the flow of satellite-related information.
Date of the update	30 November 2015
Contact Person 1	<p>Mr Takeshi Otomo Senior Coordinator for Satellite Systems Satellite Program Division, Observation Department Japan Meteorological Agency (JMA) Japan Tel: +81-3201-8677 Fax: +81-3217-1036 E-mail: ootomo@met.kishou.go.jp</p>
Contact Person 2	<p>Dr Dohyeong KIM Senior Scientist National Meteorological Satellite Center Korea Meteorological Administration Republic of Korea Tel: +82-70-7850-5705 Fax: +82-43-717-0210 E-mail: dkim@kma.go.kr</p>

ANNEX 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).

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

10–11 February 2017, Abu Dhabi, United Arab Emirates (UAE)

PROVISIONAL PROGRAMME

DAY 1: 10 February 2017 (Friday)

08:30-09:00 Registration

09:00-09:30 Opening Ceremony (30')

- Opening statement – Representative of the Government of UAE
- Welcoming remarks – President of RA II
- Welcoming remarks – WMO Secretary-General

09:30-10:00 Group Photo & Refreshment (30')

10:00-10:20 Outcomes of the survey on the basic capability of NMHSs in RA II (20')

10:20-12:30 Session 1: Reports of WGs and Pilot Projects (130')

- WG-Weather Services (30')
- WG-Climate Services (20')
- WG-Hydrological Services (20')
- WG-WIGOS and WIS (30')
- Discussion (30')

12:30-14:30 Lunch (120')

14:30-18:00 Session 2: Global and Regional Partnerships for Implementation of WMO and Regional priorities (210')

2.1 Global and Regional Partnerships (120')

- Outcomes of Donor Roundtable 2016 - Principles for Donor Engagement (10')
- Global and regional challenges and opportunities - *Presentations by representatives of sub-regions* (50')
- Sub-regional partners for the regional cooperation (60')

Refreshment (20')

2.2 Panel Discussion: Challenges and Successes on the Strategic Implementation of WMO and Regional priorities (70')

Success stories and challenges in promoting national agenda for the successful implementation of WMO and Regional priorities including DRR, GFCS, WIGOS, Aviation, Hydrological Services, Polar and High Mountains as a means of sharing experiences in terms of engaging governments, human resource management, management of infrastructure and budget.

DAY 2: 11 February 2017 (Saturday)

09:00-18:00 Session 3: Entrepreneurial Skills in the Management of NMHSs

09:00-09:30 **Keynote presentation:** Management issues and concern for NMHSs (WMO SG)

09:30-10:30 **3.1 Sharing national experience in the management of NMHSs (60')**

- *Presentations by representatives of sub-regions: West Asia, Central Asia, East Asia, Southeast Asia, and South Asia*
- *Discussion*

Success stories and challenges in the management of their National Meteorological Service (NMHS) as a means of sharing experiences in the management of NMHSs in terms of challenges of engaging governments, engaging users, leadership, human resource management, management of infrastructure and budget.

10:30-10:50 **Refreshment (20')**

10:50-12:30 **3.2 Public-Private Partnership (100')**

- WMO White Paper on the public-private partnership (20')
- Private sector engagement in Asia (20')
- Dialogue: Opportunities and Challenges for private sector engagement in RA II (60')

Review the outcomes and recommendations of the Special Session on Public-Private Partnerships at EC-68 and follow up actions on development of Position (White) Paper and provide directions from the regional perspectives regarding the development of Public-Private Partnerships related to data, service delivery and other areas of WMO mandate.

12:30-14:00 Lunch (90')

14:00-15:30 **3.3 Improving and developing National Strategic Plans (90')**

The Secretariat will introduce the WMO Integrated Strategic Planning handbook and template for use by NMHSs together with the various strategic planning models.

A strategic plan is an important management tool that enables institutions to implement targeted investments by focusing on a clearly defined strategic direction. It is in view of this that WMO decided to develop an integrated strategic planning handbook and template to assist NMHSs in strengthening their capacity in strategic planning so as to initiate or improve their national strategic plans.

15:30-16:00 **Refreshment (30')**

16:00-17:30 **3.4 Panel Discussion: Enhancing the management skills of senior managers of NMHSs in the context of societal needs (90')**

How to enhance the visibility, relevance and capacity of NMHSs in engaging governments, users, funding agencies and beyond in terms of recognition of

NMHS contribution to national agenda and success in securing financing from national budgets and other sources within the country and from external sources.

17:30-18:00 Summary (30')

18:00 Closure

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

10-11 February 2017, Abu Dhabi, United Arab Emirates

TENTATIVE WORK PLAN

Friday, 10 February		Saturday, 11 February	
08:30-09:00	Registration		
09:00-10:40	<p>Opening Ceremony</p> <p>Outcomes of the survey on the basic capability of NMHSs in RA II</p> <p><i>Group photo and refreshment</i></p>	09:00-12:30	<p>Session 3: Entrepreneurial Skills in the Management of NMHSs</p> <p>Keynote presentation: Management issues and concern for NMHSs</p> <p>3.1 Sharing national experience in the management of NMHSs</p> <p>3.2 Public-Private Partnership</p>
10:40-12:30	Session 1: Reports of WGs and Pilot Projects		
12:30-14:30	Lunch Break	12:30-14:00	Lunch Break
14:30-18:00	<p>Session 2: Global and Regional Partnerships for Implementation of WMO and Regional priorities</p> <p>2.1 Global and Regional Partnerships</p> <p>2.2 Panel Discussion: Challenges and Successes on the Strategic Implementation of WMO and Regional priorities</p>	14:00-18:00	<p>3.3 Improving and developing National Strategic Plans</p> <p>3.4 Panel Discussion: Enhancing the management skills of senior managers of NMHSs in the context of societal needs</p> <p>Closure</p>

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

10-11 February 2017, Abu Dhabi, United Arab Emirates

CONCEPT NOTE

1. BACKGROUND

The Regional Conference on Management of National Meteorological and Hydrological Services (NMHSs) in Regional Association II (Asia) (RA II RECO) is organized once during each WMO financial period. RA II RECO brings together Directors and/or senior officials of NMHSs in RA II with an ultimate aim to discuss emerging issues and challenges on regional cooperation and capacity development.

The Seventh Regional Conference in RA II (RA II RECO-7) will be 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.

2. OBJECTIVES

The specific objectives of the RA II RECO-7 are:

- (a) To identify and address the emerging issues and challenges, strengthen regional cooperation and enhance partnerships for implementation of WMO and Regional priorities;
- (b) To enhance the management skills of Directors and senior managers of NMHSs and improve and develop National Strategic Plans;

In order to achieve the specific objectives, the provisional programme is organized in the following sessions:

- (a) Session 1: Reports of WGs and Pilot Projects;
- (b) Session 2: Global and Regional Partnerships for Implementation of WMO and Regional priorities;
 - Global and Regional Partnerships
 - Challenges and Successes on the Strategic Implementation of WMO and Regional priorities
- (c) Session 3: Entrepreneurial Skills in the Management of NMHSs
 - Sharing national experience in the management of NMHSs
 - Public-Private Partnership
 - Improving and developing National Strategic Plans
 - Enhancing the management skills of senior managers of NMHSs in the context of societal needs

3. EXPECTED OUTCOMES

Expected outcomes are the recommendations on the private sector engagement and the strategy on the enhancement of the visibility and relevance of NMHSs including the improvement of resource mobilization and capacity development of NMHSs through regional cooperation and partnership with an ultimate goal to contribute to better weather, climate and water services and sustainable development in the Region.

4. EXPECTED PARTICIPANTS

Expected participants include Directors and/or senior officials from NMHSs or equivalent national institutions in Region II and chairpersons of RA II Working Groups (WGs), Expert Groups (EGs) and Implementation Coordination Teams (ICTs). The president, the vice president and the WGs/EGs/ICTs chairpersons are expected to facilitate the sessions of RA II RECO-7.

PROVISIONAL AGENDA for RA II-16

1	Opening of the session
2	Organization of the session
2.1	Consideration of the report on credentials
2.2	Adoption of the agenda
2.3	Establishment of committees
2.4	Other organization matters
3	Report by the President of the Association
4	Programme activities - regional aspects
4.1	Disaster Risk Reduction, Resilience and Prevention focusing on impact-based decision support services
4.2	Climate Services, Action, and Resilience
4.3	Observations and Data Exchange
4.4	Service Quality and Service Delivery
4.5	Polar and High Mountain Regions
4.6	Data Processing, Modelling and Forecasting
4.7	Research
4.8	Capacity Development
4.9	Partnerships and role of RA II in regional consultation process
5	Improved efficiency and effectiveness
5.1	WMO strategic and operating plan – regional aspects
5.2	Internal matters of the Association
6	Emerging issues and specific challenges
6.1	Private sector engagement
6.2	Gender equality
7	WMO Regional Office for Asia and the South-West Pacific including WMO Office for West Asia
8	Review of previous resolutions and recommendations of the Association and of relevant Executive Council resolutions
9	Election of officers
10	Date and place of the seventeenth session
11	Closure of the session

ANNOTATED PROVISIONAL AGENDA

1. OPENING OF THE SESSION

The sixteenth session of Regional Association II (ASIA) will open at 9.30 a.m. on Sunday, 12 February 2017 at the Dusit Thani Hotel, Abu Dhabi, United Arab Emirates. Information on material arrangements for the session is given in RA II-16/INF.1.

2. ORGANIZATION OF THE SESSION

2.1 Consideration of the report on credentials

The representative of the Secretary-General will present report on credentials taking into account the documents received prior to and during the session. The Association is invited to consider this report.

2.2 Adoption of the agenda

In accordance with General Regulations 173 and 176, the provisional agenda will be submitted for approval by the association as soon as possible after the opening of the session and may be amended at any time during the course of the session.

Additional items for the agenda may be forwarded by Members to the Secretariat before the session, but preferably not later than thirty days before the opening of the session. Working documents on additional items proposed by Members should be provided by the Member concerned as early as possible, but preferably not later than sixty days before the opening of the session.

2.3 Establishment of committees

The Association will be invited to work in plenary throughout the session. Committees for the session will be established. These will include:

- (a) Credentials Committee;
- (b) Nomination Committee;
- (c) Drafting Committee (if required);
- (d) Coordination Committee.

The Association may wish to nominate a Rapporteur on Previous Resolutions and Recommendations of the Association and relevant Resolutions of the Executive Council, and establish, for the duration of its session, other committees as it deems necessary.

2.4 Other organization matters

The Association will agree upon:

- (a) Working hours of the meetings: 9:30–12:30 and 14:30–17:30;
- (b) Tentative programme of work for the session.

3. REPORT BY THE PRESIDENT OF THE ASSOCIATION

The report will deal with the activities of the Association and any other matters related to the Association since its fifteenth session. The Association normally will have a general discussion on the report by the president during the same plenary meeting and will refer any points requiring detailed study or subsequent action to the appropriate agenda items.

4. PROGRAMME ACTIVITIES – REGIONAL ASPECTS

4.1 Disaster Risk Reduction, Resilience and Prevention focusing on impact- based decision support services

Under this agenda item the Association is invited to discuss and make decisions, as necessary, on issues related to disaster risk reduction, resilience and prevention focusing on impact-based decision support services in connection with:

- 4.1(1) Implementation of WMO DRR Roadmap in RA II including major activities on DRR Services;
- 4.1(2) Public weather services and the provision of multi-hazard impact-based forecast and warning services;
- 4.1(3) Flood Forecasting;
- 4.1(4) Severe Weather Forecasting Demonstration Project (SWFDP) – Reporting and identification of regional entity;
- 4.1(5) Tropical Cyclone Forecasting to guide actions for enhancing capability of the NMHSs in tropical cyclone impact-based forecasting and warning services, following the multi-hazard early warning approach;
- 4.1(6) Coastal Inundation Forecasting to provide guidance on further development of the Coastal Inundation and Forecasting Demonstration Project (CIFDP), as part of a multi-hazard approach to coastal inundation caused by various phenomena (especially storm surge);

4.2 Climate Services, Action, and Resilience

Under this agenda item the Association is invited to discuss and make decisions, as necessary, on issues related to:

- 4.2(1) Paris Agreement;
 - Invite Members to engage in National Action Plan (NAP) preparation;
 - Invite Members to contact Nationally Designated Authorities to get involved in Green Climate Fund (GCF) proposal development.
- 4.2(2) Global Framework for Climate Services (GFCS) and WMO contribution to the GFCS
 - Definition of national frameworks for climate services with other ministries and non- NMHS partners, and establishment of inter-ministerial governance mechanisms;
 - Modification of the task team in line with the mechanism for WMO

contributions to the GFCS, key regional priorities for support from the technical commissions.

4.2(3) Climate Service Information System (CSIS)

- Regional architecture for CSIS implementation, including RCCs, objective regional forecasting systems, institutional regional responsibilities.

4.3 Observations and Data Exchange

Under this agenda item the Association is invited to discuss and make decisions, as necessary, on issues related to:

4.3(1) WMO Integrated Global Observing System (WIGOS)

- The Association will be invited to review the implementation activities and projects, and proposed plans for Regional WIGOS Center(s) in Region II;
- The Association will be invited to decide on the list of stations to compose the Regional Basic Synoptic Network (RBSN), the Regional Basic Climatological Network (RBCN), and the pilot Regional Basic Observing Network (RBON) for Regional Association II;
- The Association will also be invited to endorse an update to the Regional WIGOS Implementation Plan for Region II (R-WIP-II).

4.3(2) WMO Information System (WIS)

4.4 Service Quality and Service Delivery

Under this agenda item the Association is invited to discuss and make decisions, as necessary, on issues related to:

4.4(1) Further Implementation of the WMO Strategy for Services Delivery and Harmonization of Service Delivery in RA II

4.4(2) Meteorological services for aviation

4.4(3) Meteorological services for agriculture

4.4(4) Meteorological services for marine operations

4.5 Polar and High Mountain Regions

Under this agenda item the Association is invited to discuss and make decisions, as necessary, on issues related to:

- Consider and act upon specific recommendations of the Executive Association Panel of Experts on Polar and High Mountain Observations, Research and Services, regarding: (i) The development of the Global Cryosphere Watch (GCW), and its Cryonet, and participation in the CryoNet Asia working group; (ii) The development of observations at high elevation in the third pole region; (iii) The association support to the Year of Polar Prediction (YOPP); and (iv) The development of Polar Regional Climate Centres (PRCCs) in the region.

4.6 Data Processing, Modelling and Forecasting

Under this agenda item the Association is invited to discuss and make decisions, as necessary, on issues related to:

- 4.6(1) Seamless Data-processing and Forecasting System
- 4.6(2) Implementation of Forecast verification activities, high resolution NWP and Impact- based forecast and warning
- 4.6(3) Hydrology and Water Management

4.7 Research

Under this agenda item the Association is invited to discuss, as necessary, on issues related to:

- 4.7(1) Research and innovation for Urban and high-dense populated regions
 - New predictive tools and observations across weather, climate and environment
 - Early warning systems and communication
- 4.7(2) Research advancements in early warning systems
 - Biomass burning and impacts on air quality
 - Sand and dust storm

4.8 Capacity Development

- 4.8(1) WMO Capacity development priorities for 2016-2019

Under this agenda item the Association is invited to discuss the completion of focal point for a successful implementation and operation of Country Profile Database (CPDB) and consider recommendations of the EC Panel of Experts on Capacity Development including capacity development priorities for 2016-2019 and Capacity Development Strategy Implementation Plan 2016-2019.

- 4.8(2) Education and training

The Association is invited to:

- Discuss and make suggestions on how education and training could more effectively support NMHSs and Members to deliver effective services to support the implementation of socio-economic and development initiatives;
- Discuss and report on regional priorities for education and training;
- Review status of RTCs and discussions on how to strengthen them

- 4.8(3) Resource mobilization

The Association is invited to review from the regional perspectives the resource mobilization strategy for the Organization for 2016-2019 endorsed by EC-68.

4.9 Partnerships and role of RA II in regional consultation process

Under this agenda item the Association is invited to:

- Provide directions for strengthening WMO cooperation with the UN system and other international organizations;
- Guide a comprehensive review of existing MoUs established by the Organization and principles for the development of cooperation agreements;
- Provide direction on recognition of partner organizations contributing to the WMO Programmes and constituent bodies and vice versa;
- Provide guidance for positioning and strengthening WMO contribution to, and support Members implementation of, the 2030 Agenda for sustainable development.

5. IMPROVED EFFICIENCY AND EFFECTIVENESS

5.1 WMO strategic and operating plan – regional aspects

Under this agenda item, the Association will be invited to discuss the issues related to the WMO Strategic and Operational Planning processes and the WMO Strategic and Operating Plan 2020-2023 focusing on the regional aspects. The session will consider and endorse the proposed WMO-wide and regional priorities for 2020-2023 submitted by the president of regional association. The session will also consider the progress in performance as indicated in the survey on Impacts of Achieved results. The Association will review the RA II Operating Plan (2016-2019) in comparison with the consolidated WMO Operating Plan and the status of implementation of the plan, and will agree on principles of further planning of activities during the next intersessional period.

5.2 Internal matters of the Association

Under this agenda item the Association will address the need for enhancing its working mechanisms towards an action and results-oriented approach that would bring more benefits to its Members. This would include a critical analysis of conduct of regional events and other activities, the role and operation of the Management Group and other subsidiary bodies using the lessons learnt during the preceding intersessional period. The Association will decide on the new structure and tasks of its subsidiary bodies for the next intersessional period.

The Association will also be invited to discuss the general guidelines on the priorities in RA II for the next fiscal period from 2020 to 2023 for the contribution to the next WMO strategic and operating plans, which need to be developed before the eighteenth session of Congress in 2019.

6. EMERGING ISSUES AND SPECIFIC CHALLENGES

6.1 Private sector engagement

Under this agenda item the Association is invited to:

- Review the position paper prepared by EC-68 and provide directions from the regional perspectives regarding the development of Public-Private Partnerships related to data, service delivery and other areas of WMO mandate.

6.2 Gender equality

The Association will be invited to:

- Recall Decision 77 (EC-68) on WMO Gender Action Plan (GAP) and to identify priority actions from the Action Plan to be implemented in RA II in 2016-2019
- Discuss the current status of gender equality in RA II regarding representation and participation in the WMO activities.

7. WMO REGIONAL OFFICE FOR ASIA AND THE SOUTH-WEST PACIFIC INCLUDING WMO OFFICE FOR WEST ASIA

The Association will review the performance of Regional Office for Asia and the South-West Pacific in conducting its tasks within the framework of Regional Programmes and the Technical Cooperation Programmes as decided by Sixteenth Congress and Seventeenth Congress. The Association will advise on enhancing the role and performance of Regional Office as the main focal point for the regional activities in view of the relocation of Regional Office to Singapore.

8. REVIEW OF PREVIOUS RESOLUTIONS AND RECOMMENDATIONS OF THE ASSOCIATION AND OF RELEVANT EXECUTIVE COUNCIL

The Association will be invited to consider the relevant resolutions which are presently in force, in accordance with the provisions of Regulation 163(c) of the General Regulations and Rule 21 of the Rules of Procedure of the Executive Council.

9. ELECTION OF OFFICERS

The Association will elect a president and a vice-president to hold office until the end of the next session of the Association. Details regarding eligibility and procedures for election are given in Regulations 11, 27, 57-65, 80-90, 141, 168, 174(11) of the General Regulations, Convention Part V article 6, as well as the relevant provisions of Resolution 37 (Cg-XI) concerning the eligibility of candidates for these offices.

10. DATE AND PLACE OF THE SEVENTEENTH SESSION

The Association will be invited to set the tentative dates for its seventeenth session in order to facilitate organizational arrangements.

Taking into consideration any relevant decisions taken by the Association on the future conduct of its Session, Members attending the session will be invited to present invitations from their Governments for hosting the seventeenth session of Regional Association II. Members interested in extending such invitation should take into consideration the provisions of Regulations 18, 169, 170(a) and 171 of the General Regulations. The Association may wish to record any such invitations or suggestions in the report of the session.

11. CLOSURE OF THE SESSION

The sixteenth session of the Association is scheduled to close on Thursday, 16 February 2017.

Sixteenth Session of Regional Association II

12–16 February 2017, Abu Dhabi, United Arab Emirates (UAE)

TEATATIVE WORK PLAN

All items will be discussed in Plenary meetings	Sunday 12 February		Monday 13 February		Tuesday 14 February		Wednesday 15 February		Thursday 16 February	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
General Plenary Chair: President Items: 1, 2, 3, 5-11	1 2.1 2.2 2.3 2.4 3	6.1 8*	9** 5.2**	5.1			7 6.2 D	D	8	D 10 11
Plenary A Co-Chair: Member Items: 4.1-4.4				4.1 4.2		4.3 4.4			D	
Plenary B Co-Chair: Member Items: 4.5-4.9					4.5 4.6		4.7 4.8 4.9		D	

Explanatory notes:

D - consideration of outstanding in-session Draft Decisions: Draft 2, Draft 3, ... Approved.

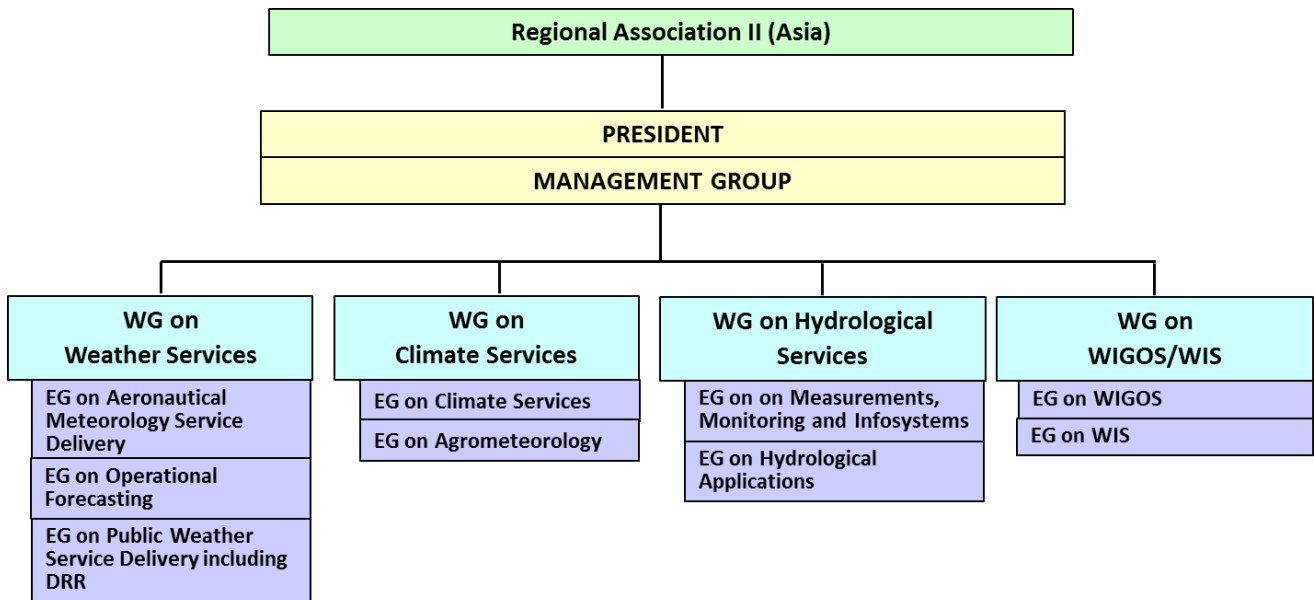
* To appoint a Rapporteur

** To appoint a sub-committee

Side meetings: dates and time will be provided at the session

Calendar to be updated on the WMO web page

WORKING STRUCTURE OF RA II SUBSIDIARY BODIES FOR 2017–2020



RA II INTER-SESSIONAL PLANNED MEETINGS 2017-2020

Years	2017	2018	2019	2020
Weather and Disaster Risk Reduction	Stakeholders Workshop to Implement the WMO Strategy for Service Delivery (SSD)	Stakeholders Workshop to Initiate Assessing the Social and Economic Benefits (SEB) of Meteorological and Hydrological Products	CAP Jump-start training	Stakeholders Workshops to Implement the WMO Strategy for Service Delivery (SSD)
	Stakeholder Workshop to Implement Impact-based Forecasts and Warning Services	Meeting of Stakeholders Workshops to Implement the WMO Strategy for Service Delivery (SSD)	Stakeholders Workshops to Implement the WMO Strategy for Service Delivery (SSD)	Stakeholder Workshops to Implement Impact-based Forecasts and Warning Services
	Common alerting protocol (CAP) Jump-start training Workshop	Stakeholder Workshop to Implement Impact-based Forecasts and Warning Services	Stakeholder Workshops to Implement Impact-based Forecasts and Warning Services	
			Meeting of the World Weather Information Service (WWIS) language hosts	
WIGOS	RA II OSCAR/Surface, WIGOS metadata and Station Identifiers for RA II LDCs	RA II RBON implementation	RA-II/EG-WIGOS-2	DBCP Capacity Building workshop for the North Pacific Ocean and its Marginal Seas (NPOMS-5)- Application of Regional Ocean Observations for Increasing Society's Understanding and Forecasting of Typhoons
	Joint RA II/V Projects on Radar and on Satellite data	Annual meeting of Asia-Oceania Meteorological Satellite Users' Conference (AOMSUC) (Indonesia to host AOMSUC-9 in Oct/Nov 2018)	DBCP Capacity Building workshop for the North Pacific Ocean and its Marginal Seas (NPOMS-5)- Application of Regional Ocean Observations for Increasing Society's Understanding and Forecasting of Typhoons	

	Annual meeting of Asia-Oceania Meteorological Satellite Users' Conference (AOMSUC) and the meeting of the Coordinating Group of the RA II WIGOS Project (the Russian Federation to host AOMSUC-8 in Vladivostok on October 16-21, 2017)	CMOC-China, Oceanographic and marine meteorological data management and service in Western Pacific region;	WIS Training on "Managing Discovery Metadata"	
	Two training events on the use of multi-channel geostationary imagery from MSG over the Indian Ocean region and Central Asia (Training event for Central Asia: June 2017; training event for Indian Ocean region: November 2017)	DBCP Capacity Building workshop for the North Pacific Ocean and its Marginal Seas (NPOMS-5) Forecasting of Typhoons		
	RA II Regional Pyrheliometer Comparison (23 January to 3 February 2017)	IOC/WESTPAC, IODE		
	Regional Workshop on AMDAR for Central Asia (4th quarter, 2017)			
	DBCP Capacity Building workshop for the North Pacific Ocean and its Marginal Seas (NPOMS-5)			
	Asia High Elevation Cryospheric Observation (AHECO) workshop (Kyrgyzstan, Feb. 2017)			
	Regional Workshop on AMDAR for Central Asia (23 Jan - 3 Feb)			
	Regional Workshop on AMDAR for Asia (4Q)			
WIS	Three GISC workshops	Two GISC workshops	Three GISC workshops	Two GISC workshops
	One RTC to provide training on general WIS competencies including train the trainer competencies	Introduction course on Information Management (WIS Part C).	One RTC to provide training on general WIS competencies including train the trainer competencies	Introduction course on Information Management (WIS Part C)

	Secondment of 3 potential WIS experts to an NC where WIS has been implemented	One RTC to provide training on general WIS competencies, including train the trainer competencies	Propose secondment of 3 potential WIS experts each to two NCs where WIS has been implemented	One RTC to provide training on general WIS competencies including train the trainer competencies
		Secondment of 3 potential WIS experts each to two NCs where WIS has been implemented	RA II Workshop on Information management and WIS Part C and update RA II WIS IP to include WIS Part C	Propose secondment of 3 potential WIS experts each to two NCs where WIS has been implemented
Development and Regional Activities	RA II WG-ICT-TT Chairs' Meeting (December)	Meeting of Working Group on Weather Services (WGWS) Meeting of Working Group on Climate Services (WGCS)		
	WMO Online Course for Trainers, and Training Development Workshop (September)	Meeting of Working Group on Hydrological Services (WGHS)	Meeting of Working Group on WMO Integrated Global Observing System (WIGOS) and WMO Information System (WIS) (WG-WIGOS/WIS)	
Research	Fourth International Workshop on Tropical Cyclone Landfalling Processes 2017, in conjunction with the joint TLFDP/ UPDRAFT workshop (Last week of November or early December 2017)	Asia-Pacific GAW Workshop on Greenhouse Gases (October)	Asia-Pacific GAW Workshop on Greenhouse Gases (October)	Asia-Pacific GAW Workshop on Greenhouse Gases (October)
	Vegetation Fires and Smog Forecasting regional center meeting (time tbd)			
	Asia-Pacific GAW Workshop on Greenhouse Gases (October)			
Climate and Water	Indian Ocean Data Rescue (INDARE) steering committee meeting, venue: September (tbc pending XB funds availability)	Workshop on reporting information on the state of the climate and extremes at regional and national levels WMO/LAS/ESCWA workshop on Climate Data Management and Data Rescue (tbc)	Training for trainers on Climate Data Management and applications for computing Standard Climatological Normals and climate change indices (March)	
	10 Session of South Asian Climate Outlook Forum (SASCOF) Bhutan	South Asian Climate Outlook Forum (SASCOF) (2 sessions)	South Asian Climate Outlook Forum (SASCOF) (2 sessions)	South Asian Climate Outlook Forum (SASCOF) (2 sessions)

9th NOAA/WMO International Training Workshop on Climate Variability and Prediction, Pune, India			
FOCRAII	FOCRAII	FOCRAII	FOCRAII
ASEAN Climate Outlook Forum (ASEANCOF) (2 sessions – online and face-to-face)	ASEAN Climate Outlook Forum (ASEANCOF) (2 sessions – online and face-to-face)	ASEAN Climate Outlook Forum (ASEANCOF) (2 sessions – online and face-to-face)	ASEAN Climate Outlook Forum (ASEANCOF) (2 sessions – online and face-to-face)
East Asian winter Climate Outlook Forum (EASCOF)	East Asian winter Climate Outlook Forum (EASCOF)	East Asian winter Climate Outlook Forum (EASCOF)	East Asian winter Climate Outlook Forum (EASCOF)
North Eurasian COF (NEACOF) (2 sessions – online and face-to-face)	North Eurasian COF (NEACOF) (2 sessions – online and face-to-face)	North Eurasian COF (NEACOF) (2 sessions – online and face-to-face)	North Eurasian COF (NEACOF) (2 sessions – online and face-to-face)
SAsiaFFG REGIONAL OPERATIONAL WORKSHOP (October)			
SAsiaFFG OPERATIONAL TRAINING AT HRC (June)			
SAsiaFFG STEERING COMMITTEE MEETING 2 (April)			
BSMEFFG STEERING COMMITTEE MEETING 2 (January)			
MRCFFG TRAINING WORKSHOP (May)			
MRCFFG STEERING COMMITTEE MEETING 2 (November)			
CARFFG Follow-up Operational Workshop (May)			
CARFFG STEERING COMMITTEE MEETING 3 (September)			
Afghanistan Meteorological Instruments Maintenance Training (January), Forecasters Training (April), Satellite Meteorology Training (July), Hydrometeorologist Training (October)			

RA II Management Group meeting for the preparation of RA II-16 (MG-11)
Abu Dhabi, UAE, 7-8 December 2016

List of participants

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