

World Meteorological Organization

RA II/MG-4/INF. 7

**REGIONAL ASSOCIATION II (ASIA)
MANAGEMENT GROUP
FOURTH SESSION**



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WORLD METEOROLOGICAL ORGANIZATION

**WORKING GROUP ON HYDROLOGY
REGIONAL ASSOCIATION II (ASIA)**

Report of the WGH – RA II (Asia)

**Seoul, Republic of Korea
23-26 November 2010**

FINAL REPORT

February 2011

TABLE OF CONTENT

1. OPENING OF THE MEETING
2. ORGANIZATION OF THE WORK OF THE SESSION AND ADOPTION OF THE AGENDA
3. BRIEFING BY THE WMO REPRESENTATIVE AND THE REPRESENTATIVE OF THE COMMISSION FOR HYDROLOGY
4. BRIEFING ON RELEVANT ONGOING REGIONAL ACTIVITIES
5. CONSIDERATION OF THE WORK PLANS AND EXPECTED RESULTS
6. DEVELOPMENT OF THE CONSOLIDATED WORKPLAN AND DOCUMENTATION OF RESULTS FOR THE FIFTEENTH SESSION OF THE REGIONAL ASSOCIATION II (ASIA) IN 2012
7. IMPLEMENTATION OF THE STRATEGIC PLAN FOR THE ENHANCEMENT OF NATIONAL METEOROLOGICAL AND HYDROLOGICAL SERVICES (NMHSs) IN REGIONAL ASSOCIATION II (ASIA) FOR THE PERIOD UP TO 2012
8. IMPLEMENTATION OF THE WMO FLOOD FORECASTING INITIATIVE: STRATEGY AND ACTION PLAN FOR THE ENHANCEMENT OF COOPERATION BETWEEN NATIONAL METEOROLOGICAL AND HYDROLOGICAL SERVICES FOR IMPROVED FLOOD FORECASTING
9. OVERVIEW OF REGIONAL REQUIREMENTS WITH REGARD TO CLIMATE INFORMATION FOR WATER MANAGEMENT AND DISASTER REDUCTION
10. CONTRIBUTION OF THE WORKING GROUP HYDROLOGY OF THE ESCAP/WMO TYPHOON COMMITTEE – FOLLOWED BY DISCUSSION ON POSSIBLE JOINT ACTIVITIES
11. DISCUSSION ON THE EXCHANGE OF HYDROLOGICAL DATA AND INFORMATION IN THE REGION, INCLUDING THE STATUS OF WHYCOS PROJECTS
12. DISCUSSION ON THE NEEDS OF THE REGION IN RELATION TO HYDROLOGY AND WATER RESOURCES INCLUDING CAPACITY BUILDING
13. DISCUSSION ON FUTURE ACTIVITIES OF THE REGIONAL ASSOCIATION II (ASIA) IN THE FIELD OF HYDROLOGY AND WATER RESOURCES AND RECOMMENDED RELEVANT PRIORITY AREAS OF COOPERATION BETWEEN WMO AND OTHER REGIONAL ORGANIZATIONS AND PROGRAMMES
14. ANY OTHER MATTERS
15. ADOPTION OF THE REPORT AND CLOSURE OF THE MEETING

1. OPENING OF THE MEETING

1.1 At the kind invitation of the Sustainable Water Resources Research Centre (SWRRC), the session of the Working Group on Hydrology (WGH) of the WMO Regional Association II (Asia) was held in Seoul, Republic of Korea, from 23 to 26 November 2010.

1.2 The session was opened at 09:30 a.m. on Tuesday 23 November 2010 in the premises of the Sustainable Water Resources Research Centre.

1.3 In his welcome remarks, the Director of the SWRRC, Mr. Sung Kim highlighted the importance of the Regional Working Group Hydrology as an important platform to address hydrological and water management issues that are specific to the region. He noted that the composition of the Working Group also reflects the vast diversity in terms of problems faced in the region and different levels of capacity to cope with these problems. In particular he highlighted the importance of developing and applying new methodologies for water budgeting and hydrological balances to improve water resources assessment as an important decision-making tool for improved water management under a changing climate. Mr. Kim provided information of the research undertaken at SWRRC in this regard. Consequently, Ms. Hwi-Rin Kim of the River Information Center of the Han River Flood Control Office (HRFCO) provided an overview presentation on the water resources of Korea, historical floods and the tasks and operations of the HRFCO. This was later complemented by a tour through the Office in the course of the meeting, which was highly appreciated by participants.

1.4 The representative of WMO, Mr. Wolfgang Grabs thanked Mr. Kim for hosting the meeting of the Working Group. He reiterated the importance of the work of the group, serving as regional platform to address critical issues related to hydrology and water resources in a unique way. He expressed his expectation that the group would fulfill the high expectations of the National Meteorological and Hydrological Services of the region in that satisfactory results could be achieved in the theme areas the Regional Association had endorsed during its session in 2008.

1.5 The group noted with deep regret the untimely demise of Professor Igor Shiklomanov, Director of the State Hydrological Institute of Russia, Hydrological Advisor to the president of RA II, and Chairman of the WGH. The group recalled the eminent contributions of Professor Shiklomanov to hydrology and water resources, worldwide and his services over so many years for the Regional Association and its Working Group Hydrology. A presentation over the major achievements of Professor Shiklomanov was followed by a minute of silence observed by the group.

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

2.1 The session was attended by 14 participants from 10 countries of the RA II. Mr. J. Wellens-Mensah attended the meeting in his capacity as vice-president of the WMO Commission for Hydrology (CHy). Mr. Jinping LIU participated in his function as Hydrologist of the UNESCAP/WMO Typhoon Committee Secretariat (TCS).

The list of participants is given in Annex 1 to this report. Mr. W. Grabs acted as Secretary for the meeting and Mr. Sung Kim, Director, Sustainable Water Resources Research Centre (SWRRC), Korea Institute of Construction Technology chaired the sessions of the WGH.

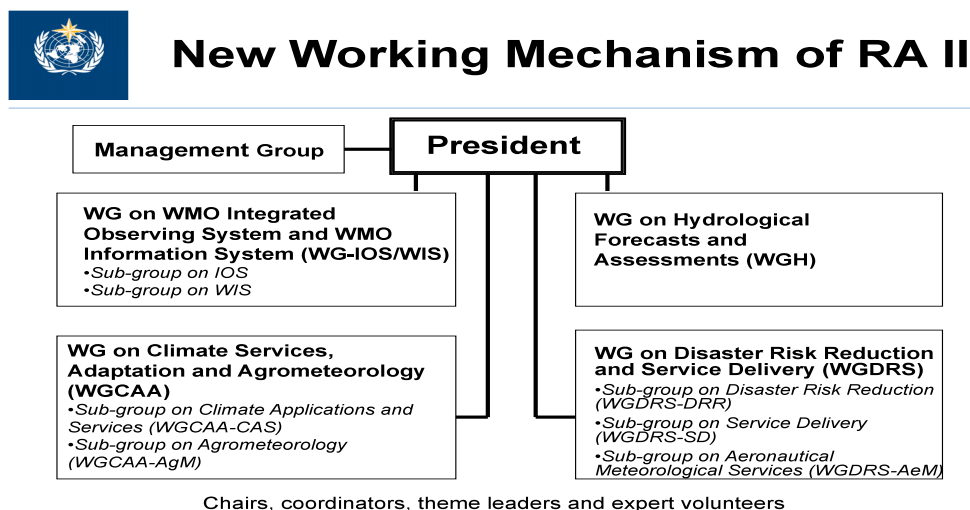
2.2 The WGH adopted its agenda that constitutes the table of contents of this report (Annex 2). It also agreed on the working hours. *All presentations made during the meeting can be downloaded from the following URL:*

http://www.wmo.int/pages/prog/hwrrp/rwqh/RA_II/seoul_2010.php

2.3 After an initial discussion, participants agreed that the main deliverables of this meeting were to

- i. Agree on the deliverables and individual work plans to meet the targets of the Regional Association within the existing work plans;
- ii. Discuss and conclude on the priorities for Hydrology and Water Resources Management in the region;
- iii. Seek closer cooperation with regional bodies such as the ESCAP/WMO Typhoon Committee and to
- iv. Propose the themes and deliverables for the subsequent Regional Working Group Hydrology in the next intersessional period 2008-2012.

2.4 The group took note of the relationship of the WGH in the context of other working groups that had been established by WMO RA II (Asia) during its XIV session in 2008:



3. BRIEFING BY THE WMO REPRESENTATIVE AND THE REPRESENTATIVE OF THE COMMISSION FOR HYDROLOGY

3.1 BRIEFING BY THE WMO REPRESENTATIVE

3.1.1 The representative of WMO, Mr. W. Grabs provided a briefing on the Hydrology and Water Resources Programme (HWRP) of the organization. In his presentation he provided information of programme elements and activities that were relevant for the present and potential future activities of the Working Group.

3.1.2 In discussing the briefing provided, participants specifically commented on flood-related issues:

3.1.3 With regard to the WMO Flood Forecasting Initiative, the group acknowledged progress made especially with regard to specific activities that are outlined in the Strategy and Action Plan of the Initiative, especially with regard to establishing Flash Flood Guidance Systems. The group welcomed concrete plans for the enhancement of forecasting and prediction services of Members through activities such as a model intercomparison and development of tools to assess the effectiveness of flood forecasting services. More information on this issue is provided in section 8 below.

3.1.4 The group felt that urban flood forecasting and management was another pressing issue – especially in Asia – that should receive heightened attention. Reference was made at this point to the planned urban flood forecasting projects of the ESCAP/WMO Typhoon Committee.

3.1.5 Participants of the Working Group welcomed progress made in the Associated Programme on Flood Management (APFM) and especially on the tools developed and the HelpDesk established under the programme. The group likewise encouraged WMO to intensify its efforts to develop and implement an Integrated Drought Management Programme which was seen as highly relevant for the region.

3.2 BRIEFING BY THE REPRESENTATIVE OF THE WMO COMMISSION FOR HYDROLOGY, FOLLOWED BY DISCUSSION

3.2.1 Mr. Wellens-Mensah, in his function as vice-president of the Commission for Hydrology outlined the organization and functions of the Commission. Specifically, participants were informed on items documented below:

3.2.2 Open Panels for CHy Experts (OPACHES): Mr. Wellens-Mensah pointed out that most of the work of the Commission is carried out on the basis of voluntary contributions. OPACHES largely support the activities of the Commission. An OPACHE is open to all Members of CHy. One can sign up to contribute his/her expertise in any of the Thematic Areas. The procedure for signing up is simple and is available at WMO website (under HWRD). He further encouraged members of the working group to register as experts in the area of individual expertise.

3.2.3 Participants took note of the following achievements and on-going activities of the Commission:

(a) Quality Management Framework (QMF)

The QMF – Hydrology aims at improving all aspects of operations and activities of NHSs/NMHSs. Two stages of activities are envisaged:

- Produce Guides and Manuals to improve operations of NHSs/NMHSs;
- Encourage NHSs/NMHSs to adopt and implement Quality Management Systems (QMS) and finally obtain ISO certification.
-

(b) Publications

The following publications have been recently published or are in a stage close to be published in 2011:

1. The Guide to Hydrological Practices has been published in English and distributed in both hard and soft copies to NHSs/NMHSs. Translation into French, Spanish and Russian is being done. It is planned to put the Guide on the Web to facilitate corrections, updates and revisions of Chapters;
2. Manual on PMP has been distributed and a second batch reprinted.;
3. Manual on Low Flow Estimation and Prediction has been distributed and also reprinted;
4. Manual on Stream Gauging has been completed. Getting ISO to join WMO for a joint publication;
5. The Glossary of Hydrology is a joint effort between WMO and UNESCO. Currently the Glossary is undergoing linguistic editing and will be published soon;
6. Manual on Flood Forecasting and Warning is ready for linguistic editing.

(c) Quality Management

Participants appreciated the work undertaken in Quality Management. The group observed however that it were necessary to better integrate instruments and methods of observations into the overall quality management framework of National Hydrological Services in line with the WMO Quality Management Framework. The group reiterated the importance of guiding materials for new hydrometric instruments, calibration procedures, data quality assurance through the quantification of observational errors, the use of new hydrometric observations in particular the use of and application of satellite-based observation in hydrometry and hydrology and the necessity to improve capacity building especially on the technical level to make adequate and professional use of new instruments and methods of observation in hydrometry and hydraulics.

(d) Capacity Building

In Capacity Building the following achievements have been made and a number of activities are on-going including:

- Developed a Strategy Document for Distance Learning.
- A Distance Learning in Basic Hydrology has been carried out in a joint collaboration between WMO and COMET (established at NOAA, USA).
- A Distance Learning Programme in Advanced Hydrology is being finalized for Eastern Europe. It is planned to start from 24 January 2011 and will run for 7 weeks.
- Technology Transfer through HOMS – Hydrological Operational Multipurpose Sub-Programme is still available. There is an appeal for new components from NHSs/NMHS.

3.2.4 The Group appreciated the wide field of programmes and activities undertaken by the Secretariat and observed that the activities of CHy were directly relevant and beneficial to the region. However, participants were also of the opinion that the programme of the Commission should consider more closely the activities of the RA WGH in shaping and defining the future work programme of the Commission.

3.2.5 In further discussing the role of CHy in regional activities, the group felt that there was a general need for further strengthening the support of the CHy to the activities of the Working Group on Hydrology in particular with regard to finding adequate additional experts, sources of information and facilitating linkages between international and regional experts as well as with relevant regional and international institutions. One reason for the necessity of this assistance is the often quite isolated manner in which experts of the WGH have to accomplish their work, in many cases without adequate access to vital information to fulfil their terms of reference. The Group saw the potential of the OPACHES to alleviate this situation.

4. BRIEFING ON RELEVANT ONGOING REGIONAL ACTIVITIES

4.1 The representative of WMO provided an overview of regional activities. He reported on the thrust to implement the RA II (Asia) Strategic Plan for the Enhancement of National Meteorological and Hydrologic Services at the level of the services. The group appreciated technical cooperation activities with a number of countries in the region, notably the support that WMO provides to the government of Pakistan after the disastrous floods in the monsoon season of 2010.

4.2 In this context, Mr. Muhammad Ajamal SHAD provided a presentation on flood forecasting in Pakistan especially in the light of the recent flood disaster. The presentation also demonstrated the necessity for close cooperation between meteorological forecasting and flood forecasting services to improve early warning and accuracy of flood forecasting.

4.3 Participants noted with appreciation progress made in several regional WHYCOS projects, notably the Mekong-HYCOS and the Hindu Kush Himalayan (HKH) HYCOS

projects that are currently implemented. The group regretted that after many years of effort and the expressed wish of NMHSs of Central Asia, the ARAL-HYCOS has not received funding to implement the project.

4.4 The regional implementation of the WMO Information System (WIS) was generally welcomed as it is expected to provide improved interoperability of regional and national observing systems that would benefit early warning and forecasting services as well as a generally improved access to hydrometeorological data and information.

4.5 The survey undertaken in RA II to assess capabilities for disaster risk reduction was seen as an opportunity to improve on forecasting and early warning systems and as a reference to strengthen different components of disaster risk reduction systems that are relevant to NMHSs.

4.6 Noting the emerging Global Framework for Climate Services (GFCS), the group noted its potential in improving long-term water management practices that are based on improved climate information that can be utilized to arrive at seasonal or sub-seasonal predictions of hydrological conditions. The establishment of Climate Prediction Centers in the region, together with Regional Climate Outlook Forums was seen as important steps. The group however noted that adequate mechanisms need to be developed to enhance capabilities in NMHSs region-wide to effectively utilize climate information that will be generated through the GFCS.

4.7 Members of the group noted with concern the generally inadequate representation of experts in hydrology and water resources in WMO's regional meetings where a more adequate representation of hydrologists were needed given the importance of hydrology and water resources in many programs of WMO.

4.8 Presentations by members of the Working Group

4.8.1 Mr. Kazuhiko FUKAMI made a presentation on typical examples of activities in Japan relevant to the theme on Hydrological Response to Climate Variability and Change. He introduced a comprehensive research project on climate change projection and its impact assessment with a super-high-resolution (20km) atmospheric general circulation model of Meteorological Research Institute (MRI-AGCM) to analyze extreme events such as floods and droughts on a river basin scale. He showed some examples of ongoing research results such as the possibility of decreasing the number of typhoon's generation, increasing the strength of typhoon, and so forth. The necessity to consider bias correction of those GCM outputs and to reduce uncertainties through ensemble analysis was discussed. He also mentioned a recent publication of "Practical Guidelines on Strategic Climate Change Adaptation Planning -Flood Disasters-" edited by the Japanese Ministry of Land, Infrastructure, Transport and Tourism (MLIT). Finally, he introduced a free software to promote the implementation of flood runoff analysis and forecast in developing countries, i.e. Integrated Flood Analysis System (IFAS) developed by International Centre for Water Hazard and Risk Management under the auspices of UNESCO (UNESCO-ICHARM), which can incorporate satellite-based rainfall data and GIS-based parameters for its preliminary application and its step-by-step improvement with in-situ data. IFAS is expected to contribute to the enhancement of local ownership of flood early warning system. The necessity to input and to test more variety of satellite-based rainfall products in the world was discussed.

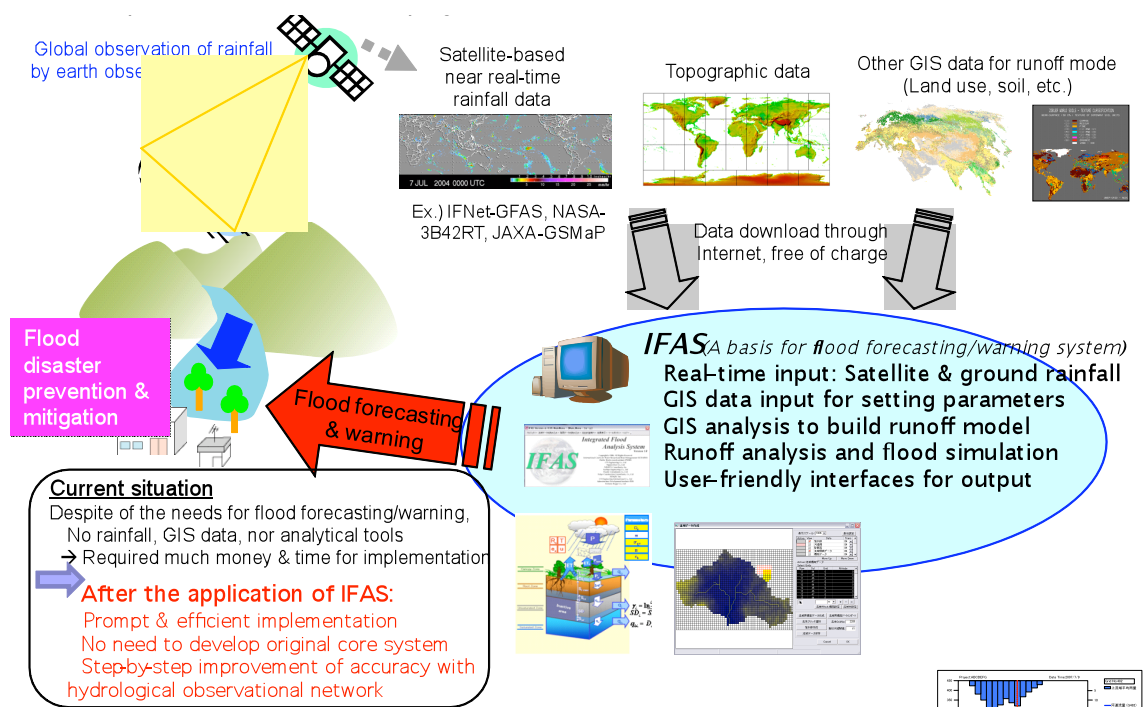


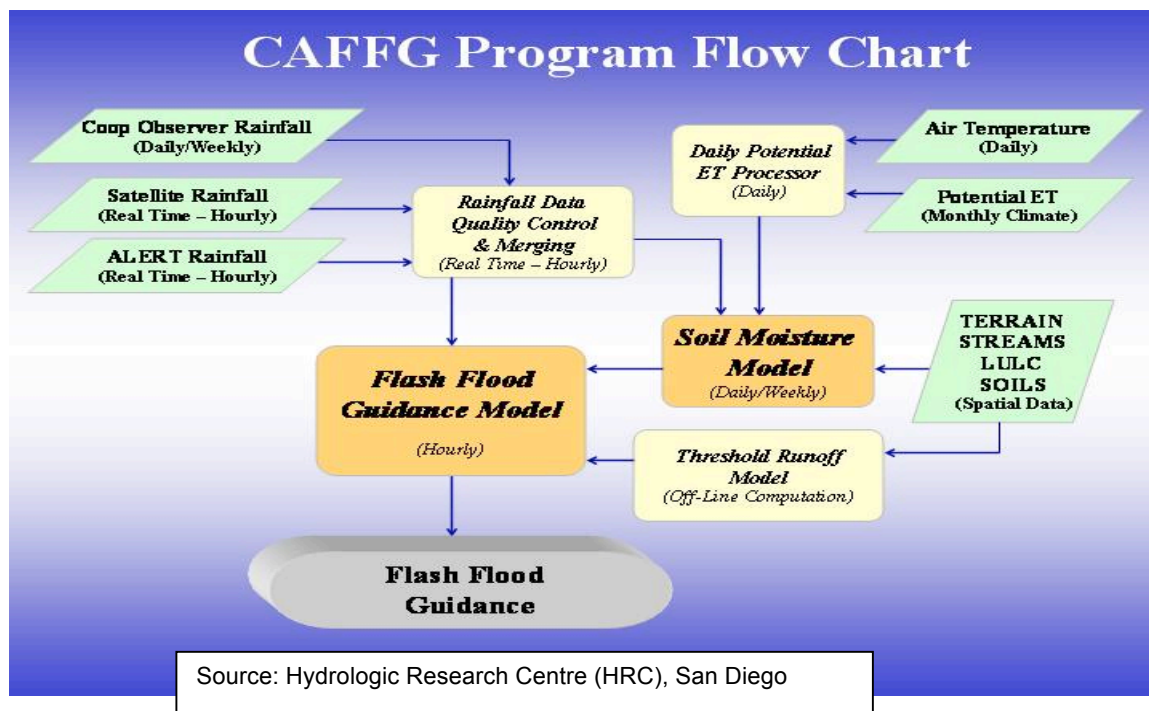
Fig. * Concept of Integrated Flood Analysis System (IFAS)

4.8.2 Ms. Patchara PETVIROJCHAI presented on a cooperation project between the Thai Meteorological Department and the Center for Water Resources and Environment, Sun Yat-sen University, PR China. Highlights of this project are not only the establishment of the Xin'anjiang flood forecasting model, and the development of numerical rainfall predictions but also on rainfall/flood triggered mudflow analysis and the development of flash flood risk maps in selected parts of Thailand. Likewise, the importance of fully functional telemetry systems such as for flash flood warnings was demonstrated using the examples from the Thai Meteorological department.

4.8.3 Mr. Wolfgang Grabs provided an outline of the Flash Flood Guidance system project that is being implemented in different regions around the world and including the Mekong River Basin. Recently, Pakistan has also voiced its keen interest to implement the system on its territory. Participants noted recent findings of the WMO (WMO 2008) country-level survey, where out of 139 countries, 105 indicated that flash floods were among the top two most important hazards around the world and require special attention.

The group appreciated the potential of the system for the provision of flash flood guidance in large parts of the region that is heavily affected by the disastrous impacts of flash floods.

The diagram below shows the flow chart of the Flash Flood Guidance System in a typical configuration for its implementation in different regions. Such as the Central American Flash Flood Guidance System (CAFFG)



4.8.4 Mr. Dang Ngoc TINH made a presentation of institutional capacity building in Vietnam. In his presentation he highlighted on the following areas including Flash Flood Forecasting, training in the application of the Integrated Flood Alert System (IFAS), and capacity building efforts through the Mekong HYCOS project. With regard to the Severe Weather Forecasting Demonstration Project (SWFDP), Mr. Tinh highlighted on the RA II Pilot Project on City-specific NWP forecasts and the RA II Pilot Project on NWP support (provisionally called Asian Consortium for NWP Forecasts, or ACNF) – This had been proposed in the XIV-RA II session in Tashkent (2008), and the idea is still under further conceptual development. A questionnaire to survey Members' needs is being planned. Initial thinking is a virtual online resource centre geared towards technical research and training issues in support of Members with some capacity to experiment or operationally run NWP models.

4.8.5 Other initiatives with an expected benefit for RA II Members include the World Bank Global Flood Disaster Risk Reduction (GFDRR) initiative in conjunction with WMO DRR programme for five countries (Viet Nam, Cambodia, Lao PDR, Indonesia and Philippines). High on the agenda are projects to be planned and executed for real-time urban flood modeling and forecasting in close linkage to improved forecasting capabilities including through the use of NWP rainfall forecasts.

5. CONSIDERATION OF THE WORK PLANS AND EXPECTED RESULTS

5.1 The group reviewed and revised the work plans in view of the short time available to produce tangible results until March 2012 when the final reports need to be available for documentation for the upcoming fifteenth session of the Regional Association. This resulted in a marked shortening of originally anticipated activities within each of the themes. Participants realized the necessity to make full use of supporting experts to the working who had been nominated for the different theme areas.

5.2 The Working Group expressed its regret that two of the anticipated theme areas, namely:

- Disaster Management – Hydrological Aspects of Drought, including Drought Monitoring, assessment of water scarcity and deficits and
- Improved Accuracy of Hydrometric and Sediment Observations including Space-based Technologies in RA II

will not be implemented in the intersessional period, as the nominated theme leaders could not be contacted and did not respond to appeals to take up their assigned responsibilities. Recognizing the importance of the theme areas, the group decided to recommend the theme areas for the proposed work plans of the next intersessional period of RA II (2012-2016).

6. DEVELOPMENT OF THE CONSOLIDATED WORK PLAN AND DOCUMENTATION OF THE RESULTS FOR THE FIFTEENTH SESSION OF THE REGIONAL ASSOCIATION II (ASIA) IN 2012

6.1 The revised work plans for the different themes are documented below as a result of the review described under item 5 above.

Theme/Area of activities	Improving Institutional Capacity including the implementation of the RA II Strategic Plan for NHSs			
Priority	High – WMO Core Activity			
Background Material e.g. Previous reports of the RAIL WGH	<ul style="list-style-type: none">• Strategic Plan for the Enhancement of NHSs in RA II• Strategy for Capacity Building (WMO)• Manual on the Management and Operation of NHSs			
Expected Outputs	<ul style="list-style-type: none">• Progress in implementation of Strategic Plan, review of plan• Training requirements and opportunities• Implementation of the Manual on the management and operation of NHSs			
Expected Results	<ul style="list-style-type: none">• NHSs with prioritized Strategic Planning Capabilities• Improved management capabilities of NHSs			
Specific Activities	<ul style="list-style-type: none">• Compile a summary of good management practices in NHSs• Promotion of the Manual on the management and operation of NHSs			
Potential Linkages	<ul style="list-style-type: none">• WMO – CHy			
Timeframe	Progress Report	April	2011	
	Draft Report	December	2011	
	Final Report	March	2012	
Potential contributors	<ul style="list-style-type: none">• NHSs			

Theme/Area of activities	Disaster Mitigation – Implementation of the WMO Flood Forecasting Initiative including Flash Flood Forecasting Capabilities			
Priority	High – WMO Core Activity			
Background Material e.g. Previous	<ul style="list-style-type: none"> • WMO Strategy and Action Plan • Regional report of the WMO Flood Forecasting Initiative • DPM RA II Regional Analysis Document (The WMO Disaster 			

reports of the RAI WGII	Risk Reduction Country Level Survey)
Expected Outputs	<ul style="list-style-type: none"> • Implementation of the Strategy and Action Plan of the WMO Flood Forecasting Initiative • Best practice of flash flood forecasting and warning (QPE, QPF) Develop demonstration projects
Expected Results	<ul style="list-style-type: none"> • Improved flood forecasting capacity • Enhanced and effective cooperation between NMHSs
<i>Specific Activities</i>	See items listed below
Established Linkages	<ul style="list-style-type: none"> • WMO DPM Programme • CHy • ICHARM • Typhoon Committee
Timeframe	Progress Report April 2011 Draft Report December 2011 Final Report March 2012
Identified contributors	<ul style="list-style-type: none"> • DPM national focal points • PWRI • ICHARM • Typhoon Committee • Selected NMHSs

Specific activities are described below in support of identified specific activities in the work plan:

A) Promote implementation of the Strategy and Action Plan through assistance in the development of national implementation plans:

(1) Taken from the detailed Activity Plan of the December 2009 workshop (see item 8 below): Prioritize activities in accordance to the three different capability categories of NHSs: Strengthening of observing and information systems; improvement of hydrological forecasting practices and products; strengthening of institutional coordination, cooperation and integration between NMSs and NHSs; make suggestions for national implementation.

(2) From latest version of the RA II Strategic Plan: Update – where appropriate –
The table on activities in hydrology;

- Contribute to document on the Assessment of Efficiency of Flood Forecasting Services; (Collect National Standard for hydrological information and hydrological forecasting, for China, issued in 2008);
- Contribute to Project: “Intercomparison of Flood Forecasting Models”

(3) Collect and recommend some hydrological models which are not in the Hydrological Model Gallery but have wide and efficient application in flood forecasting in this region, from China, such as XinAn-Jiang model which has widely application in humid and semi-humid regions

Pending approval from Ministry of Water Resources, WR, P.R.C.: Some possible opportunities for cooperation with countries in RA II (Asia) in Hydrology and Water Resources:

(a) Introduce and Extend National Flood Forecasting System of China, the User Manual in English version will be published in the first half of 2011;

(b) Organize regional international workshop on flood forecasting technology and models to provide a platform for sharing experience; Office of Hydrology had done successfully in 2008 where 10 countries participated;

(c) Extend the XinAn-Jiang model to some countries in this region including, Thailand, Malaysia, Vietnam;

(d) Learn the technology or experience of using the combination rainfall data of radar and observation as an input for flood forecasting, from Japan and Korea; Learn the technology and experience on flash flood forecasting by using cumulative precipitation curve from Japan; learn the technology and experience on urban flood warning and defense from Singapore and Japan....)

B) Develop project briefs for demonstration projects on the basis of proposed pilot projects in the Activity Plan of the FFI

Select pilot project(s) and prepare project brief and concept for discussion and possible implementation. Aim at development of 2 pilot project briefs:

Project 1: Inter-comparison of coupled forecasting models currently in use in the different countries in this region, then identify the most suitable models to serve their requirements, Project 2: Joint research activities on flood forecasting system and models in countries with similar regional characteristics.)

C) Promote and participate in the planning and implementation of the Global Flash Flood Guidance System in RA II; Collect information on operation of FFGS in the Mekong Basin

D) Compile case study on enhanced flash flood guidance and forecasting (in China: Enhanced radar-based precipitation information, improved rain-gage network in south-western part of China, Yunnan, Jiangxi, Hunan province, establishment of community-based precipitation stations for empiric early warning purposes and improved use of satellite-base precipitation estimates for operational purposes.)

E) Collect and disseminate guidance materials and manuals on the assessment of mass movement hazards (If time and available material permits: on the basis of materials collected mainly from Japan, Nepal and China)

Theme/Area of activities	Water Resources Assessment, Availability and Use (Surface water and groundwater)
Priority	<ul style="list-style-type: none"> • High – WMO core activity • High – Millenium Development Goals
Background Material e.g. Previous reports of the RAI WG	<ul style="list-style-type: none"> • WMO-UNESCO Water resources Assessment Manual • IGRAC Webpage, manuals and guidelines (on their webpage) • Global Water resources Outlook at the beginning of the 21st Century • Selected UNESCAP studies
Expected Outputs	<ul style="list-style-type: none"> • Implementation of the WRA manual in countries in RA II • Changes in the availability of groundwater resources in large aquifers
Expected Results	<ul style="list-style-type: none"> • Improved capability to contribute to IWRM • Improved knowledge for catchment management

Specific Activities	<ul style="list-style-type: none"> • Collect information on water use in countries of the region • Provide information on shifts in water resources availability
Potential Linkages	CHy UNESCAP Member countries
Timeframe	Progress Report April 2011 Draft Report December 2011 Final Report March 2012
Potential contributors, (<i>inter alia</i>)	<ul style="list-style-type: none"> • WMO Secretariat • UNESCO/IHP • IGRAC • Sustainable Water Resources Research Center (SWRRC)

Theme/Area of activities	Hydrological responses to climate variability and change and promotion of the use of climate information by water managers		
Priority	High – WMO Core activity (WCP-Water)		
Background Material e.g. Previous reports of the RAII WGH	<ul style="list-style-type: none"> • WCP-Water reports • IPCC Assessments and special report on water (2008) • Web-research and specialized publications • FRIEND reports 		
Expected Outputs	<ul style="list-style-type: none"> • Search for suitable climate prediction products for water managers 		
Expected Results	<ul style="list-style-type: none"> • Improved adaptation capacity of water resources systems in a changing climate 		
Specific Activities	<ul style="list-style-type: none"> • Preparation of a requirements document of water managers in terms of climate information • Overview of impacts of climate change on water resources in the region (selected examples) 		
Potential Linkages	<ul style="list-style-type: none"> • IPCC Working Group II • UNESCO/IHP 		
Timeframe	Progress Report April 2011 Draft Report December 2011 Final Report March 2012		
Potential contributors, (<i>inter alia</i>)	<ul style="list-style-type: none"> • Russian Academy of Science – Institute of Geography • Climate Research and Prediction Centres • World Climate Applications Programme (WCAP) 		

Theme/Area of activities	Regional exchange of hydrological data and information including WHYCOS and contributions of regional aspects of INFOHYDRO
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Priority	High – WMO Core activity
Background Material e.g. Previous reports of the RAII WGH	<ul style="list-style-type: none"> • WHYCOS websites • FRIEND websites and publications • INFOHYDRO • River Basin agreements
Expected Outputs	<ul style="list-style-type: none"> • Assessment of challenges and opportunities for the exchange of hydrological data and information • Promotion of the WHYCOS Programme in RA II • Facilitation of inputs towards INFOHYDRO • Case studies on successful data sharing arrangements in the region
Expected Results	<ul style="list-style-type: none"> • Improved regional and global access to hydrological data and information for water-related projects and scientific programmes within and beyond the region
Specific Activities	<ul style="list-style-type: none"> • Documentation of data exchange agreements and practices in the region • Documentation of “lessons-learnt” in data exchange and access to metadata on hydrological information
Potential Linkages	<ul style="list-style-type: none"> • WHYCOS/HYCOS • CHy • UNESCO/IHP • Global Data Centres (GRDC) • Regional and river basin websites
Timeframe	Progress Report April 2011 Draft Report December 2011 Final Report March 2012
Potential contributors, (<i>inter alia</i>)	<ul style="list-style-type: none"> • WHYCOS partners • FRIEND Rivers Catalogue • River Basin Organizations and NHSs • INFOHYDRO National Focal Points

7. IMPLEMENTATION OF THE STRATEGIC PLAN FOR THE ENHANCEMENT OF NATIONAL METEOROLOGICAL AND HYDROLOGICAL SERVICES (NMHSs) IN REGIONAL ASSOCIATION II (ASIA) FOR THE PERIOD UP TO 2012

7.1 The group reviewed the Strategic Plan for the Enhancement of NMHSs in RA II and observed that the merging of the strategies for the enhancement of NMSs and NHSs had resulted in a loss of unique strategic issues specifically related to hydrology and water resources. The group however appreciated the viewpoint that the current strategy reflects the efforts of Members to enhance cooperation between NMSs and NHSs and recalled that this concept is at the core of the WMO Flood Forecasting Initiative.

7.2 Participants concluded on desired amendments of the current strategy and in particular those related to the WMO Expected Result 3: Enhanced capabilities of Members to provide better hydrological forecasts and assessments. Participants felt that the items listed under this Result require prioritization in view of the practicability of the implementation of the strategy in NHSs. The amendments and relative priorities are documented in the table below; relative priorities are indicated in brackets; the first three highest priorities are highlighted in yellow:

Regional ER3(a): <i>Improvement in Members' capability in observation and development of products and services for the user community, including flood/flash flood urban floods and landslide/debris flow warnings</i> Deliverable:	
3.1 (5)	Growth in spatial and temporal coverage of hydrological observation networks
3.2 (15)	Growth in number and frequency of hydrology-related publications issued by NMHSs
3.3 (4)	Reliability of maintenance procedures for measurement and equipment (including gauges) in hydrological stations
3.4 (3)	Reliability of quality control procedures applied on data collected from hydrological stations
3.5 (6)	Real-time reporting of hydrological data from networks including from remote stations
3.6 (1)	Hydrometric measurements with quality and accuracy
3.7 (2)	Calculation of runoff with quality and accuracy and including rating curves
3.8 (12)	Estimation of sedimentation rates and sediment budgets with accuracy
3.9 (14)	Measurement of changes in river flow in snow/glacier-fed rivers (to assess effect of climate change and climate variability); conduct snow and glacier observations
3.10 (7)	Issuance of flood warnings and constantly improving upon them
3.11 (8)	Issuance of flash flood warnings and constantly improving upon them
3.12 (13)	Issuance of landslide/debris flow warnings and constantly improving upon them
3.13 (10)	Improvement in warnings capability through enhanced and effective cooperation with other NMHSs
3.14 (11)	Contribution towards Integrated Flood Management (IFM)
3.15 (9)	Urban Floods
Regional ER3(b): <i>Upgrade in Members' capability in monitoring changes in hydrological parameters and in assessing water availability especially in light of climate change</i> Deliverable:	
3.15 (2)	Assessment of basin-wide water resources availability, including use of climate predictions
3.16 (11)	Measurement and estimation of other forecasting and assessment relevant hydrological variables
3.17 (1)	Implementation of Water Resources Assessment (WRA)
3.18 (6)	Improved contributions to Integrated Water Resources Management (IWRM)
3.19 (5)	Improved management of lakes and reservoirs
3.20 (4)	Improved knowledge for catchment management and including groundwater
3.21 (8)	Contribution to adaptation relating to changes in water resources availability (including trends and outlook)
3.22 (3)	Enhanced preparedness to predict and manage hydrological droughts
3.23 (10)	Improvement in building knowledge and assessments for decision-making at national and regional levels
3.24 (7)	Improvement in adaptation capacity of water resources systems in a changing climate

3.25 (9)	Improvement in capacity for water-related disaster management (Hydrological extremes)
Regional ER3(c): Encouragement of Members to contribute to, and benefit from, appropriate databases, resources and expertise Deliverable:	
3.26 (10)	Participation in the Hydrological Information Referral Service (INFOHYDRO)
3.27 (3)	Participation in national/regional joint activities/programmes involving hydrologists, meteorologists and the climate communities
3.28 (5)	Access to, and appropriate use of, relevant new technologies through improved exchange mechanisms in the context of HOMS
3.29 (4)	Improved development, adaptation and use of hydrological models for forecasting and assessments
3.30 (8)	Participation in the planning and implementation of the World Hydrological Cycle Observing System (WHYCOS)
3.31 (1)	Improved access and use of national, regional and global hydrological data and information for water-related projects and scientific programmes within and beyond the Region
3.32 (7)	Improvement in strategic planning capability
3.33 (6)	Improvement in institutional management capability
3.34 (2)	Development of national and regional capacity building programmes and related training activities

7.3 The group likewise reviewed the Action Plan for the Enhancement of NMHSs in RA II and made amendments specifically to the summary of activities listed under Strategic Thrust 1 – Improving Service Quality and Service delivery. The amendments are documented in the table below. Note that the amendments are shown in ***bold italics***

Strategic Thrust 1 – Improving Service Quality and Service Delivery
Expected Result 2 – Enhanced capabilities of Members to reduce risks and potential impacts of hazards caused by weather, climate and water and related environmental elements

Item	Old Item No.	Deliverable	Key Performance Indicator/Target	Summary of activities
2.1	3.1	Growth in spatial and temporal coverage of hydrological observation networks	Percentage of Members expanding their hydrological observation network both spatially and temporally, to reach 25% or above.	Include item starting from the next survey among Members <i>Keep stations with long hydrological records for climate purposes</i>
2.2	3.3	Reliability of maintenance procedures for measurement and equipment (including gauges) in hydrological stations and of quality control procedures applied on data collected from hydrological stations	Percentage of Members having implemented reliability measures for their maintenance procedures for measurement and equipment in hydrological stations and for their quality	Include item starting from the next survey among Members <i>Develop SOPs for operation and maintenance of stations</i>

			control procedures applied on data collected from their hydrological observation stations, to reach 25% or above.	
2.3	3.7	Calculation of runoff with quality and accuracy	Number of Members capable of calculating runoff with quality and accuracy, to reach 25% or above.	Include item starting from the next survey among Members Focus on rating curves
2.4	3.9	Measurement of changes in river flow in snow/glacier-fed rivers (to assess effect of climate change and climate variability)	Number of Members measuring changes in river flow in snow/glacier-fed rivers, to reach 25% or above.	Include item starting from the next survey among Members Improve on snow and glacier measurements and observations including use of remote sensing
2.5	3.10	Issuance of flood, flash and urban flood warnings and constantly improving upon them	Number of Members giving and constantly improving flood and flash flood warnings, to reach 50% or above.	(a) Include item starting from the next survey among Members; (b) conduct mission visit(s) to Members in developing countries or least developed countries , develop user-oriented flood forecasting products
2.6	3.12	Issuance of landslide/debris flow warnings and constantly improving upon them	Number of Members giving and constantly improving landslide/debris flow warnings, to reach 50% or above.	Include item starting from the next survey among Members See Typhoon Committee reports on this subject, engage in hazard mapping
2.7	3.13	Improvement in hydrological warnings capability through enhanced and effective cooperation with other NMHSs	Number of Members having improvement in its warnings capability through enhanced and effective co-operation with other NMHSs, to reach 25% or above.	(a) Include item starting from the next survey among Members; (b) organize training course for Members Use WMO Flood Forecasting Initiative as platform
2.8	3.22	Enhanced preparedness to predict and manage hydrological droughts and knowledge for decision-making	Number of Members having enhanced its preparedness to predict and manage hydrological droughts and its knowledge for decision-making, to reach 25% or above.	Include item starting from the next survey among Members Follow-up on drought related research and action activities including CAgM and drought management Programme

2.9	3.24	Improvement in adaptation capacity of water resources systems in a changing climate	Number of Members having improved adaptation capacity of water resources systems in a changing climate, to reach 25% or above.	Include item starting from the next survey among Members Improve on requirements for climate information for water managers
2.10	3.25	Improvement in capacity for water-related disaster management (Hydrological extremes)	Number of Members having improved capacity for water-related disaster management, to reach 25% or above.	(a) Include item starting from the next survey among Members; (b) organize training course for Members Organize workshops in support to providing inputs to decision support for disaster management
2.11	6.3	Now-casting (0-6 hours ahead) service on high-impact weather	Percentage of Members providing now-casting service on high-impact weather, to reach 77% (or +1 Member) or above. [2008 level: 74%]	(a) Continue monitoring; (b) encourage and facilitate exchange and training on relevant know-how Provide training and technical support for flash flood and urban flood forecasting
2.12	6.5	Issuance of short-range forecasts/warnings (6-24 hours ahead)	Percentage of Members issuing short-range forecasts/warnings, to be maintained at 91% or above. [2008 level: 91%]	(a) Continue monitoring; (b) encourage and facilitate exchange and training on relevant know-how
2.13	6.6	Issuance of storm surge warnings	Percentage of marine met service providers issuing storm surge warnings, to reach 69% (or +1 Member) or above. [2008 level: 65%]	(a) Continue monitoring; (b) encourage and facilitate exchange and training on relevant know-how Use CFIDP project to improve on capacity for coastal flood forecasting and management (including deltas and estuaries)
2.14	6.8	Provision of support for combating marine pollution	Percentage of marine met service providers providing support for combating marine pollution, to reach 62% (or +1 Member) or above. [2008 level: 58%]	(a) Continue monitoring; (b) encourage and facilitate exchange and training on relevant know-how Encourage NHSs to provide water quality information of rivers discharging into the oceans
2.15	6.9	Provision of support for search and rescue operations	Percentage of marine met service providers	(a) Continue monitoring; (b) encourage and

			providing support for search and rescue, to reach 85% (or +1 Member) or above. [2008 level: 81%]	facilitate exchange and training on relevant know-how
2.16	6.11	Implementation of instrumentation (e.g., DART) for real-time monitoring of storm surge or tsunami	Number of systems implemented in the region (to be determined in the next survey).	Include item starting from the next survey among Members
2.17	6.15	Establish/strengthen links with national disaster managers	Percentage of Members having links with national disaster managers, to be maintained at 94% or above. [2008 level: 94%]	(a) Continue monitoring; (b) provide support and/or conduct expert visit to Members in need, if necessary
2.18	6.16	Develop/implement a public education programme	Percentage of Members having a public education programme, to reach 77% (or +1 Member) or above. [2008 level: 74%]	(a) Continue monitoring; (b) encourage and facilitate exchange and training on relevant know-how

8. IMPLEMENTATION OF THE WMO FLOOD FORECASTING INITIATIVE: STRATEGY AND ACTION PLAN FOR THE ENHANCEMENT OF COOPERATION BETWEEN NATIONAL METEOROLOGICAL AND HYDROLOGICAL SERVICES FOR IMPROVED FLOOD FORECASTING

8.1 Participants were briefed on progress made in the implementation of the WMO Flood Forecasting Initiative and in particular the outcomes of the Workshop on the Strategy and Action Plan (SAP) held in December 2009 in Geneva. That workshop aimed at the documentation of priority activities on national level to implement that SAP. Participants agreed to the findings of the workshop that amongst the most challenging factors impeding effective flood forecasting were:

- Inadequate professional capacity at the working and the institutional level;
- Obsolete or dysfunctional hydrological information systems including station networks and communication facilities;
- Fragmented forecasting services;
- Insufficient cooperation between meteorological and hydrological agencies;
- General lack of adequate quality management controls in forecasting; and
- Low level of integration of forecasting services in natural risk management and disaster reduction management.

8.2 From the outcomes of the workshop, participants selected the following priority activities, highly relevant for RA II:

- Wide promotion of the Activity Plan – together with the Strategy and Action Plan - to NMHSs;
- Facilitated national consultations to sensitize National Meteorological and Hydrological Services for an improved cooperation. WMO is seen as the lead agency to facilitate these consultations;
- Integration of the Plan in Working Groups Hydrology of WMO's Regional Associations;

- Integration of the Plan in the hydrological domain of WMO's Tropical Cyclone Programme such as in the Working Group Hydrology of the Typhoon Commission;
- Prepare a training module for the use of the SAP and Activity Plan in NMHSs;
- Fostering twinning agreements between NMHSs with the objective of sharing know-how and technology in improved cooperation and the development and use of advanced forecasting products and their dissemination.

8.3 The group was further informed on the progress made in the implementation of the Flash Flood Guidance System (FGS) project that is a key component of the Flood Forecasting Initiative. Here, participants voiced their support and great interest in the project that was seen of high importance for the region.

8.4 Participants were also informed on two activities that will be carried forward in 2011 and onwards, namely the

- Intercomparison of forecasting models currently in use in the various WMO Regions, to help the countries in identifying the most suitable models to serve their requirements;
- Development of a framework for the assessment of service delivery capabilities of hydrological services in flood forecasting.

8.5 The group highlighted the importance given to the subject that is reflected in the current work plan and voiced its appreciation for the theme leader, Ms ZhouLi and support given to her work by the Office of Hydrology of P.R.C. China.

8.6 The group likewise recommended that the implementation of the Flood Forecasting Initiative be taken up further in the Workplan for the next intersessional period of RA II (2012-2014)

9. OVERVIEW OF REGIONAL REQUIREMENTS WITH REGARD TO CLIMATE INFORMATION FOR WATER MANAGEMENT AND DISASTER REDUCTION

9.1 The group recalled that this issue had already been on the agenda of the previous session of the WGH but that no substantive follow-up could be achieved in part, because relevant working mechanisms had not been in place. This situation has changed since the third World Climate Conference held in Geneva in 2009 and the subsequent efforts under way to establish a Framework for Climate Services (GFCS).

9.2 The group reiterated its view that impacts of climate variability and change are foremost felt in the water sector with repercussions in water-dependant sectors. In reviewing the 2006 report on the need of climate information for water managers, the group engaged in a brainstorming session to compile a preliminary survey on climate information that is required for hydrologists and water managers. The preliminary survey is documented below.

9.3 Likewise, the group recommended that a comprehensive requirements document on the subject needs to be developed that should include knowledge from public utility organizations. The group further recommended that an expert meeting should be organized on the subject, where climatologists and hydrologists/water managers would outline suitable climate information products that could serve as input information for hydrological modelling and as decision making tools for water managers.

9.4 Preliminary survey items (not ordered for priorities) include:

- GCM –models temperature/precipitation for hydrological models
- Improved downscaling techniques
- Assessment of uncertainties

- Ranking of GCM model outputs (precipitation data)
- Use Ensemble prediction tools (long/short term)
- Trends, non-stationarity of design criteria
- Documentation of trends of hydrometeorological extreme events (frequency, duration, magnitude...)
- (floods, droughts, cyclones...)
- Critical Variables including: temperature, precipitation, evapotranspiration, soil moisture, runoff
- Hydrological normals derived from climatological normals
- Localization of events
- Statistical tools from seasonal climate predictions to shorter time-scales....need to develop new statistical methods accounting for non-stationary.....
- Improve on spatial and temporal resolution
- Operationalization of products, move to more quantitative products,
- Focus on river basins/sub river basins
- Coupled modeling: interaction between hydrological, groundwater and climatological modelling
- Scenario-techniques used for
- System's sensitivity assessments
- Provide seasonal predictions tailored to sector needs
- Connectivity of global circulation systems (development of blocking situations, for example)
- Statistical methods: analysis of long time series
- Data collection: Establish improved integrated observation networks to better understand the water balance
- Development of adaptation strategies
- Climate change effects in coastal zones, and mountain areas

9.5 With regard to water resources assessment the group recommended to improve dialogue between climatologists and water resources management.

10. CONTRIBUTION OF THE WORKING GROUP HYDROLOGY OF THE ESCAP/WMO TYPHOON COMMITTEE – FOLLOWED BY DISCUSSION ON POSSIBLE JOINT ACTIVITIES

10.1 The group recalled a number of activities that are being undertaken by both, the RA II WGH and the Working Group Hydrology of the Typhoon Committee. The group further recalled that the representative of the Typhoon Committee had already participated in the session of the WGH in 2007 and that subsequently efforts were made to enhance cooperation between the two working groups. This had also been communicated to the 41st session of the TC in Chiang Mai in 2008. Reviewing the work areas of both working groups, and based on a presentation of the representative of the TC, the group adopted areas of joint activities to the benefit of the Members of RA II and the Typhoon Committees as documented below.

10.2 It was agreed that the RA II WGH would nominate its chair to represent activities of the WGH and likewise that the results of the proposed joint working areas be communicated during the 43rd session of the TC in January 2011. The four areas where joint activities are envisaged are documented below.

Area 1: Urban Flood Risk Management (UFRM)

Purpose:

- ① to exchange and share experiences on UFRM including technologies on urban flood monitoring, forecasting and warning;
- ② to enhance capacity of UFRM management; and

- ③ to strengthen regional cooperation towards flood resilient cities considering climate change.

Feasibility:

- ① TC on-going cross-cutting project (good practice, pilot cities, guidance material);
- ② Existing research results
- ③ WMO RA II work plan

Area 2: Flash Flood/Debris Flow/landslide Forecasting/Warning

Purpose:

- ① To establish a methodologies by simply using rainfall indexes to forecast/warning the occurrence of disaster;
- ② To identify the hazard map which helps in judgment during public evacuations in community;
- ③ To give alarm by using simple alarm instrument.

Feasibility:

- ① TC concluded project and on-going project;
- ② WMO FFGS
- ③ WMO RA II work plan

Area 3: Assessment of the Variability of Water Resources in a Changing Climate

Purpose:

- ① To promote the actions of local government bodies/ communities to strengthen the level of preparedness and adaptation measures for problems on water resources impacted by Climate Change.

Feasibility:

- ① WMO RA II work plan;
- ② TC new proposed project;

Area 4: Drought Monitoring and Forecasting based on Space-based Information

Purpose:

- ① To seek the possibility, find the solution and utilize space-based technology and information to drought disaster monitoring and assessment;
- ② To enhance the mutual cooperation and data sharing on drought risk reduction by using newly developed space-based technology-application.

Feasibility:

- ① RA II WGH work plan & GEO
- ② The Regional Cooperative Mechanism of ESCAP on Drought Disaster Monitoring and Early Warning;
- ③ TC on-going project.

11. DISCUSSION ON THE EXCHANGE OF HYDROLOGICAL DATA AND INFORMATION IN THE REGION, INCLUDING THE STATUS OF WHYCOS PROJECTS

11.1 As an introduction to this topic, Mr. Anvar Homidov reported on the requirements for the exchange of hydrological data and information with a focus on Central Asia. He highlighted on the outcomes of an "Information Meeting on the preparation of Modernization Programs of the Hydrometeorological Services in Central Asia ", in October 2010 and other

related conferences and meetings. He also reported on costs involved in modernizing hydrometeorological services in view of user demands and in different areas of modernization including providing access to data and information and improvement of forecasting services.

11.2 Participants saw this presentation with interest as it relates closely to the RA II Strategy on the “Enhancement of Meteorological and hydrological Services” as well as being an example of a sub-regional approach to the modernization of hydrometeorological services.

11.3 Globally and region-specifically however, the group noted with concern that efforts in improving data exchange and access to hydrological information falls sharply behind the needs for such information in the light of critical requirements pertaining to the need of such information for transboundary water management, the establishment of regional water balances and in support of adaptation to climate change, amongst others. The group also recognized that in addition to historical information such as hydrological data supplied by Members to the Global Runoff Data Centre (GRDC), more and more near real time hydrological information is required to ensure flexible water resources management in response to seasonal climate prediction and disaster risk reduction as a result of hydrometeorological extremes including floods and drought.

11.4 The group expressed its concern that data generated in different WHYCOS projects is not shared beyond the immediate project partners. In particular, the group identifies the following items:

11.4.1 In transboundary river basins, a win-win situation needs to be established that would encourage upper riparian countries to establish, operate and maintain observing networks that would benefit lower riparians. This could be achieved by compensatory measures as a result of bilateral or regional arrangements;

11.4.2 The scope of climate services that need to be delivered for different sectors would require the timely availability of hydrological data and information;

11.4.3 Likewise, the continuous monitoring of regional, sub-regional and basin-oriented water balances as an important means for sustainable water management practices will require the sharing of near-real time high quality hydrological data and information;

11.4.4 In the spirit of resolution 25 (Cg-XII), Members are encouraged to identify dedicated hydrological stations whose observations are available in an institutionalized manner;

11.5 Activities undertaken under WIS are seen as potentially effective to overcome technical hindrances in the access to hydrological data and information such as through the identification of data through a comprehensive and standardized metadata catalogue.

11.6 The group was informed about the efforts undertaken by GRDC to develop such a metadata catalogue which has reached completion stage and is about to be made available to the interested public in the context of WIS.

12. DISCUSSION ON THE NEEDS OF THE REGION IN RELATION TO HYDROLOGY AND WATER RESOURCES INCLUDING CAPACITY BUILDING

12.1 The group recalled the presentation of the vice president of CHy on the following capacity building activities:

- Developed a Strategy Document for Distance Learning.
- A Distance Learning in Basic Hydrology has been carried out in a joint collaboration between WMO and COMET (in USA).
- A Distance Learning Programme in Advanced Hydrology is being finalized for Eastern Europe. It is planned to start from 24 January 2011 and will run for 7 weeks.

- Technology Transfer through HOMS – Hydrological Operational Multipurpose Sub-Programme is still available. Appealing for new components from NHSs/NMHS.

12.2 The group further noted with appreciation various capacity building activities that had been undertaken in the recent past in the fields of hydrology, water resources management and integrated flood management. In discussing additional capacity building requirements, the group recommended dedicated capacity building efforts in the following areas:

- Use of hydrological models
- Use of remote sensing applications in hydrology and water resources management
- New methodologies in water resources assessment

12.3 As a complementary effort in the context of the Quality Management Framework of WMO, the group recommended that for newly developed manuals and guidance materials, specific training components need to be developed to enhance effectiveness of the implementation of the Manuals and Guidelines. As an example, the Manuals on PMP and Lowflow Estimation were mentioned.

13. DISCUSSION ON FUTURE ACTIVITIES OF THE REGIONAL ASSOCIATION II (ASIA) IN THE FIELD OF HYDROLOGY AND WATER RESOURCES AND RECOMMENDED RELEVANT PRIORITY AREAS OF COOPERATION BETWEEN WMO AND OTHER REGIONAL ORGANIZATIONS AND PROGRAMMES

13.1 Reflecting on its work in previous years the group concluded that it has a key role in promoting regional issues related to hydrology and water resources and increasingly critical role in the light of emerging challenges related to hydrological forecasting, water resources assessment and adaptation water management systems under climate change. It therefore recommended to urge the Management Group of RA II to provide all means possible in support of the activities of the Working Group Hydrology and consequently to re-establish the Working Group in the upcoming fifteenth session of RA II (Asia). The group recalled that XIV RA II (Asia) in its Resolution 10 had stated that the establishment of the Working Group would serve to “identify the best means of meeting the hydrological needs in the region.”

13.2 In a number of presentations, members of the Working Group reflected on priority issues related to research, services and operations that are relevant in the context of RA II and beyond.

13.2.1 In his presentation on “Influence of climate changes on the hydrological regime and water resources of the Russian rivers”, Mr. Mikhail Georgievsky demonstrated the actual impact of climate change on the magnitude of changes in hydrological regimes and its impact on the availability of freshwater resources. He also pointed towards the problems of estimating the current and expected changes in water resources and water regime of rivers under climate warming conditions. The group also recognized that science based tools to assess water resources under climate change and its associated prediction uncertainties need to be developed on a priority base.

13.2.2. Participants discussed at length the critical need for activities related to Water Resources Assessment and concluded that at present there is no complete overview on methods and approaches. Participants also called for the development of new methods for water resources assessment as this issue was seen as critical in the development of climate change adaptation plans with regard to the management and use of scarce water resources in a rapidly developing world.

13.2.3 On this subject, Mr. Sun Kim presented on the sustainability of the current use of water resources in Korea and highlighted on different methodologies to monitor water resource utilization in balance to water demand and the need to obtain a region-wide picture

of water resources assessment and monitoring approaches. In this regard, Mr. Kim recommended to:

- Document and disseminate the methodology used for water resources assessment in Russia
- Review methodologies used for the assessment in RA II and develop guidance materials
- Organize a workshop for review and applications of water resources assessment methodologies in RA II
- Collect information on water use in countries in the region
- Provide information on trends in water resources availability
- Assess sedimentation rates in major reservoirs

Participants agreed to these recommendations and urged WMO and interested parties to support the proposed activities.

13.2.4 In the context of WMO's Flood Forecasting Initiative, one main thrust aims at an improved cooperation between meteorological and hydrological services. In this context, Mr. Jinping LIU provided a presentation on Progresses and Challenges on QPE/QPF Utilization in Hydrology. He arrived at the following conclusions:

1. It is recognized that QPE/QPF products is very important factor to improve hydrological service. However, QPE/QPF has not been extensively used in real-time hydrological modeling maybe because:
 - (1) its uncertainty and less-confident reliability;
 - (2) QPE/QPF products were developed for meteorological, not hydrologic purposes;
2. The progresses of research on NWP and EPS makes QPE/QPF products get closer to the hydrological requirements and hopefully can be used more widely in hydrology and disaster reduction in practice;
3. The QPE and QPF could be strengthen through enhanced coupling modeling and an end-to-end evaluation on QPE/QPF quality and impacts on flood and streamflow products for basins of diverse size and topography;
4. To improve QPE and QPF, hydrologists could be encouraged to work with QPE/QPF groups to ensure the hydrological requirements for precipitation (QPE/QPF) can be considered.

13.2.5 Mr. Sergey Myagkov provided a presentation on "Hydrological responses to climate variability and change and promotion of the use of climate information by water managers". Highlights of the presentation were capacity building activities region-wide for monitoring of water resources and water supply in the light of climate change including:

1. Implementation of the collection of hydrological and climatic information in accordance with the principles of monitoring (the formation of long and homogeneous series of observations), replenishment of hydrological and climatic database main hydrological and climatic characteristics.
2. To continue to study and evaluate the impacts of climate change on agro-climatic and water resources, hazardous hydrometeorological phenomena.
3. Assessment of available water resources at the basin level, including the use of climate prediction or climate scenarios.
4. Evaluations of snow cover in mountain river basins, important for the prediction and assessment of water resources due to climate change.
5. Development of methodologies for the rational use of water reservoirs in conditions of climate and hydrological variability.
6. Contribution to adapt due to changes in water availability, development of the indicative projections and trends.

7. Increased preparedness for predicting hydrological drought and mitigate its negative effects.
8. The development, adaptation and use of hydrological models for the prediction and assessment flow.
9. Provide information needed to make adaptation strategies to respond to climate change in the sectors of water resources and agriculture.

Other important elements focus on the development of a knowledge base, participation in regional and sub-regional hydrological and climate research, collaboration and development of partnerships and improving services to various sectors of the economy.

Participants welcomed the presentation as it actually links integrated water resources management (including its assessment and monitoring) and including disaster risk reduction to the availability of relevant climate information, a viewpoint that is critical for the implementation of the emerging “Global Framework for Climate Service”.

13.3 In the light of discussions conducted under different agenda items of the meeting agenda, participants discussed and concluded on future activities of the Working Group Hydrology.

13.3.1 In preparing the proposed work plans for the intersessional period 2012 – 2016, the group retained key theme areas of the current intersessional period 2008 – 2012 to ensure continuity of critical work areas of the working group while also including new themes. The group recommended terminating two of its working themes, namely

- Improving Institutional Capacity and
- Regional Exchange of Hydrological Data and Information.

13.3.2 The group recognized that these working areas would be treated in future as cross-cutting themes critical to most other themes and defined them as a joint responsibility of the entire working group and as such be retained in the agenda of discussions and conclusions. The group however concluded that from a results-based perspective, the reports expected in the current intersessional period would serve as reference documents for future activities but would justify the continuation of the subject areas as separate theme areas. Alternatively, the group recommended as a new theme: Sediment disasters and mass movements (flood and rainfall induced)

13.4 The tables below reflect the recommended theme areas for the next intersessional period. The group agreed that these areas should be proposed to the next session of the WMO RA II in 2012.

Theme 1:

Theme/Area of activities	Strengthening the capability of Members to assess their water resources: Water Resources Assessment, its Variability and Use (Surface Water including reservoirs and Groundwater)
Expected Outputs	<ul style="list-style-type: none"> • Develop and promote new approaches for WRA • Provide guidance materials for WRA and its variability
Expected Results	<ul style="list-style-type: none"> • Capacity building provided in WRA • Develop continuous monitoring tool for WRA
Specific Activities	<ul style="list-style-type: none"> • Link variability to climate predictions • Case studies • TBD

Theme 2:

Theme/Area of activities	Improve accuracy and timeliness of forecasting floods of different cause and origin through enhanced cooperation between NMSs and NMHSs – within context of WMO Flood Forecasting Initiative
Expected Outputs	<ul style="list-style-type: none"> • Implementation of the Strategy and Action Plan of the WMO Flood Forecasting Initiative • Best practice of flash flood forecasting and warning (QPE, QPF) Develop demonstration projects
Expected Results	<ul style="list-style-type: none"> • Improved flood forecasting capacity • Enhanced and effective cooperation between NMHSs
Specific Activities	To be finalized in accordance to progress achieved in the current (2008-2012) intersessional period of RA II

Theme 3 :

Theme/Area of activities	Hydrological Aspects of Drought, including Drought Monitoring, Assessment of Water scarcity and Deficits
Expected Outputs	<ul style="list-style-type: none"> • Assessment and outlook of basin-wide water availability surplus and deficits on a national levels in a regional context including the use of climate scenarios • Development of indicators for the determination of the onset of hydrological droughts • Guidance for the development of drought monitoring networks
Expected Results	<ul style="list-style-type: none"> • Knowledge base to adapt to changes in water resources availability (trends, outlooks..) • Enhanced preparedness to manage droughts
Specific Activities	<ul style="list-style-type: none"> • Document the use of existing hydrological drought indicators • Document overview of operational drought monitoring methodologies/system • Documentation and assessment of national guidance materials to manage droughts

Theme 4 :

Theme/Area of activities	Hydrological responses to climate variability and change and promotion of the use of climate information by water managers
Expected Outputs	<ul style="list-style-type: none"> • Detection of trends and variability in selected river basins in the region • Snow and glacier observations and impact on mountain water resources • Detection of changes in frequency/magnitude of extremes • Suitable climate prediction products are available for water managers
Expected Results	<ul style="list-style-type: none"> • Improved adaptation capacity of water resources systems in a changing climate • Improved capacity for water-related disaster management (Hydrological extremes)
Specific Activities	<ul style="list-style-type: none"> • Collate comprehensive information on the regional situation of glaciers and glacial runoff in RA II (in collaboration with IGOS – Cryosphere and CliC)

	<ul style="list-style-type: none"> • Preparation of a requirements document of water managers in terms of climate information • • Overview of impacts of climate change on water resources in the region (selected examples)
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Theme 5 :

Theme/Area of activities	Improved Accuracy of Hydrometric and Sediment Observations including Space-based Technologies
Expected Outputs	<ul style="list-style-type: none"> • Assessment of the performance of hydrometric instruments and techniques of observations • Improved sediment measuring techniques • Assessment of the accuracy and use of space-based observations for hydrometric purposes
Expected Results	<ul style="list-style-type: none"> • Improved quality and accuracy of observations and calculation of runoff in an overall quality Management framework of NHSs • Improved accuracy of the estimation of sedimentation rates and sediment budgets
Specific Activities	<ul style="list-style-type: none"> • Provide guidance on the use of appropriate instrumentation and methods of observation in diverse conditions • Review of the use and suitability of space-based observations • Prepare detailed proposal for the intercomparison of methods of observations and their relative accuracy • Prepare documentation for the intercomparison of instruments

Theme 6 :

Theme/Area of activities	Sediment disasters and mass movements (flood and rainfall induced)
Expected Outputs	<ul style="list-style-type: none"> • Best practice of flash flood forecasting and warning (QPE, QPF) and landslide/debris flow hazards in mountain areas • Assessment and prediction of sedimentation in major selected reservoirs
Expected Results	<ul style="list-style-type: none"> • Improved reservoir operation • Risk reduction through improved hazard management of rainfall/flood induced landslides, mud/ and debris flows
Specific Activities	<ul style="list-style-type: none"> • Collection and dissemination of guidance materials and manuals on the assessment of rainfall/flood induced mass movement hazards • Assessment of sedimentation rates in major reservoirs • Development of early warning methodologies including documentation of best practices

14. ANY OTHER MATTERS

14.1 Mr. W. Grabs reminded all participants of the time lines for finalizing the works on the different themes. He reiterated that these timelines must be adhered to in order to provide effective input to the upcoming session of the RA – II (Asia) in late 2012. The timelines are:

Progress Report	April	2011
Draft Report	December	2011
Final Report	March	2012

15. ADOPTION OF THE REPORT AND CLOSURE OF THE MEETING

15.1 The group adopted the conclusions, recommendations and work plans as elaborated during the session of the Working Group. Participants agreed that the final draft report would be circulated to participants and the final endorsement of the report should be sought from the Chair of the Working Group before dissemination of the report.

15.2 The chairman, Mr. S. Kim, thanked the participants and the WMO Secretariat for their contributions and professionalism that made the meeting a success. Mr. Kim thanked the representative of CHy for providing a close link between the work of the Commission and the RA II WGH. He noted with appreciation the links established between the WMO-RA II WGH and the WGH of the UNESCAP/WMO Typhoon Committee that was made possible through the contributions provided by the Chair of the WGH of the Typhoon Committee. He also thanked Mr. Grabs for the effective conduct of the meeting.

15.3 The vice-president of the Commission for Hydrology, Mr. Wellens-Mensah, thanked the Sustainable Water Resources Research Centre for providing all necessary technical and professional inputs that helped making the meeting a success. He expressed his satisfaction to see a really active Working Group that he would expect to deliver its final expected outputs. He further congratulated the participants on the results of the meeting and reiterated the need for continuing an enhanced cooperation between CHy and its Expert Groups and the RA II WGH.

15.4 Mr. W. Grabs expressed his gratitude to Water Resources Research Centre and in particular Mr. S. Kim, Ms. M. Lee and all staff in supporting the effective organization of the meeting. He further thanked the participants for their commitment to the tasks of the Working Group and their constructive contributions towards the success of the meeting. He expressed the expectation that the work plans would be fulfilled to the benefit of the NHSS and the region at large.

15.5 The meeting closed on 26 November 2010 at 13:30 and was followed by a field trip.

List of Participants
Meeting of RA II (Asia) Working Group on Hydrology (WGH)
(Seoul, Republic of Korea, 23-26 November 2010)

Working Group on Hydrological Forecasts and Assessments (WGH)

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WORLD METEOROLOGICAL ORGANIZATION

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WORKING GROUP ON HYDROLOGY
WMO REGIONAL ASSOCIATION II (ASIA)

RA II - WGH/ DOC 2
16 November 2010)

SEOUL, REPUBLIC OF KOREA,
23-26 NOVEMBER 2010

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AGENDA

1. OPENING OF THE MEETING
2. ORGANIZATION OF THE WORK OF THE SESSION AND ADOPTION OF THE AGENDA
3. BRIEFING BY THE WMO REPRESENTATIVE AND THE REPRESENTATIVE OF THE COMMISSION FOR HYDROLOGY
4. BRIEFING ON RELEVANT ONGOING REGIONAL ACTIVITIES
5. CONSIDERATION OF THE WORK PLANS AND EXPECTED RESULTS
 - a. Improving Institutional Capacity (Mr. Dang Ngoc TINH)
 - b. Disaster Mitigation - Implementation of the WMO Flood Forecasting Initiative (Ms. ZHOU, Li)
 - c. Disaster Management – Hydrological Aspects of Drought (Mr. Ali Karem KHADUM)
 - d. Water Resources Assessment, Availability and Use and Sedimentation in Rivers and Reservoirs (Mr. Sung KIM)
 - e. Improved Accuracy of Hydrometric and Sediment Observations (Mr. Ali FATAHI)
 - f. Hydrological Responses to Climate Variability and Change (Mr. Sergej MYAGKOV)
 - g. Examples of Research and practice in Japan relevant to WMO RA II WGH activities, focusing on climate change impact analysis (Mr. Kazuhiko FUKAMI)
 - h. Regional Exchange of Hydrological Data and Information (Mr. Anvar HOMIDOV)
6. DEVELOPMENT OF THE CONSOLIDATED WORKPLAN AND DOCUMENTATION OF RESULTS FOR THE FIFTEENTH SESSION OF THE REGIONAL ASSOCIATION II (ASIA) IN 2012
7. IMPLEMENTATION OF THE STRATEGIC PLAN FOR THE ENHANCEMENT OF NATIONAL METEOROLOGICAL AND HYDROLOGICAL SERVICES (NMHSs) IN REGIONAL ASSOCIATION II (ASIA) FOR THE PERIOD UP TO 2012
8. IMPLEMENTATION OF THE WMO FLOOD FORECASTING INITIATIVE: STRATEGY AND ACTION PLAN FOR THE ENHANCEMENT OF COOPERATION BETWEEN NATIONAL METEOROLOGICAL AND HYDROLOGICAL SERVICES FOR IMPROVED FLOOD FORECASTING

9. OVERVIEW OF REGIONAL REQUIREMENTS WITH REGARD TO CLIMATE INFORMATION FOR WATER MANAGEMENT AND DISASTER REDUCTION
10. CONTRIBUTION OF THE WORKING GROUP HYDROLOGY OF THE ESCAP/WMO TYPHOON COMMITTEE – FOLLOWED BY DISCUSSION ON POSSIBLE JOINT ACTIVITIES
11. DISCUSSION ON THE EXCHANGE OF HYDROLOGICAL DATA AND INFORMATION IN THE REGION, INCLUDING THE STATUS OF WHYCOS PROJECTS
12. DISCUSSION ON THE NEEDS OF THE REGION IN RELATION TO HYDROLOGY AND WATER RESOURCES INCLUDING CAPACITY BUILDING
13. DISCUSSION ON FUTURE ACTIVITIES OF THE REGIONAL ASSOCIATION II (ASIA) IN THE FIELD OF HYDROLOGY AND WATER RESOURCES AND RECOMMENDED RELEVANT PRIORITY AREAS OF COOPERATION BETWEEN WMO AND OTHER REGIONAL ORGANIZATIONS AND PROGRAMMES
14. ANY OTHER MATTERS
15. ADOPTION OF THE REPORT AND CLOSURE OF THE MEETING

NOTE: A technical excursion will be organized by the Sustainable Water Resources Research Centre on the last day of the meeting.

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