

# **WORLD METEOROLOGICAL ORGANIZATION**



## **REGIONAL ASSOCIATION II (ASIA)**

### **WORKING GROUP ON HYDROLOGY**

Jointly organized by WMO and  
Bureau of Hydrology, Ministry of Water Resources  
People's Republic of China

*(Beijing, China, 26 – 30 March 2007)*

### **FINAL REPORT OF THE SESSION**

## TABLE OF CONTENTS

1.	OPENING OF THE MEETING .....	4
2.	ORGANIZATION OF THE WORK OF THE SESSION AND ADOPTION OF THE AGENDA .....	5
3.	BRIEFING BY THE WMO REPRESENTATIVE .....	5
4.	BRIEFING ON RELEVANT ONGOING REGIONAL ACTIVITIES .....	7
5.	CONSIDERATION OF THE WORK PLANS AND EXPECTED RESULTS .....	9
5.1	Improving Institutional Capacity both Nationally and Regionally (K. Fukami)	
5.2	Disaster Mitigation – Improvements to Short-duration (Flash) Flood Forecasting Capabilities in Urban Areas (P. Petvirojchai)	
5.3	Disaster Management – Climate Variability and Hydrological Aspects of Drought (Z. Liu)	
5.4	Water Resources Assessment, Availability and Use (Surface water and groundwater) in cooperation with UN ESCAP and IGRAC (S. Awan)	
5.5	Improved Accuracy of Flow Measurements and Estimation in RA II (F.Yazadandoost)	
5.6	Briefing on activities in Central Asia (A.Homidov)	
6.	DEVELOPMENT OF THE CONSOLIDATED WORKPLAN AND .....	10
	DOCUMENTATION OF RESULTS FOR THE FOURTEENTH SESSION OF THE REGIONAL ASSOCIATION II (ASIA) IN 2008	
7.	IMPLEMENTATION OF THE STRATEGIC PLAN FOR THE .....	17
	ENHANCEMENT OF NATIONAL HYDROLOGICAL SERVICES (NHSS) IN REGIONAL ASSOCIATION II (ASIA) FOR THE PERIOD 2004 - 2008	
8.	IMPLEMENTATION OF THE WMO FLOOD FORECASTING .....	18
	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 .....	19
	CLIMATE INFORMATION FOR WATER MANAGEMENT AND DISASTER REDUCTION	
10.	DISCUSSION ON THE EXCHANGE OF HYDROLOGICAL DATA AND .....	20
	INFORMATION IN THE REGION, INCLUDING THE STATUS OF WHYCOS PROJECTS	
11.	DISCUSSION ON THE NEEDS OF THE REGION IN RELATION .....	20
	TO HYDROLOGY AND WATER RESOURCES INCLUDING CAPACITY BUILDING	

12.	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	23
13.	ANY OTHER MATTERS	26
14.	ADOPTION OF THE REPORT AND CLOSURE OF THE MEETING	26
	<b>ANNEX 1</b> – Agenda of the meeting	28
	<b>ANNEX 2</b> – List of participants	30
	<b>ANNEX 3</b> – Draft work plans of the Regional Association II Working Group on Hydrology (2008 – 2012)	34

## **1. OPENING OF THE MEETING**

1.1 At the kind invitation of the Bureau of Hydrology (BoH), the session of the Working Group on Hydrology (WGH) of the WMO Regional Association II (Asia) was held in Beijing, China, from 26 to 30 March 2007.

1.2 The session was opened at 09:30 a.m. on Monday 26 March 2007 in the Zhong Min Plaza Hotel in Beijing, China.

1.3 In opening the session, the Deputy Director-General of the Bureau of Hydrology, Mr Liang Jiazhi cordially greeted participants. He stressed the continued enormous annual losses due to floods and droughts that exceed annually 100 billion RMB. In addition, increasingly flash floods associated with debris flows and landslides add to the economic losses and in particular to the high loss of lives. He pointed out that currently 60% of cities of China face water shortage. This situation calls for new approaches in risk-based and integrated water resources management. Mr Jiazhi noticed that in recent years more attention has been given to hydrological issues in RA II. For example he noted a larger number of meetings that resulted in actual activities and also the inclusion of water-related issues in the new Disaster and Prevention Programme (DPM) of WMO. He was also pleased to realize that the Working Group on Hydrology (WGH) is addressing priority issues including the five themes that the Working Group is addressing, including a strong element of disaster mitigation and management. He assured participants and WMO of the continued support and active participation of China in participation in and support of hydrological activities and contributions to regional cooperation.

1.4 In addressing the participants on behalf of the Permanent Representative of China with WMO, Mr Zhenlin Chen, Deputy Director of the China Meteorological Organization (CMA) stressed the view of CMA that the subtitle of WMO "Weather, Climate, Water" reflected equal importance in WMO. As China is frequently hit by various natural disasters such as floods, droughts, typhoons etc, effective early warning and mitigation of these disasters is fundamental to the socio-economic development, national security and sustainable development of China. Therefore, CMA and the Ministry of Water Resources have established good partnership in addressing those issues. The two organizations effectively collaborate with each other directly and through the office of the State Flood Control and Drought Relief Headquarter in combating many serious floods in large river basins. Such cooperation contributes to the sustainable development and a harmonized society in China. He assured continued full support of China to WMO and its Hydrology and Water Resources Programme.

1.5 The Chair of the WGH, Mr Igor Shiklomanov, Head of the State Institute of Hydrology of the Russian Federation welcomed the participants and stressed the importance of achieving tangible results from the work of the Working Group for the benefit of the region and for the convincing demonstration of results-oriented work to the WMO Regional Association II (Asia) during its next session late 2008. He called for a closer cooperation between CHy and the Working Group and stressed the importance of engaging CHy experts in the activities of the WGH.

1.6 On behalf of the WMO Secretariat, Mr Wolfgang Grabs, Chief of the Water Resources Division thanked the BoH for the efforts made to host this meeting and the participants for their willingness to dedicate substantial work and time to achieve the deliverables of the Working Group as expected by the Regional Association and in particular the National Hydrological Services of the region.

1.7 Mr Grabs mentioned that addressing water-related problems is directly important to all citizens in the region provided that there is the level of national and regional political will for improved cooperation and the plans and resources are available to make the necessary investments. In this context it will be important to integrate activities of the Working Group in the Strategic Plan for the Enhancement of National Hydrological Services in RA II (Asia) that had been approved in June 2005. The achievements of these themes will be reported to the next

session of the Regional Association in late 2008 with a view to translate proposals to actions. This task is extremely demanding as no additional core funds are available and there are now only 15 months left to elaborate tangible results. He further stressed that the transformation of plans and recommendations into actions requires at the national level a high degree of cooperation between National Hydrological and Meteorological Services to improve forecasting and predictions, authorities responsible for disaster management, and in general an institutionalised exchange of data and information relevant to water resources management and disaster prevention. This level of cooperation needs to be replicated at the regional level where some countries would be in the position to provide a lead in assisting others to follow.

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

2.1 The session was attended by 12 participants from six 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) and Mr J. Zhang as member of the CHy Advisory Working Group. Mr Jin Ping Liu of the Bureau of Hydrology participated in his function as Vice-Chair of the Working Group on Hydrology of the Typhoon Committee. The list of participants is given in Annex 1 to this report. Mr W. Grabs acted as Secretary for the meeting and Mr I. Shiklomanov 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.

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

- i. Agree on the deliverables and individual work plans to meet the targets of the Regional Association;
- ii. Discuss and conclude on the priorities for Hydrology and Water Resources Management in the region and to
- iii. Propose the themes and deliverables for the subsequent Regional Working Group Hydrology in the next interessional period 2008-2012.

## **3. BRIEFING BY THE WMO REPRESENTATIVE**

3.1 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.

3.2 In addressing regional activities, Mr Grabs pointed out that during the interessional period most of the Regional Working Groups in Hydrology have decided to work towards concrete projects, instead of continuing to compile reports. CHy-XII had expressed its concerns at the decline in support to the regional activities of the WGHs during the last interessional period. During the present interessional period, the Advisory Working Group (AWG) of the CHy has actively sought to align the activities of the Working Groups with those of the Commission with the aim to increase the support available for these activities.

3.3 Participants noted with appreciation progress made in several regional WHYCOS projects, planned (and already published) publications including manuals and guidelines addressing issues in hydrology and water resources and efforts made in the capacity building programme. With regard to the WMO Flood Forecasting Initiative, the group promised full support to the implementation of the Strategy and Action Plan and highlighted the necessity to include a special focus on flash flood early warning methods and systems.

3.4 In the group discussion that followed the presentation, participants appreciated the detailed information made available and provided additional comments and recommendations:

3.5 The Group appreciated the wide field of programmes and activities undertaken by the Secretariat and the CHy that were directly relevant and beneficial to the region.

3.6 There was a general view that the support of the CHy to the activities of the Working Group on Hydrology needs to be further strengthened 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.

3.7 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.

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

3.9 Related to the update of several manuals and guidelines including the *"Manual on Stream Gauging"* and the *"Guide to Hydrological Practices"*, Members of the Working Group discussed at length the necessity 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.

3.10 Mr Zhang expressed interest to organize a regional conference on this issue in Nanjing in 2008. In this undertaking, the PUB initiative of UNESCO and IAHS should be actively involved.

3.11 The group was informed by Mr Shiklomanov that the Russian Federal Agency for Water Resources was planning an International Conference on Hydrological Disasters in the third quarter of 2008 in Moscow. Presently the Scientific and Organization Committees were being formed and resources have been pledged to conduct the conference.

#### 4. BRIEFING ON RELEVANT ONGOING REGIONAL ACTIVITIES

4.1 Information was provided by the WMO representative on the work plan of RA II with regard to the Hydrology and Water Resources Programme. The meeting noted the necessity to establish an effective promotion and monitoring mechanism for the implementation of the Strategy for the Enhancement of National Hydrological Services in RA II to which the Strategy and Action Plan of the WMO Flood Forecasting Initiative is complementary on a specific technical level.

4.2 Based on additional information provided on the status of the Regional Strategic Plan for the Enhancement of National Hydrological Services in Asia (2005-2008), participants agreed to the necessity to urge Members of RA II to participate actively in the implementation of the Strategic Plan, including through implementation at national level and recommended that this should be part of the work plan for Institutional Capacity building, reflected in the final revised work plan of the respective theme leader. The meeting voiced its concern over the ability to mobilize resources for technical cooperation activities in line with the Strategic Plan.

4.3 With regard to the planned regional activities to study in more detail the role of glaciers and snowfields in mountainous areas and to take into consideration the storage of freshwater in lakes and reservoirs in the Region when conducting water resources assessments, members of the WGH reiterated the importance of this subject for improved water resources assessment especially in the context of climate change. It was recommended to scope for the possibility to link with other international programmes with the aim to develop a mountain initiative as a platform to address this issue.

4.4 In the context of the goal of RA II to reduce hydrological risk and vulnerability, the group fully agreed to improve collaboration with the WMO Tropical Cyclone Programme, especially regarding the enhancement of the hydrological components of the programme and collaboration with ESCAP as well as to liaise with the regional Working group on Disaster Prevention.

4.5 Additional information was provided with regard to activities in the Tropical Cyclone Programme and the Disaster Prevention Programme.

4.6 In this respect, Mr J. Liu made a presentation on the status of activities of the Typhoon Committee and in particular the Working Group Hydrology. In particular he highlighted on progress made in the areas seen as priority by the Working Group Hydrology of the Typhoon Committee. Based on the recommendations of the Expert Review Missions carried out in September and October 2001, eleven activities were identified by the TC Hydrologists that are being undertaken in a number of projects for which lead countries have been identified. These areas, some of the formulated as projects had been reviewed by the 39<sup>th</sup> session of the Typhoon Committee.

- I. Assessment of national requirements and capabilities on hydrological and Disaster Prevention and Preparedness (DPP) components (Concluded in 2001);
- II. Pilot project for data sharing between TC Members to enhance flood forecasting accuracy. (Members);
- III. Development of guidelines for dam operation in relation flood forecasting. (Korea);
- IV. On the Job Training on Flood Forecasting between TC members (Malaysia);
- V. Extension of flood forecasting systems to selected river basins (China);
- VI. Pilot project on the preparation of Inundation and Water-related Hazard Maps. (Japan);
- VII. Project on the evaluation and improvement of operational flood forecasting system focusing on model performance (Korea);

- VIII. Pilot project on the establishment of community-based flood forecasting system. (Philippines);
- IX. Pilot project on the establishment on flash-flood warning system including debris flow and landslides (Japan);
- X. Improvement of Hydrological products in response to user needs (Philippines);
- XI. Project on the evaluation and improvement of hydrological instruments and telecommunication equipment (China).

4.7 Mr Liu reported that the TC also endorsed the proposal of WGH of the Typhoon Committee to undertake the following two new projects and encourage Members to support in their implementation:

- I. Project on Socio-economic Impact Assessment of Typhoon-related Disasters (to be launched and led by the Philippines)
- II. Project on the Management of Floods in Urban Areas (to be launched and led by China)

4.8 The meeting recommended that a much closer linkage with the Typhoon Committee should be established to harmonize the work of the WMO RA II Working Group on Hydrology with activities undertaken by member countries in Typhoon Committee. The group recommended that the Chair of the RA II WGH contacts officially the chair of the WGH of the Typhoon Committee to explore possible mechanisms for enhanced cooperation.

4.9 The group continued to discuss in some length the weaknesses and strengths of the hydrological component in the Tropical Cyclone Programme and concluded, while there exist some informative arrangements in the ESCAP/WMO Typhoon Committee, the lack of nomination of hydrologists as participants in the WMO/ESCAP Panel on Tropical Cyclones contributed to the unsatisfactory reflection of hydrology and hydrological aspects of disasters in the Panel. With regard to the storm-surge project proposed to be re-vitalized, the group noted that issues of coastal floods and any other aspects of hydrological disasters were not reflected. The group noted further that it appeared that the storm-surge project had not been given governmental attention and priority as it has not proposed in an integrated, convincing manner.

5.0 Turning on progress made in the WMO Disaster Prevention Programme (DPM), the group appreciated the comprehensive efforts made in the regional survey that has a wide-reaching potential to make an impact in addressing disaster management issues across sectors in the region. Participants urged the Secretariat to ensure that the relevant theme leaders of the WGH continue to be adequately informed and integrated in the activities of this cross-cutting programme. It was mentioned that the cross cutting nature of the programme also needs to be reflected in cross-cutting regional activities. In reviewing the current list of DPM focal points in the region, participants noted, that most of the focal points are connected with meteorological services that were not in charge or mandated for DPM activities and that several focal points were incorrect (persons retired) or inadequate to drive the programme in the region. Participants therefore recommended to update the list of focal points and to make links with national disaster prevention and management authorities by likewise keeping the National Meteorological and Hydrological Services informed.

5.1 The meeting agreed that the Chair of the Working Group Hydrology should formally contact the Chair of the RA II Working Group on Disaster Prevention to coordinate activities that have a high and promising potential for cross-programme cooperation.

5.2 The Vice-President of the CHy, Mr J. Wellens-Mensah provided information on the work of CHy and the different Regional Working Groups on Hydrology and invited experts in the region to contribute to the work of CHy through the OPACHEs. The summary table of activities of the regional Working Groups on Hydrology is presented below. He stressed the high potential for collaborative efforts in those topics of regional working groups that were common. This cooperation could be facilitated through the office of the Vice-President of the Commission.



RAAs WGH Summary Table - Future Work Plans

TOPIC	RA I	RAII°	RA III	RA IV	RA V	RA VI
WHYCOS/HYCOS	WP	WP	WP	WP	WP	A
HOMS	WP		WP	WP	WP	A
Guide & Technical Regulations	WP	A	A	A	WP	
Water Resources Assessment	WP	WP		WP	WP	
WRA Workshop	WP		WP	WP		
Costa Rica Action Plan			WP	WP		
Drought Forecasting	WP	WP				WP
Flood Forecasting/Warning	WP	WP		WP	A	WP
Strom Surge – Low Lying Areas				WP	A	
Accuracy of Flow Measurements		WP			WP	
Sedimentation in river systems						
Commercialisation etc.						
Promotion, visibility and awareness			WP		WP	WP
Establishment of RA Web Site, Linkages with regional institutions and Forum			WP	WP	WP	WP
Joint use of surface and ground waters		WP		WP		
El Niño – SOI			WP		WP	
Climate/Water variability and change		WP			WP	WP
Hydrological networks			WP		WP	WP
Coupling meteorological and hydrological models					WP	
Hydrological Training			WP	WP	WP	
Linkages with Typhoon and cyclone committees					WP	
Extreme Floods						WP

°Current Work Plan 2004 – 2008, future proposed Work Plan 2008 – 2012 is shown in Annex 3. WP: Part of Future Work Plan; A: Part of Agenda

## 5. CONSIDERATION OF THE WORK PLANS AND EXPECTED RESULTS

5.1 On the basis of the draft work plans that had been revised in December 2006 and communicated to the theme leaders, the work plans were introduced by the theme leaders in the following order:

- 5.1.1 Improving Institutional Capacity both Nationally and Regionally (K. Fukami)
- 5.1.2 Disaster Mitigation – Improvements to Short-duration (Flash) Flood Forecasting Capabilities in Urban Areas (P. Petvirojchai)
- 5.1.3 Disaster Management – Climate Variability and Hydrological Aspects of Drought (Z. Liu)
- 5.1.4 Water Resources Assessment, Availability and Use (Surface water and groundwater) in cooperation with UN ESCAP and IGRAC (S. Awan)
- 5.1.5 Improved Accuracy of Flow Measurements and Estimation in RA II (F. Yazadandoost)

5.2 Noting, that draft final results of the WGH need to be available latest by July 2008 for proper documentation for the upcoming session of the RA II (Asia) in late 2008, the work plans were modified in terms of achievable priority deliverables, means of simple implementation and timelines. In discussing the individual work plans the group stressed that it might well be necessary to extend the themes and some activities for another intersessional period.

5.3 The group agreed that at the information collection stage, not only representatives of the NMHSs should be contacted but that information should be gathered from relevant and useful sources beyond the scope of NMHSs to obtain the best possible and comprehensive sources of information to achieve the objectives of the themes.

5.4 Briefing on activities in Central Asia (A. Homidov)

5.4.1. The group recognized that in the past, Central Asia was either absent or under-represented in the RA II WGH and welcomed the presence of Mr A. Homidov to present a number of projects specifically concerning the five Central Asian States that are riparian to the Aral Sea Basin. As an ex-officio member of the Working Group, Mr A. Homidov made a presentation on "Briefing of activities in Central Asia". The extent of the Aral Sea crisis was presented in detail and also the various projects and efforts to mitigate the crisis. In particular, Mr Homidov highlighted the general decline of the observational networks and also the regional aspects of transboundary water management in the region. The creation of the Executive Committee - International Fund for the Saving of the Aral Sea (EC-IFAS) marked a turning point in this direction but still, efforts do not suffice to change the present situation. In 1998 representatives of governments of five countries of the basin agreed to develop and implement the ARAL-HYCOS project that had been developed together with WMO to improve water resources management in the Aral Sea basin. As the project has not yet taken up due to lack of funding, the project document has been revised and agreed on in a regional meeting held in Almaty in December 2006. Main objective of revising the project document was the improvement of the transboundary aspect in the context of hydrometeorological observations, data collection and dissemination.

5.4.2 Main project goals are:

- i. Development and improvement of national and regional capacity of the Aral Sea Basin countries in the sphere of water resources evaluation and investigation of global hydrological cycle,
- ii. Strengthening of regional cooperation in water resources management

5.4.3 It is expected, that the Aral-HYCOS Project will make an important contribution in the socio-economic development of five countries of the Aral Sea basin and will promote to the development of cooperation and achievement of a steady development of the region.

## **6. DEVELOPMENT OF THE CONSOLIDATED WORKPLAN AND DOCUMENTATION OF RESULTS FOR THE FOURTEENTH SESSION OF THE REGIONAL ASSOCIATION II (ASIA) IN 2008**

6.1 Under this agenda item, the group agreed on the final work plans. Therefore, the work plans shown below reflect the results of the discussion of the group. The theme leaders pledged to make their utmost effort to achieve the expected deliverables for the benefit of the region. The group agreed that all reports and any other outputs should be fully documented and made available in electronic formats. It was also highlighted that with the time remaining, not all results would be available in their final form and format as some deliverables, especially related to guiding materials and good practices would need a peer review before final release.

**RA II WORKING GROUP ON HYDROLOGY 2007-2008  
Final Revised Work Plan of Mr Kazuhiko FUKAMI**

Theme/Area of activities	<b>Improving Institutional Capacity both Nationally and Regionally</b>
Priority	<ul style="list-style-type: none"> <li>• High – WMO Core activity</li> </ul>
Background Material	<ul style="list-style-type: none"> <li>• Strategic Plan for the Enhancement of National Hydrological Services (NHSs) in RA II</li> </ul>
Expected Outputs	<ul style="list-style-type: none"> <li>• Progress report on the application of the Strategic Plan</li> <li>• Identification of training requirements and opportunities in RA II</li> <li>• Information on the value of hydrological data and products</li> </ul>
Expected Results	<ul style="list-style-type: none"> <li>• NHSs with improved Strategic Planning capabilities</li> <li>• NHSs with efficient and effective access to relevant new technology through improved (including concepts) exchange systems</li> <li>• NHSs have access to capable and skilled staffing resources</li> <li>• Increased public awareness for the use of hydrological data and products</li> </ul>
Specific Activities	<ul style="list-style-type: none"> <li>• Promote and monitor the application of the Strategic Plan in RA II NHSs</li> <li>• Provide updated overview of hydrological training initiatives/programmes/opportunities in RA II</li> </ul>
Potential Linkages	<ul style="list-style-type: none"> <li>• Commission for Hydrology</li> <li>• UNESCO/IHP</li> <li>• ESCAP/WMO Typhoon Committee</li> <li>• International Centre for Water Hazard and Risk Management (ICHARM, Tsukuba, Japan)</li> <li>• UNESCAP</li> <li>• UNESCO/IHE</li> <li>• IGWCO and GEO through the Asian Water Cycle Initiative (AWCI)</li> <li>• SENTINEL Asia Project</li> <li>• Asia – Pacific Water Forum</li> </ul>
Timeframe	<ul style="list-style-type: none"> <li>• 07/2007 Send questionnaires to members countries</li> <li>• 09/2007 Evaluate questionnaires</li> <li>• 11/07 – 04/2008 Supplementary investigations</li> <li>• 06/2008 Draft report</li> <li>• 07/2008 Final draft report</li> <li>• Target: Monitor the application of the Strategic Plan in RA II NHSs by end of 2007</li> </ul>
Potential contributors, ( <i>inter alia</i> )	<ul style="list-style-type: none"> <li>• See above under linkages</li> </ul>

Additional information on the work plan:

1. To promote and monitor the application of the Strategic Plan in RA II NHSs
  - 1.1 Investigation on the status of implementing the Strategic Plan in RA II NHSs.

The theme leader will review the status of formulation of long term programme and detailed action plan to implement the Strategic Plan on the enhancement of national hydrological services (NHSs) in RA II, through mainly questionnaire surveys supplemented by direct interviews, hopefully (dependent upon the available resource), based on the cooperation of other members of RA II Working Group of Hydrology, such as the following points:

- a) Status of capacity/capability and needs of the NHSs in RA II such as hydrological monitoring and database systems, available resources (organizations, human resources, budget, etc.) , etc.
- b) Status of needs of NHSs and major challenging issues to improve NHSs such as:
  - Information in support of sustainable development of water resources
  - Robust hydrological products and hydrological prediction methodologies
  - Disaster management issues
  - Climate change and variation in a hydrological context
  - Promotion and awareness of the value of hydrological services
  - Competent, capable and responsive staff
  - Continuous improvement in organizational performance
  - Responsive and rational use of new technology

1.2 Status of formulating long term programme, action plan and/or projects to implement the Strategic Plan and to assist the NHSs to:

- To develop and/or help NHSs to easily get access to appropriate databases, resources and expertise to allow them to: (i) provide appropriate and timely hydrological services to their countries, such as advice and products for water-user sectors (e.g., water supply, agriculture and industry) and for national development planners and decision-makers; and (ii) to fulfill their national, regional and international obligations.
- To develop or adapt scientific methodology and resources to provide timely hydrological information, hydrological forecasts/predictions and flood warnings;
- To provide better services in areas related to disaster mitigation, prevention and preparedness and pollution monitoring; and
- To assist in capacity building to upgrade and modernize NHSs' services, including the improvement of infrastructure (buildings, equipment and facilities), acquisition and application of new technology, and staff training at the professional, technical and supporting personnel level.
- To strengthen cooperation with regional and sub-regional organizations and institutions through joint arrangements and organization of cooperative activities.

1.3 Feedback to NHSs in RA II

The theme leader will draft a report on the results of the above investigations based on the cooperation of other members of RA II Working Group of Hydrology. The report will not only summarize the overview of the analyzing results but also focus on the introduction of typical and good examples, projects and/or achievements to overcome challenging issues and to implement long-term plan and action plan to enhance NHSs. The report should also include any recommendation to update the Strategic Plan. The report will be distributed to the countries in RA II.

1.4 To provide updated overview of hydrological training initiatives / programmes / opportunities in RA II

The theme leader will review the current status and future plans on training initiatives / programmes / opportunities in RA II through mainly questionnaire surveys supplemented by direct interviews, hopefully (dependent upon the available resource), based on the cooperation of other members of the RA II Working Group on Hydrology. The survey will include the opportunities under international activities such as listed under “potential linkages” in the table above. The theme leader will draft a report on the results of the above investigations based on the cooperation of other members of RA II Working Group on Hydrology. The report should include any recommendation not only RA II member countries but also WMO and/or other international organizations to enhance strengthen capacity building activities in RA II. The report will be distributed to the countries in RA II.

**RA II WORKING GROUP ON HYDROLOGY 2007-2008  
Final Revised Work Plan of Ms Patchara PETVIROJCHAI**

Theme/Area of activities	<b>Disaster Mitigation – Improvements to Short-duration (Flash) Flood Forecasting Capabilities in Urban areas</b>
Priority	<ul style="list-style-type: none"> <li>• High – WMO NDPMP, Millennium Development Goals and Johannesburg Plan of Implementation</li> </ul>
Background Material	<ul style="list-style-type: none"> <li>• Strategic Plan for the Enhancement of NHSs in RA II</li> <li>• Regional and global workshop reports on flash floods (to be supplied)</li> <li>• Report on the Workshop on Evaluation and Improvement of Operational Flood Forecasting Models in the Typhoon Committee area</li> <li>• UNESCAP relevant studies</li> </ul>
Expected Outputs	<ul style="list-style-type: none"> <li>• Draft guiding materials for urban Flash Flood Forecasting and Warning Systems</li> <li>• Collection of Proven regional techniques</li> </ul>
Expected Results	<ul style="list-style-type: none"> <li>• Higher profile for NHSs and NHMSs in disaster mitigation</li> <li>• Improved collaboration between NHSs and NMSs</li> </ul>
Specific Activities	<ul style="list-style-type: none"> <li>• Review of Flash Flood forecast and warning practices capabilities and techniques in RA II and beyond for urban areas</li> <li>• Review of Quantitative Precipitation Forecasting (QPF) capabilities in RA II</li> <li>• Preparation of draft guiding materials for Flash Flood Forecasting and Warning Systems in urban areas</li> </ul>
Potential Linkages	<ul style="list-style-type: none"> <li>• UNESCAP/WMO Typhoon Committee</li> <li>• WMO Disaster Mitigation Programme</li> <li>• Commission for Hydrology (CHy)</li> <li>• International Centre for Water Hazard and Risk Management (ICHARM, Tsukuba, Japan)</li> </ul>

Timeframe	<ul style="list-style-type: none"> <li>• Collection and analysis of information on current capabilities by mid 2007</li> <li>• Development of guidance material by mid 2008</li> </ul>
Potential contributors ( <i>inter alia</i> )	<ul style="list-style-type: none"> <li>• Pakistan</li> <li>• China</li> <li>• Hong Kong Observatory</li> <li>• UNESCAP/WMO Typhoon Committee</li> <li>• ICHARM</li> <li>• US Hydrologic Research Centre (HRC)</li> <li>• Responsible officials of selected mega cities in Asia</li> <li>RA II WG on Disaster Prevention</li> </ul>

Additional information on the work plan:

Focus is on city examples and good practices: The scope is on forecasting and not on flash flood management.

Work steps:

- Step 1: Seek all possible information from links and collaborators  
 Step 2: Collect and analyse information of Flash Flood Forecasting in urban areas  
 (Methods, practices, experiences)  
 Step 3: Prepare the draft guiding materials  
 Step 4: Submit draft guiding materials for review  
 Step 5: Develop guidance material  
 Step 6: Submit draft report to WMO and develop report for distribution

**RA II WORKING GROUP ON HYDROLOGY 2007-2008  
 Final Revised Work Plan of Mr Zhiyu LIU**

Theme/Area of activities	<b>Disaster Management – Climate Variability and Hydrological Aspects of Drought</b>
Priority	<ul style="list-style-type: none"> <li>• High – WMO Natural Disaster Prevention and Mitigation Programme (NDPMP), Millennium Development Goals and Johannesburg Plan of Implementation</li> </ul>
Background Material	<ul style="list-style-type: none"> <li>• Reports on Drought, Climate and Water Resources</li> <li>• FAO relevant studies</li> <li>• UNESCAP relevant studies</li> <li>• CHy draft drought management proposal</li> <li>• IPCC assessments</li> </ul>
Expected Outputs	<ul style="list-style-type: none"> <li>• Review and evaluate criteria for defining hydrological drought – including a review of hydrological drought definitions</li> <li>• Case studies/good practices to evaluate drought management approaches</li> <li>• Review of and guidance on techniques for forecasting drought, including, evaluation of low-flow forecasting techniques</li> <li>•</li> </ul>

Expected Results	<ul style="list-style-type: none"> <li>• Improved capability to cope with drought in RA II</li> <li>• Improved capability to predict the onset of drought</li> </ul>
Specific Activities	<ul style="list-style-type: none"> <li>• Update and improve the review of drought undertaken by the previous working group</li> <li>• Identification of pilot studies to evaluate in greater detail drought management approaches</li> <li>• Review and revise hydrological drought forecasting methodologies</li> <li>• Preparation of general guidance for risk-based drought management</li> </ul>
Potential Linkages	<ul style="list-style-type: none"> <li>• WMO Commission for Climatology</li> <li>• WMO Commission for Agricultural Meteorology</li> <li>• WMO Commission for Hydrology</li> <li>• UNESCAP</li> <li>• UNESCO/IHP</li> </ul>
Timeframe	<ul style="list-style-type: none"> <li>• Review of drought forecasting techniques by mid 2007</li> <li>• Development of Guidance material and draft report by mid 2008</li> </ul>
Potential contributors, ( <i>inter alia</i> )	<ul style="list-style-type: none"> <li>• Pakistan, India, China, Mongolia, other Members of RA II</li> <li>• ESCAP</li> <li>• RA II WG on Disaster Prevention</li> </ul>

**RA II WORKING GROUP ON HYDROLOGY 2007-2008  
Final Revised Work Plan of Mr Shaukat Ali AWAN**

Theme/Area of activities	Water Resources Assessment, Availability and Use (Surface water and groundwater) in cooperation with UNESCAP and IGRAC
Priority	<ul style="list-style-type: none"> <li>• High – Millennium Development Goals and Johannesburg Plan of Implementation</li> </ul>
Background Material	<ul style="list-style-type: none"> <li>• Report on Assessment of Surface Waters and Groundwater (Quantity/Quality)</li> <li>• UNESCO/WMO WRA Handbook for Review of National Capabilities</li> <li>• 2<sup>nd</sup> World Water Development Report</li> <li>• Global Water Resources Outlook for 21<sup>st</sup> Century</li> <li>• Selected UNESCAP case studies</li> <li>• ESCAP study</li> <li>• Prof. Shiklomanov</li> <li>• Material from China</li> </ul>
Expected Outputs	<ul style="list-style-type: none"> <li>• Improved methodology for water resources assessment for Asia</li> <li>• Review of the water availability, demand and use (withdrawal and consumption) in the Region</li> </ul>
Expected Results	<ul style="list-style-type: none"> <li>• Improved capability in the region for water resources assessment</li> <li>• Identification of “hot spots” with respect to water availability, use and demand</li> </ul>

Specific Activities	<ul style="list-style-type: none"> <li>• Review existing methodologies and practices in the Region (as a result of the country survey)</li> <li>• Compile improved forecasts of water availability and use in the region based on scenarios (socio-economic and climate change) (to be touched but not covered completely)</li> </ul>
Potential Linkages	<ul style="list-style-type: none"> <li>• Commission for Hydrology</li> <li>• UNESCO/World Water Assessment Programme (WWAP)</li> <li>• IAHS</li> <li>• ESCAP</li> <li>• Prof Shiklomanov</li> </ul>
Timeframe	<ul style="list-style-type: none"> <li>• Review of methodologies and practices by end of 2007</li> <li>• Documentation of results by mid 2008 for dissemination</li> </ul>
Potential contributors ( <i>inter alia</i> )	<ul style="list-style-type: none"> <li>• China</li> <li>• India</li> <li>• Japan</li> <li>• Russian Federation</li> <li>• Pakistan</li> <li>• UNESCAP</li> <li>• Additional information through questionnaires</li> </ul>

**RA II WORKING GROUP ON HYDROLOGY 2007-2008  
Final Revised Work Plan of Mr F. YAZDANDOOST**

Theme/Area of activities	<b>Improved Accuracy of Flow Measurements and Estimation in RA II</b>
Priority	<ul style="list-style-type: none"> <li>• High – Core WMO activity</li> </ul>
Background Material	<ul style="list-style-type: none"> <li>• Guide to Hydrological Practices</li> <li>• Practices of National Hydrological Services in RA-II</li> <li>• Practices of NHSs (good practices)</li> <li>• Manuals under development at WMO</li> </ul>
Expected Outputs	<ul style="list-style-type: none"> <li>• Updated guidance material</li> <li>• Development of an intercomparison of flow measurement methods and instruments</li> </ul>
Expected Results	<ul style="list-style-type: none"> <li>• Increased accuracy of flow measurement as input to water resources assessment</li> <li>• Intercomparison of flow measurement methods</li> <li>• Updated guidance materials</li> <li>• Identify developing countries challenges, develop incentives, networking</li> </ul>
Specific Activities	<ul style="list-style-type: none"> <li>• Review of practices and manuals on flow measurement methods and instrumentation</li> <li>• Increased accuracy of flow measurement as input to Water Resources Assessment</li> <li>• Review of existing instruments, current meter calibration canals and calibration procedures available in Asia</li> <li>• Proposal for an intercomparison exercise in RA-II</li> <li>• Review of existing instruments, calibration of procedures and instruments</li> </ul>



Potential Linkages	<ul style="list-style-type: none"> <li>• Commission for Instrumentation and Methods of Observation (CIMO) – CHy representative</li> <li>• Commission for Hydrology (CHy)</li> <li>• IAHR, IWRA, IHP, IAHS</li> </ul>
Timeframe	<ul style="list-style-type: none"> <li>• Review of existing methods and instruments in the region by early 2007</li> <li>• Intercomparison proposal completed by end 2007</li> <li>• Updated guidance material by mid 2008</li> </ul>
Potential contributions ( <i>inter alia</i> )	<ul style="list-style-type: none"> <li>• Russian Federation, Japan</li> <li>• China</li> <li>• Add information from other climatic conditions of the region (arid-semi-arid)</li> </ul>

## 7. IMPLEMENTATION OF THE STRATEGIC PLAN FOR THE ENHANCEMENT OF NATIONAL HYDROLOGICAL SERVICES (NHSS) IN REGIONAL ASSOCIATION II (ASIA) FOR THE PERIOD 2004 – 2008

7.1 For the purpose of the meeting, the representative of WMO informed the group on progress related to the development and dissemination of the Strategic Plan. Members of the Working Group recalled that the **goal** of the Strategic Plan is to: (i) develop a long term programme, agreed upon by all the NHSs in the Region, on their priorities and objectives for their individual and joint development through mutual cooperation; and (ii) to formulate detailed action plans for organization of activities, so as to ensure that the planned programme would be successfully implemented.

7.2 Key elements in the implementation of the Strategy are:

- i. To develop and/or help NHSs to easily get access to appropriate databases, resources and expertise;
- ii. To provide better services in areas related to disaster mitigation, prevention and preparedness and pollution monitoring; and
- iii. To assist in capacity building to upgrade and modernise NHSs' services
- iv. To strengthen cooperation with regional and sub-regional organizations and institutions through joint arrangements and organization of cooperative activities

7.3 Based on the survey results undertaken to develop the Strategy, participants recalled that the main issues to be addressed in RA II in terms of the Strategy are:

- Information in support of sustainable development of water resources
- Robust hydrological products and hydrological prediction methodologies
- Disaster management issues
- Climate change and variation in a hydrological context
- Promotion and awareness of the value of hydrological services
- Competent, capable and responsive staff
- Continuous improvement in organisational performance
- Responsive and rational use of new technology

7.4 The group noted that the activities undertaken at present are in line with key requirements of the Strategy and that there was a need to develop the work plan of the future Working Group hydrology for the period 2008-2012 along the requirements of the Strategy.

7.5 In particular, the Working Group stressed the necessity to be fully engaged in the facilitation of the implementation of the Strategy noting for practical purposes the following steps that are envisaged for the implementation of the Strategic Plan:

- (a) The Plan needs to be reviewed on a continuous basis and revised by Members of RA II, with advice from the RA II Working Group on Hydrology;
- (b) A brief review of the current status and capacity/capability and the needs of the NHSs in the Asia Region needs to be undertaken by WMO and Members on the basis of the review;
- (c) A more detailed needs' analysis will be undertaken, based on the review of the requirements of NHSs; an expert team from the Region, to be available over a period of several months, will visit and discuss with NHSs concerned in consultation with WMO;
- (d) A draft assistance programme would be developed, subdivided into projects for implementation by WMO and Members, as well as by other regional and international institutions and donor agencies;
- (e) Strategic alliances—preferably with the NHSs as driver—will be sought with other groups and organizations within, and also outside the Region, for the planning and implementation of regional activities in hydrology and water resources; and
- (f) An online follow-up review would be needed to monitor the programme/project implementation by WMO and the experts' team from the Region.

7.6 The meeting agreed that the Strategy forms the basis for its work for the foreseeable future and ultimately, through the achievement of its selected themes would ultimately contribute significantly to the full implementation of the Strategy across the region.

## **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 The representative of WMO informed the meeting on the aims and objectives of the WMO Flood Forecasting Initiative encompassing riverine and flash floods. He pointed out that the principal objective of the Flood Forecasting Initiative has been to strengthen the cooperation between National Hydrological and Meteorological Services to deliver timely and more accurate products and services required in flood forecasting and warning.

8.2 Representatives noted with interest the following key features of the Strategy and Action Plan (SAP) that had been developed on the basis of eight regional workshops and one global synthesis conference paired with two regional (in RA II) and one global Flash Flood Forecasting conference:

- i. The SAP promotes the preparation of national implementation plans
- ii. The SAP suggests the implementation of demonstration projects at various levels (country-specific, sub-regional and regional projects).
- iii. At the regional level, the SAP advocates the establishment of a framework under which partnerships and development assistance could be provided and coordinated amongst the Members and the various contributing agencies while taking advantage of existing regional and international arrangements.
- iv. The SAP also addresses requirements of well-established flood forecasting and warning systems for their further improvement through the development and use of new technology.

8.3 On the basis of the report, the group recommended that the implementation of the SAP on national and regional level should be reflected in the future work plan of the Working Group taking up the key elements of the Plan. The group further recommended that strategic alliances

be built to foster the implementation of the Plan looking at collaborative efforts with the International Flood Initiative (IFI) and ICHARM as well as the Typhoon Committee. Likewise, linkages should be sought with the Global Flood Alert System (GFAS) project undertaken with the support of Japan, the International Flood Network (IFNET), relevant activities of the Regional WMO Working Group on Disaster Prevention and activities of the Integrated Water Cycle Observation (IGWCO) theme chaired by WMO with regard to improved high resolution rainfall estimates from satellite observations.

8.4 The meeting agreed that the Chair of the Working Group should make the necessary contacts with potential key partners to facilitate an institutionalized cooperative framework. Participants were also of the opinion that the SAP would tie in perfectly as a key element of the Strategic Plan for the Enhancement of NHSs, discussed under the agenda item above.

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

9.1 The group noted that climate variability and change become an increasing concern for the management of water resources including the design, implementation and operation of water infrastructure but also with regard to hydrometeorological extremes and their potential to trigger major disasters.

9.2 The representative of WMO reported that activities in this area are planned and implemented within the World Climate Programme – Water (WCP-Water). He further reported that in an effort to guide activities in trend analysis, Members have been requested to identify pristine river basins in the countries that could serve as reference basins to detect climate change signals in hydrological time series. About 40 Members have indicated the availability of hydrological time series data from river basins in their respective countries.

9.3 The meeting noted with interest that an expert meeting on “The needs of Water Managers for Climate Information in Water Resources Planning” was organized in December 2006 in Geneva. The results of the expert meeting could form the basis for the integration of climate information in water resources planning and management, at the national level in collaboration with WMO’s Climate Prediction Centres, and the climate research community. National demonstration projects, to be undertaken through extra budgetary resources, would help water managers to adapt solutions that take due consideration of long-term potential climate change

9.4 Participants agreed on the necessity to mainstream the importance of hydrological changes and subsequent adaptation requirements in water resources as a result of climate variability and change as one of several regional priorities.

9.5 Under this agenda item, Mr I. Shiklomanov presented the results of a study of trends in surface water runoff, shifts in water resources availability and trends in the frequency of floods on the territory of Russia. He pointed out that for the given reference period until the year 2000 and further climate scenario-based projections until 2015, a general increase in annual flow can be observed in most areas coupled with a general increase in the frequency of floods. Both, Mr Shiklomanov and Mr A. Awan pointed towards observed changes in climate patterns as result of changes in large synoptic systems that lead to a spatial and temporal shift in the relative availability of water resources in several observed regions including Russia and Pakistan. The group agreed that the methodology of the detection of these trends should be well documented so that in a defined theme in the future work plan the effect of changes on the hydrological regimes and therefore the availability of water resources and the effect on the frequency and severity of floods and hydrological droughts could be assessed by a larger number of countries in RA II.

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

10.1 The group felt that the overall level of exchange of hydrological data falls sharply behind a growing need for the free and open access to these data in particular for integrated river basin management, planning purposes and scientific programmes at regional and global scales. The implementation of WMO Resolution 25 (Cg-XIII) needs to be further promoted. The group discussed at length the reasons for impediments in sharing data more freely. Amongst these reasons were political, technical, economic and organizational issues. Amongst the economic reasons are increasingly competing interests between riparian countries and lack of incentives of upper riparian countries to establish and maintain stations and costly infrastructure that mostly the lower riparian countries would benefit from. The participants noted that two of the key elements for sharing hydrological data and information were a) the principals of common or shared benefits and b) the necessity to exchange data and information on the basis of mutual bilateral or regional agreements. The group reiterated also the necessity to fully support to global data centres such as the GRDC which is essential to enable global and regional, applications-oriented research to better understand the water cycle and potential impacts of climate variability and change.

10.2 On the technical side, the participants recognized hindrances in the exchange of data are for example the lacking interoperability of data communication systems including the harmonization of standards in data transfers and generally lacking metadata pointing to original sources of data. The group was of the opinion that these hindrances can be eliminated in future through the WMO Information System approach, improved interoperability of HYCOS projects and possibly through activities facilitated by GEO.

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

11.1 Presentations and discussions under this agenda item served to identify priority areas of the future work of the Working Group Hydrology in the next intersessional period of WMO RA II (Asia) 2008-2012. In the discussions the group recalled also the presentations made and the results of the discussions under the previous agenda items related to regional activities including enhanced collaboration with activities specifically related to the Typhoon Committee and the regional Working Group on Disaster Prevention as well as the implementation of strategies and issues related to impacts of climate change as well as the necessity to improve exchange of hydrological data and information.

11.2 Under this agenda item, Mr J. Wellens-Mensah made a presentation on the linkages of CHy with the Working Groups Hydrology of all WMO Regional Associations. He provided information on the five Open Panels for CHy Experts (OPACHEs) namely the thematic areas:

### **Basic systems (hydrometry and hydraulics)**

Main subjects: continue the development of automated hydrometric data-production procedures, including a decision-support system; review and revise the *Manual on Stream Gauging* (WMO-No. 519); develop a proposal and implement a project to assess the performance of flow measurement instruments and techniques against WMO standards; assist in the development of standards, formats and protocols for data transfer.

### **Water resources assessment and water use**

Main areas: investigate the use of modern modeling technologies to increase network effectiveness and assist in the rationalization of hydrological networks (e.g. IAHS PUB); complete the preparation and publication of the manual on methodologies for determining water resources (surface and groundwater) availability and use (state and condition), including transboundary river basins/aquifers; promote the use of this manual through workshops; identify and document methods of assessing water losses from reservoirs and large lakes; assist in the

WMO contribution to the WWDR through the provision of information on water resources (surface and groundwater) availability and use, including the development of indicators; promote data rescue activities when they are of value/benefit to the activities of NMHSs in water resources assessment; review and revise the draft material provided for the manual for water resources assessment.

### **Hydrological forecasting and prediction**

Main areas: continue the CHy Project on Global/Regional Short -term Flood Forecasting (in particular with regard to the incorporation of quantitative precipitation estimation (QPE) and quantitative precipitation forecasting (QPF) in flood forecasting models); develop improved QPE techniques at the basin scale, involving multi-sensor approaches, open architecture systems and providing point, gridded or sub-basin scale estimates for data-sparse to data-rich areas; support development of a manual on flood forecasting; review approaches for forecasting combined storm surge and river flooding; review approaches for forecasting ice formation/break-up and glacier outburst; review current progress in, benefits from and capabilities of medium- to long-term hydrological forecasting/seasonal forecasting (including precipitation).

### **Disaster mitigation– floods and droughts (hydrological aspects)**

Main areas: promote the use of the United Nations *Guidelines on Reducing Flood Losses* and the role of NHSs in flood disaster mitigation; provide advice and guidance on hydrological risk management issues of relevance to the Commission; prepare a design flood estimation manual which addresses issues such as the scarcity of data, including ungauged basins, and the potential implications of climate change; prepare a design low flow estimation handbook; provide guidance on the legal and governmental frameworks as well as information and public participation for dealing with disaster management, including the role of NHSs;

### **Analysis of hydrometeorological data for variability and trends**

Main areas: continue involvement in the WCP-Water project on the analysis of variability and trends in hydroclimatological data; promote the use of the pristine river basin criteria and the identification of river basins that meet these criteria; liaise, as necessary, with relevant global data activities, such as GTN-H, GCOS and GEOSS; liaise with the IPCC working groups.

11.3 Mr Wellens-Mensah invited members of the working group to closely liaise with members of the CHy Advisory Working Group as a valuable source of know-how and possible assistance in support of the tasks of the theme leaders. He expressed the necessity to link the activities of the Working Group to activities of the CHy so as to ensure a two-way communication in the development of mutually beneficial programmes and to enable CHy to provide necessary support to the activities of all regional Working Groups Hydrology. A list of email addresses of the CHy theme leaders is provided in annex 4.

11.4 Subsequently, Mr K. Fukami provided information on the activities of ICHARM and the Asian Water Cycle Initiative in support of GEO.

11.5 With regard to ICHARM, he pointed out how the ICHARM was established under the auspices of UNESCO and aims to contribute the flood disaster mitigation in the world through introducing its objective, guiding principles, and three core activities. The core activities consist of 1) researches on technology developments in relation to the application of satellite-based information such as the development of Integrated Flood Analysis System (IFAS), 2) information networking to make policy-effective database, and 3) trainings such as hazard mapping training course since 2004 and a few more training courses such as a master course on flood disaster mitigation with the National Graduate Institute for Policy Studies in Japan to be started in 2007.

11.6 He also introduced the overview of Asian Water Cycle Initiative (AWCI). Since AWCI will implement some demonstration projects to integrate in-situ field data and new global data such as satellite data and outputs of numerical weather reanalysis data for integrated water resources management, he pointed out the high relevance with the activities of WGH in WMO-RA2 and the importance of our linkage with the AWCI.

11.7 On the basis of the presentations, the group entered an intensive discussion on the needs and requirements of the region and concluded that the best way forward towards the development of the future work plan would be to redefine the present themes in terms of scope and outputs and incorporate new elements. Two new themes were also proposed. The group justified this approach by noting that the present themes 2004-2008 need to be extended in time and scope to meet priority requirements of the region that are mainly related to five priority areas:

- i. Capacity building including the exchange and transfer of technology and know-how
- ii. Water resources assessment and management
- iii. Disaster mitigation
- iv. Adaptation to climate variability and change and
- v. Ensuring the quality of observations and data within the quality management framework of WMO

11.8 Participants also recognized that the institutionalized exchange of hydrological data and information were crucial to achieve the objectives of several of the priority areas listed above. It was therefore agreed to propose a support theme on the exchange of hydrological data and information including the promotion of HYCOS project in the region.

11.9 Addressing capacity building issues, the group noted that insufficient capacity especially at the technical level but also in overall insufficient institutional capacity was a key factor for the failure or inadequate implementation of many programmes, projects and even regular activities of NHSs in the region. In this regard the group further noted that the implementation of the Capacity building Strategy endorsed by the CHy in 2004 would need a more vigorous promotion and adequate implementation in the region. One step will be a simple country survey on three most important topics of each member in RA II to cluster common interest. For this purpose, a questionnaire developed by the WMO Secretariat was distributed with the request to circulate it to all members of RA II and to collect the response through the theme leader responsible for capacity building.

11.10 With regard to water quality, the group felt that while this were also a very important issue as water pollution effectively further constrains the use of scarce water resources, this issue should be taken up further at a global level from where regional benefits and national action programmes could be derived in cooperation with other UN-Organizations such as UNEP.

11.11 Water scarcity and water deficits are pertinent in RA II. The group recognized this and recommended that issues related to water scarcity and solutions for water deficits should be discussed in an integrated fashion with several other bodies and partners as this issue is not at the centre of the scope of the WGH.

11.12 In seeking strategic alliances to achieve the expected results of the themes participants recommended strong linkages in particular with the Typhoon Committee, ICHARM and the Asian Water Cycle Initiative and Asia-Pacific Water Forum in addition to the conventional partners such as regional organizations including the NMHSs, UN ESCAP and other regional and professional organizations national, regional and global.

11.13 The group felt that the present format of presenting the themes and work plans should be maintained as it represents a balanced combination of reports, assessments and potential pilot projects and also encourages outreach processes rather than static reports. The participants noted that the work plan can be best implemented if individual theme leaders make substantial use of additional experts through the CHy expert data base, additional experts nominated by Permanent Representatives and experts from collaborating institutions as well as other contributors. The work plan also identifies strategic linkages with other organizations.

11.14 In a first approximation, the group merged the present themes 2004-2008 with the proposed future themes 2008-2012 as shown below: The **bold** text represents the present themes while the text in *italics* represent new contents under the present headings to be amalgamated in the proposed work plans for 2008-2012 :

- (i) **Improving Institutional Capacity both Nationally and Regionally**  
*Capacity building, HOMS, technology transfer, Implementation of RA II Strategic Plan*
- (ii) **Disaster Mitigation – Improvements to Short-duration (Flash) Flood Forecasting Capabilities in Urban Areas**  
*Disaster mitigation (landslides, debris flows, flash floods) (monitoring and early warning), hilly and mountainous regions, WMO Flood Forecasting Initiative*
- (iii) **Disaster Management – Hydrological Aspects of Drought, including Drought Monitoring, assessment of water scarcity and deficits**  
*Regional water availability analysis, assessment of water scarcity and deficits; Monitoring of drought, onset of drought, solutions to water scarcity, networks for drought monitoring*
- (iv) **Water Resources Assessment, Availability and Use (Surface water and groundwater) in cooperation with UN ESCAP and IGRAC**  
*Sedimentation in rivers and reservoirs (assessment, forecasting)*
- (v) **Improved Accuracy of Flow Measurements and Estimation in RA II**  
*improved methods of instrumentation and observations including space based technologies and observations, and including sediment observations (with UNESCO – International Sediment Initiative (ISI)9*

#### **Proposed new Theme Areas**

- (vi) Hydrological responses to climate variability and change, pristine basins, Climate change and snow/glacier fed rivers
- (vii) Regional exchange of hydrological data (WHYCOS), documentation, case studies, assessment, challenges, opportunities, lessons learnt

#### **12. 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**

12.1 On the basis of the discussions of the previous agenda item, participants agreed on the following theme areas and their associated key outputs and expected results. The meeting established a draft work plan (Annex 3) for presentation to the Fourteenth Session of RA II in late 2008.

**PRIORITY ACTIVITIES OF THE RA II WORKING GROUP HYDROLOGY  
2008 – 2012**

**Theme 1: Improving Institutional Capacity including the implementation of the RA II Strategic Plan for NHSs and Technology Transfer in the context of HOMS**

Expected Outputs	<ul style="list-style-type: none"> <li>• Progress in implementation of Strategic Plan, review of plan</li> <li>• Training requirements and opportunities</li> <li>• Information on hydrological data and products</li> <li>• Technology transfer and HOMS issues</li> <li>• Implementation of the Manual on the management and operation of NHSs</li> </ul>
Expected Results	<ul style="list-style-type: none"> <li>• NHSs with improved Strategic Planning Capabilities</li> <li>• NHSs with efficient access to relevant new technologies through improved exchange mechanisms</li> <li>• Improved management capabilities of NHSs</li> </ul>

**Theme 2: Disaster Mitigation – Implementation of the WMO Flood Forecasting Initiative including Flash Flood Forecasting Capabilities and Mass Movements**

Expected Outputs	<ul style="list-style-type: none"> <li>• Implementation of the Strategy and Action Plan of the WMO Flood Forecasting Initiative</li> <li>• Best practice of flash flood forecasting and warning (QPE, QPF) and landslide/debris flow hazards in mountain areas</li> <li>• Develop and initiate demonstration projects</li> </ul>
Expected Results	<ul style="list-style-type: none"> <li>• Improved flood forecasting capacity</li> <li>• Enhanced and effective cooperation between NMHSs</li> </ul>

**Theme 3: Disaster Management – Hydrological Aspects of Drought, including Drought Monitoring, Regional Water availability analysis, assessment of water scarcity and deficits**

Expected Outputs	<ul style="list-style-type: none"> <li>• 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</li> <li>• Development of indicators for the determination of the onset of hydrological droughts</li> <li>• Guidance for the development of drought monitoring networks</li> </ul>
Expected Results	<ul style="list-style-type: none"> <li>• Knowledge base to adapt to changes in water resources availability (trends, outlooks..)</li> <li>• Enhanced preparedness to manage droughts</li> <li>• Improved knowledge for decision-making on national and regional levels</li> </ul>



**Theme 4: Water Resources Assessment, Availability and Use (Surface water and groundwater) and Sedimentation in Rivers and Reservoirs**

Expected Outputs	<ul style="list-style-type: none"> <li>• Implementation of the WRA manual in countries in RA II</li> <li>• Assessment and prediction of sedimentation in major selected reservoirs</li> <li>• Changes in the availability of groundwater resources in large aquifers including the development of methodologies</li> </ul>
Expected Results	<ul style="list-style-type: none"> <li>• Improved capability to contribute to IWRM</li> <li>• Improved reservoir operation</li> <li>• Improved knowledge for catchment management</li> </ul>

**Theme 5: Improved Accuracy of Hydrometric and Sediment Observations including Space-based Technologies in RA II**

Expected Outputs	<ul style="list-style-type: none"> <li>• Assessment of the performance of hydrometric instruments and techniques of observations</li> <li>• Improved sediment measuring techniques</li> <li>• Assessment of the accuracy and use of space-based observations for hydrometric purposes</li> </ul>
Expected Results	<ul style="list-style-type: none"> <li>• Improved quality and accuracy of observations and calculation of runoff in an overall quality Management framework of NHSs</li> <li>• Improved accuracy of the estimation of sedimentation rates and sediment budgets</li> </ul>

**Theme 6: 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"> <li>• Detection of trends and variability in selected pristine river basins in the region</li> <li>• Detection of changes in river flow in snow/glacier - fed rivers and its linkage to changes in the mass balance of glaciers and snow fields</li> <li>• Suitable climate prediction products are available for water managers</li> <li>•</li> </ul>
Expected Results	<ul style="list-style-type: none"> <li>• Improved adaptation capacity of water resources systems in a changing climate</li> <li>• Improved capacity for water-related disaster management (Hydrological extremes)</li> </ul>

**Theme 7: Regional exchange of hydrological data and information including WHYCOS and contributions of regional aspects of INFOHYDRO**

Expected Outputs	<ul style="list-style-type: none"><li>• Assessment of challenges and opportunities for the exchange of hydrological data and information</li><li>• Promotion of the WHYCOS Programme in RA II</li><li>• Facilitation of inputs towards INFOHYDRO</li><li>• Case studies on successful data sharing arrangements in the region</li></ul>
Expected Results	<ul style="list-style-type: none"><li>• Improved regional and global access to hydrological data and information for water-related projects and scientific programmes within and beyond the region</li></ul>

**13. ANY OTHER MATTERS**

13.1 The meeting discussed ways for an effective exchange of information between members of the Working Group and collaborating organizations. Likewise, the meeting was looking towards monitoring progress and being visible in the region. Participants therefore agreed that a dedicated webpage should be established. Mr A. Awan kindly agreed to host the webpage linked to the WMO webpage and keep it a living site through resources of the Flood Forecasting Division of the Pakistan Meteorological Department.

13.2 The group felt that it would be highly appreciated if some nominal funding could be made available for theme leaders to facilitate the implementation of the work plans with the assistance of dedicated collaborators.

**14. ADOPTION OF THE REPORT AND CLOSURE OF THE MEETING**

14.1 The meeting adopted the report of its session and requested the WMO Secretariat to make any editorial changes as deemed necessary. The WGH recommended that, after approval of the report of the meeting by the president of RA II, the report should be circulated to all participants of the meeting and to all Members of RA II as well as international organizations and selected regional organizations.

14.2 At the closing session, Mr. Jinping Liu on behalf of the Bureau of Hydrology expressed his satisfaction with the results of the meeting. He assured the continued support of the Bureau towards the achievement of the present work plan and support to the proposed future work plan of the Working Group Hydrology. He also remarked that the know-how and experiences of the Bureau and its professional staff could provide professional assistance in achieving the goals of the working group. In particular he offered to share the experiences and know-how of the Bureau of hydrology with National Hydrological Services of other countries. In this regard, Mr Liu stressed the necessity of a closer cooperation between the Working Group on Hydrology and the working groups of the ESCAP/WMO Typhoon Committee. He thanked the participants for coming a long way to China and wished them a safe return to their respective countries.

14.3 The chairman, Mr I. Shiklomanov, thanked the participants, the WMO Secretariat and the Bureau of Hydrology for their contributions and professionalism that made the meeting a success. Mr Shiklomanov thanked the representative of CHy for providing a close link between the work of the Commission and the RA II WGH. He also thanked Mr Grabs for the effective conduct of the meeting.

14.4 The vice-president of the Commission for Hydrology, Mr Wellens-Mensah, thanked the Bureau of Hydrology 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 a fruitful cooperation between CHy and the RA WGSH.

14.5 Mr W. Grabs expressed his gratitude to the Bureau of Hydrology and in particular Mr Zhiyu Liu, Ms Zhou Li and Ms Xinhong Li for 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.

14.5 The meeting closed at 14:30 hours on Friday 30 March 2007.

## AGENDA OF THE MEETING

### Monday 26 March 2007

09:00 - 09:30 Registration

09:30 - 10:15 Opening of the session

Message of the Representative of the Bureau of Hydrology, Ministry of Water Resources

Opening statement of the Chair of WMO RA-II Working Group on Hydrology

Statement of WMO Representative

Organization of the Session and adoption of the agenda

10:15 - 10:45 Coffee break and group photo

10:45 - 11:15 Briefing by WMO Representative

11:15 - 11:45 Briefing on relevant on-going regional activities

11:45 - 12:15 General discussion

12:15 - 13:30 Lunch

13:30 – 16:30 Consideration of the work plans and expected results (1)

Improving Institutional Capacity both Nationally and Regionally (K. Fukami)

Disaster Mitigation – Improvements to Short-duration (Flash) Flood Forecasting capabilities in Urban Areas (P. Petvirojchai)

Disaster Management – Climate Variability and Hydrological Aspects of Drought (Z. Liu)

17:30 - 19:00 Reception

### Tuesday 27 March 2007

09:00 - 12:00 Consideration of the work plans and expected results (2)

Water Resources Assessment, Availability and Use (Surface water and groundwater) in cooperation with UN ESCAP and IGRAC (S. Awan)

Improved Accuracy of Flow Measurements and Estimation in RA II (F. Yazdandoost)

Briefing on activities in Central Asia (A.Homidov)

12:00 - 13:30 Lunch

- 13:30 - 14:30 Development of the consolidated work plan and documentation of results for the Fourteenth Session of the Regional Association II (Asia) in 2008
- 14:30 – 15:00 Coffee break
- 15:00 – 16:00 Implementation of the Strategic Plan for the enhancement of National Hydrological Services in Regional Association II (Asia) for the Period 2004 - 2008
- 16:00 – 17:00 Implementation of the WMO Flood Initiative: Strategy and Action Plan for the Enhancement of cooperation between National Meteorological and Hydrological Services for Improved Flood Forecasting

**Wednesday 28 March 2007**

- 08:30 – 10:00 Overview of Regional Requirements with regard to climate information for water management and disaster reduction
- 10:00 – 18:00 Technical Excursion organized by the Bureau of Hydrology

**Thursday 29 March 2007**

- 09:00 – 10:00 Discussion on the exchange of hydrological data and information in the region, including the status of WHYCOS projects
- 10:00 – 10:30 Coffee break
- 10:30 – 12:00 Discussion on the needs of the region in relation to hydrology and water resources, including capacity building
- 12:00 – 13:00 Lunch
- 13:00 – 14:30 Discussion on future activities of the RA II (Asia) in the field of hydrology and water resources and recommended priority areas of cooperation between WMO and other regional organizations and programmes
- 14:30 – 15:00 Coffee break
- 15:00 – 16:30 Drafting Session of report (I)

**Friday 30 March 2007**

- 08:30 – 10:00 Drafting session of report (II)
- 10:00 – 10:30 Any other matter
- 10:30 – 11:00 Coffee break
- 11:00 – 12:00 Adoption of the Report (1)
- 12:00 – 13:00 Lunch
- 13:00 – 14:00 Adoption of the Report (2)
- 14:00 – 15:00 Closure of the Meeting including comments by participants, the hosting organization and WMO

## LIST OF PARTICIPANTS

### Chairperson

#### **Prof. Igor A. SHIKLOMANOV**

Roshydromet State Hydrological Institute  
2<sup>nd</sup> Line 23  
199053 SAINT PETERSBURG  
Russian Federation

Tel.: (+ 7 812) 323 3517  
Telefax: (+ 7 812) 323 1028  
E-mail: [ishiklom@zb3627.spb.edu](mailto:ishiklom@zb3627.spb.edu)

### Theme leaders

#### **Theme: Improving Institutional Capacity (national and regional)**

#### **Mr Kazuhiko FUKAMI**

Hydrologic Engineering Research Team  
International Centre for Water Hazard and Risk Management (ICHARM)  
Public Works Research Institute  
1-6, Minamihara, Tsukuba-shi

IBARAKI-KEN 305-8516  
Japan

Tel.: (+81-29) 879 6778  
Telefax: (+81-29) 879 6737  
E-mail: [k-fukami@pwri.go.jp](mailto:k-fukami@pwri.go.jp)

#### **Theme: Water Resources Assessment (surface and ground water)**

#### **Mr Shaukat Ali AWAN**

Flood Forecast Division  
46-Jail Road  
LAHORE-5400  
Pakistan

Tel.: (+92-42) 9200208  
Telefax: (+92-42) 9200209  
E-mail: [saliawan2002@yahoo.com](mailto:saliawan2002@yahoo.com)

**Theme: Disaster mitigation – climate variability and hydrological aspects of drought**

**Mr LIU Zhiyu**

Bureau of Hydrology  
Ministry of Water Resources  
No. 2 Lane 2, Baiguan Road  
BEIJING 100053  
China

Tel.: (+86-10) 6320 4513  
Telefax: (+86-10) 6354 8035 and (+86 10) 6320 2471  
E-mail: liuzy@mwr.gov.cn

**Theme: Disaster mitigation – improvement to short duration (flash) flood forecasting capabilities in urban areas**

**Ms Patchara PETVIROJCHAI**

**Hydrometeorological Academic Group**

Meteorological Development Bureau  
Thai Meteorological Department  
4353 Sukhumvit Rd.  
Bang-Na  
BANGKOK 10260  
Thailand

Tel.: (+66-2) 399 2595  
Telefax: (+66-2) 399 2595  
E-mail: patchara@tmd.go.th, patchara@hotmail.com

**Theme: Improved accuracy of flow measurements and estimation**

**Dr Farhad Yekeh YAZDANDOOST**

Islamic Republic of Iran  
Water Research Institute (WRI)  
P.O. Box 16765-313  
TEHRAN  
Islamic Republic of Iran

Tel.: (+98-21) 77312449-50  
Telefax: (+98-21) 77311959  
E-mail: [f.yazdandoost@wri.ac.ir](mailto:f.yazdandoost@wri.ac.ir)

**Expert designated by Permanent Representative of RA II**

**Mr Anvar HOMIDOV**

Hydrometeorological Agency  
47 Shevchenko Street  
DUSHANBE 734025  
Tajikistan

Tel.: (+992-37) 221 54 71  
Telefax: (+992-37) 221 55 22  
E-mail: [foreign-affairs@meteo.tj](mailto:foreign-affairs@meteo.tj)  
[anvar@meteo.tj](mailto:anvar@meteo.tj)

**Vice-president of the Commission of Hydrology**

**Mr Julius Wellens-Mensah**

Acting Director  
Hydrological Services Department  
P.O. Box MB 501  
ACCRA  
Ghana

Tel: (233 21) 66 29 89/66 66 94  
66 66 95 (main lines)  
67 73 83 (direct line)  
Fax: (233 21) 67 73 84  
E-mail: [hsd@ghana.com](mailto:hsd@ghana.com)  
Mobile : (233 24) 432 1614

**Member of the CHy Advisory Working Group**

Prof. Zhang Jian Yun  
Nanjing Hydraulic Research Institute  
No. 223  
Guang Zhou Road  
Nanjing 210029  
China

Tel: (86 25) 85828007  
Fax: (86 25) 85828888  
e-mail: [jy Zhang@mwr.gov.cn](mailto:jy Zhang@mwr.gov.cn)

**WMO Secretariat**

**Mr Wolfgang Grabs**

WMO  
Chief, Water Resources Division  
Hydrology and Water Resources Dept.  
Case postale 2300



7 bis, avenue de la Paix  
CH-1211 GENEVE 2  
Switzerland

Tel: (41 22) 730 83 58  
Fax: (41 22) 730 80 43  
E-mail: [wgrabs@wmo.int](mailto:wgrabs@wmo.int)

**Invited Guests from MWR and CMA**

**Mr. Jiazhi LIANG**

Deputy Director General  
Bureau of Hydrology (BOH)  
Ministry of Water Resources (MWR), P.R.China  
2 Lane 2, Baiguang Road  
Beijing 100053  
China

Tel: (86 10) 63202520  
Fax: (86 10) 63202471  
e-mail: [liz@mwr.gov.cn](mailto:liz@mwr.gov.cn)

**Mr. Zhenlin CHEN**

Deputy Director General  
Department of International Cooperation  
China Meteorological Administration (CMA), P.R.China  
No.46, Zhongguancun Nandajie Road,  
Beijing 100081  
China

Tel: (86 10) 62192957  
Fax: (86 10) 62174797  
e-mail:

**Mr. Jinping LIU**

Deputy Chief Engineer  
Bureau of Hydrology (BOH)  
Ministry of Water Resources (MWR), P.R.China  
Lane 2, Baiguang Road  
Beijing 100053  
China

Tel: (86 10) 63202515  
Fax: (86 10) 63202515  
e-mail: [jpliu@mwr.gov.cn](mailto:jpliu@mwr.gov.cn)

**DRAFT WORK PLANS OF THE RA II WORKING GROUP ON HYDROLOGY  
(2008 – 2012)**

Theme/Area of activities	<b>Improving Institutional Capacity including the implementation of the RA II Strategic Plan for NHSs and Technology Transfer in the context of HOMS</b>
Priority	High – WMO Core Activity
Background Material e.g. Previous reports of the RAI/ WG	<ul style="list-style-type: none"> <li>• Strategic Plan for the Enhancement of NHSs in RA II</li> <li>• HOMS Documents</li> <li>• Strategy for Capacity Building (WMO)</li> <li>• Manual on the Management and Operation of NHSs</li> </ul>
Expected Outputs	<ul style="list-style-type: none"> <li>• Progress in implementation of Strategic Plan, review of plan</li> <li>• Training requirements and opportunities</li> <li>• Information on hydrological data and products</li> <li>• Technology transfer and HOMS issues</li> <li>• Implementation of the Manual on the management and operation of NHSs</li> </ul>
Expected Results	<ul style="list-style-type: none"> <li>• NHSs with improved Strategic Planning Capabilities</li> <li>• NHSs with efficient access to relevant new technologies through improved exchange mechanisms</li> <li>• Improved management capabilities of NHSs</li> </ul>
Specific Activities	<ul style="list-style-type: none"> <li>• Implement the steps proposed in the Strategic Plan</li> <li>• Assist in the development of curricula for HOMS training workshops</li> <li>• Promotion of the Manual on the management and operation of NHSs</li> </ul>
Potential Linkages	<ul style="list-style-type: none"> <li>• WMO – CHy</li> <li>• UNESCAP</li> <li>• ICHARM</li> <li>• UNESCO/IHP</li> </ul>
Timeframe	TBD
Potential contributors, ( <i>inter alia</i> )	<ul style="list-style-type: none"> <li>• National HOMS Reference Centres</li> <li>• NHSs</li> </ul>

Theme/Area of activities	<b>Disaster Mitigation – Implementation of the WMO Flood Forecasting Initiative including Flash Flood Forecasting Capabilities and Mass Movements</b>
Priority	High – WMO core activity
Background Material e.g. Previous reports of the RAI WGH	<ul style="list-style-type: none"> <li>• WMO Strategy and Action Plan</li> <li>• Regional report of the WMO Flood Forecasting Initiative</li> <li>• DPM RA II Regional Analysis Document</li> </ul>
Expected Outputs	<ul style="list-style-type: none"> <li>• Implementation of the Strategy and Action Plan of the WMO Flood Forecasting Initiative</li> <li>• Best practice of flash flood forecasting and warning (QPE, QPF) and landslide/debris flow hazards in mountain areas</li> <li>• Develop and initiate demonstration projects</li> </ul>
Expected Results	<ul style="list-style-type: none"> <li>• Improved flood forecasting capacity</li> <li>• Enhanced and effective cooperation between NMHSs</li> </ul>
Specific Activities	<ul style="list-style-type: none"> <li>• Promote implementation of the Strategy and Action Plan through assistance in the development of national implementation plans</li> <li>• Develop project briefs for demonstration projects</li> <li>• Promote and participate in the planning and implementation of the Global Flash Flood Alert system in RA II</li> <li>• Collect and disseminate guidance materials and manuals on the assessment of mass movement hazards</li> </ul>
Potential Linkages	<ul style="list-style-type: none"> <li>• WMO DPM Programme</li> <li>• CHy</li> <li>• ICHARM</li> <li>• ISDR</li> <li>• UNESCAP</li> <li>• Typhoon Committee</li> <li>• US Hydrologic Research Centre</li> </ul>
Timeframe	TBD
Potential contributors, ( <i>inter alia</i> )	<ul style="list-style-type: none"> <li>• DPM national focal points</li> <li>• DPM regional working group</li> <li>• PWRI</li> <li>• International Flood Initiative (IFI) and ICHARM</li> <li>• Typhoon Committee</li> <li>• NMHSs</li> </ul>

Theme/Area of activities	<b>Disaster Management – Hydrological Aspects of Drought, including Drought Monitoring, assessment of water scarcity and deficits</b>
Priority	High – Millenium Development Goals
Background Material e.g. Previous reports of the RAI WGH	<ul style="list-style-type: none"> <li>• WMO Lowflow Manual</li> <li>• UNESCAP relevant studies</li> <li>• IAHS</li> <li>• IHP</li> </ul>
Expected Outputs	<ul style="list-style-type: none"> <li>• 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</li> <li>• Development of indicators for the determination of the onset of hydrological droughts</li> <li>• Guidance for the development of drought monitoring networks</li> </ul>
Expected Results	<ul style="list-style-type: none"> <li>• Knowledge base to adapt to changes in water resources availability (trends, outlooks..)</li> <li>• Enhanced preparedness to manage droughts</li> </ul>
Specific Activities	<ul style="list-style-type: none"> <li>• Document the use of existing hydrological drought indicators</li> <li>• Document overview of operational drought monitoring methodologies/system</li> <li>• Documentation and assessment of national guidance materials to manage droughts</li> </ul>
Potential Linkages	<ul style="list-style-type: none"> <li>• CHy</li> <li>• Commission for Agricultural Meteorology</li> <li>• UNESCAP</li> <li>• FAO</li> <li>• Drought Monitoring Centres</li> </ul>
Timeframe	TBD
Potential contributors, ( <i>inter alia</i> )	<ul style="list-style-type: none"> <li>• Selected countries in the region</li> <li>• UNESCAP</li> <li>• Note: Theme needs close coordination with the theme on Water resources Assessment</li> </ul>

Theme/Area of activities	<b>Water Resources Assessment, Availability and Use (Surface water and groundwater) and Sedimentation in Rivers and Reservoirs</b>
Priority	<ul style="list-style-type: none"> <li>• High – WMO core activity</li> <li>• High – Millenium Development Goals</li> </ul>
Background Material e.g. Previous reports of the RAIL WGH	<ul style="list-style-type: none"> <li>• WMO-UNESCO Water resources Assessment Manual</li> <li>• IGRAC Webpage, manuals and guidelines (on their webpage)</li> <li>• Global Water resources Outlook at the beginning of the 21<sup>st</sup> Century</li> <li>• Selected UNESCAP studies</li> </ul>
Expected Outputs	<ul style="list-style-type: none"> <li>• Implementation of the WRA manual in countries in RA II</li> <li>• Assessment and prediction of sedimentation in major selected reservoirs</li> <li>• Changes in the availability of groundwater resources in large aquifers including the development of methodologies</li> </ul>
Expected Results	<ul style="list-style-type: none"> <li>• Improved capability to contribute to IWRM</li> <li>• Improved reservoir operation</li> <li>• Improved knowledge for catchment management</li> </ul>
Specific Activities	<ul style="list-style-type: none"> <li>• Document and disseminate the methodology used for the assessment in Russia</li> <li>• Collect information on water use in countries of the region</li> <li>• Provide information on shifts in water resources</li> <li>• Assessment of sedimentation rates in major reservoirs</li> </ul>
Potential Linkages	CHy UNESCAP Member countries
Timeframe	TBD
Potential contributors, ( <i>inter alia</i> )	<ul style="list-style-type: none"> <li>• WMO Secretariat</li> <li>• UNESCO/IHP</li> <li>• IGRAC</li> <li>• IAHS</li> </ul>

Theme/Area of activities	<b>Improved Accuracy of Hydrometric and Sediment Observations including Space-based Technologies in RA II</b>
Priority	High – WMO Core activity
Background Material e.g. Previous reports of the RAI WGH	<ul style="list-style-type: none"> <li>• WMO publications (Manual on Stream Flow Gauging, Technical Regulations....)</li> </ul>
Expected Outputs	<ul style="list-style-type: none"> <li>• Assessment of the performance of hydrometric instruments and techniques of observations</li> <li>• Improved sediment measuring techniques</li> <li>• Assessment of the accuracy and use of space-based observations for hydrometric purposes</li> </ul>
Expected Results	<ul style="list-style-type: none"> <li>• Improved quality and accuracy of observations and calculation of runoff in an overall quality Management framework of NHSs</li> <li>• Improved accuracy of the estimation of sedimentation rates and sediment budgets</li> </ul>
Specific Activities	<ul style="list-style-type: none"> <li>• Provide guidance on the use of appropriate instrumentation and methods of observation in diverse conditions</li> <li>• Review of the use and suitability of space-based observations</li> <li>• Prepare detailed proposal for the intercomparison of methods of observations and their relative accuracy</li> <li>• Prepare documentation for the intercomparison of instruments</li> </ul>
Potential Linkages	<ul style="list-style-type: none"> <li>• Space agencies</li> <li>• HMEI (manufacturers)</li> </ul>
Timeframe	TBD
Potential contributors, ( <i>inter alia</i> )	<ul style="list-style-type: none"> <li>• Space agencies</li> <li>• Instrument manufacturers</li> <li>• NHSs</li> <li>• UNESCO International Sediment Initiative (ISI)</li> <li>• IAHR</li> <li>• IAHS</li> </ul>

Theme/Area of activities	<b>Hydrological responses to climate variability and change and promotion of the use of climate information by water managers</b>
Priority	High – WMO Core activity (WCP-Water)
Background Material e.g. Previous reports of the RAI WG	<ul style="list-style-type: none"> <li>• WCP-Water reports</li> <li>• IPCC Assessments and special report on water (2008)</li> <li>• Web-research and specialized publications</li> <li>• FRIEND reports</li> </ul>
Expected Outputs	<ul style="list-style-type: none"> <li>• Detection of trends and variability in selected pristine river basins in the region</li> <li>• Detection of changes in river flow in snow/glacier - fed rivers and its linkage to changes in the mass balance of glaciers and snow fields</li> <li>• Suitable climate prediction products are available for water managers</li> </ul>
Expected Results	<ul style="list-style-type: none"> <li>• Improved adaptation capacity of water resources systems in a changing climate</li> <li>• Improved capacity for water-related disaster management (Hydrological extremes)</li> </ul>
Specific Activities	<ul style="list-style-type: none"> <li>• Work to be undertaken in close liaison with WCP-Water and CHy</li> <li>• Collate comprehensive information on the regional situation of glaciers and glacial runoff in RA II (in collaboration with IGOS – Cryosphere and CiC)</li> <li>• Preparation of a requirements document of water managers in terms of climate information</li> <li>• Overview of impacts of climate change on water resources in the region (selected examples)</li> </ul>
Potential Linkages	<ul style="list-style-type: none"> <li>• WCP-Water</li> <li>• IPCC Working Group II</li> <li>• UNESCO/IHP</li> <li>• Asian Water Cycle Initiative</li> </ul>
Timeframe	TBD
Potential contributors, ( <i>inter alia</i> )	<ul style="list-style-type: none"> <li>• Russian Academy of Science – Institute of Geography</li> <li>• Climate Research and Prediction Centres</li> <li>• World Climate Programme (WCP)</li> <li>• IAHS Working Groups</li> </ul>

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



### List of Theme Leaders of the WMO Technical Commission for Hydrology

1. Basic systems (hydrometry and hydraulics) – Team Leader: Paul Pilon, Canada  
E-Mail: [pilonp@ottawa.ijc.org](mailto:pilonp@ottawa.ijc.org)
2. Water resources assessment and water use - Team Leader: Ann Calver, UK, E-Mail: [anc@ceh.ac.uk](mailto:anc@ceh.ac.uk)
3. Hydrological forecasting and prediction - Team Leader: J. Zhang, China  
E-Mail: [jy Zhang@mwr.gov.cn](mailto:jy Zhang@mwr.gov.cn)
4. Disaster mitigation – floods and droughts (hydrological aspects)  
Team Leader: - S. Demuth, Germany [*To be replaced*]  
E-Mail: [demuth@bafg.de](mailto:demuth@bafg.de)
5. Analysis of hydroclimatological data for variability and trends  
Team Leader: Harry Lins, USA  
E-Mail: [hlins@usgs.gov](mailto:hlins@usgs.gov)

Nom du document : FINAL REPORT RA-II\_WGH\_2007  
Dossier : C:\DOCUME~1\NR\LOCALS~1\Temp  
Modèle : C:\Documents and Settings\NR\Application  
Data\Microsoft\Modèles\Normal.dot  
Titre : WORLD METEOROLOGICAL ORGANIZATION  
Sujet :  
Auteur : Thomas Grabs  
Mots clés :  
Commentaires :  
Date de création : 16/07/2008 16:28  
N° de révision : 2  
Dernier enregistr. le : 16/07/2008 16:28  
Dernier enregistrement par : Grabs W  
Temps total d'édition : 1 Minute  
Dernière impression sur : 16/07/2008 16:48  
Tel qu'à la dernière impression  
Nombre de pages : 41  
Nombre de mots : 13 074 (approx.)  
Nombre de caractères : 74 524 (approx.)