Summary report on
The 6th International Coordination Group (ICG) Meeting of the GEOSS Asian Water Cycle Initiative (AWCI)
held
at the Sanur Paradise Plaza Hotel, Bali, Indonesia, 13 March 2010.
(Final draft: 2 June 2010)

The **Sixth GEOSS AWCI ICG meeting** was planned and undertaken to accelerate the GEOSS/AWCI coordination focusing on promotion of regional cooperation on climate change adaptations that was recognized as one of the main challenges of AWCI at the Fifth GEOSS AWCI ICG meeting held in Tokyo, Japan, December 2009. About 40 participants from 16 countries assembled during the meeting and discussed the topics included on the meeting agenda that reflected the outcomes of the 5th AWCI ICG meeting. The result of those discussions is summarized in this report. All of the presentation material provided by the participants at the meeting is available on the Internet through the meeting home page at: http://www.editoria.u-tokyo.ac.jp/awci/6th/presentation.html.

1. Executive Summary of Main Issues/Conclusions and Actions

The meeting was held in conjunction with the 4th GEOSS Asian Pacific Symposium that took place at the same venue, 10 – 12 March 2010 and included a special parallel session on "Hydrometeorological-Related Disaster and Water Resources Management" to which AWCI participating countries and working groups significantly contributed.

A brief executive summary of the AWCI ICG meeting and GEOSS AP water-related session is given in this section, further details follows in sections 2.1 and 2.2 below.

1.1 Hydrometeorological-Related Disaster and Water Resources Management Session

The GEOSS Asian Water Cycle Initiative (AWCI), including its four working groups on floods, droughts, water quality and climate change, has been building a regionally cooperative framework by involving experts from 20 countries. The focus is on sharing data, models, experiences and knowledge and on implementing capacity-development programs. Participants considered further convergence and harmonization of observational activities, analytical and down-scaling techniques, interoperability arrangements, and effective and comprehensive data management as the most fundamental elements for mobilizing the efforts by AWCI to create societal benefits.

The participants in the session on Hydrometeorological-Related Disaster and Water Resources Management requests the Beijing Ministerial Summit to recognize the direction and achievements of AWCI as one of the most effective regional approaches for climate change adaptation and to endorse its activities at the national and regional levels for improving the efficiency of operational water resources management.

1.2 The 6th GEOSS/AWCI International Coordination Group Meeting

The meeting reviewed accomplished and on-going activities and recognized good progress in all four working groups – flood, drought, water quality, and climate change. In particular, demonstration project data submissions, data quality control, and also metadata registration has progressed significantly since the last reporting period. The demonstration project activities in individual basins have been launched and have advanced in concert with the GEOSS/AWCI implementation plan. Also implementation planning in the three focus areas – (i) typhoon, cyclone, and induced floods; (ii) drought; and (iii) snow, glacier, and GLOF – has progressed and concrete activities are proposed aimed toward climate change impact assessment and adaptation strategies. Owing to the well populated DIAS archive including the demonstration basin data, global datasets and in particular climate projection model outputs, opportunities have arisen for climate change impact assessment and adaptation studies. Implementation chart for such studies was proposed and agreed by the participants (Fig. 8 on page 15 below).

The GEOSS/AWCI capacity building program continues in successful implementation of a number of training modules that are based on identified needs in the region as well as individual countries. The web-based interactive repository of available modules and proposed seminars that was developed by UNU is a very supportive tool that facilitates better coordination in planning the events. Also newly suggested web tutorials of individual training modules will be available through this website. The proposed further direction of the CB program is toward integration of research, capacity development and applications including capacity development programs for training a large number of competent persons and higher education research.

Two short training courses were held on the DIAS data quality check and metadata registration tools and the ICHARM flood management system IFAS, respectively. Metadata registration was accomplished for several basins during the practical exercise of the DIAS tool course.

The 4th Asian Water Cycle Symposium was proposed be held before the GEO Ministerial Summit in November 2010, most probably in October in Tokyo, Japan, in conjunction with a related ministerial-level meeting organized by MLIT, Japan. Confirmation and further details will be announced in due course.

Concluding messages were formulated:

Although climate change adaptation requires socially and economically efficient and sustainable management of the world's limited supplies of freshwater, this precious resource cannot be managed unless we know where the water is, its quantity and quality, and how its variability will change in the future.

This knowledge base relies upon our ability to measure and monitor precipitation, water quantity and quality and our continued efforts to improve our physical, chemical, biological, and ecological understanding of the water cycle.

Based on the reports and discussions at the GEOSS-AP symposium and the ICG meeting, the participants recognized the commonality and regionality of water-related issues and socio-economic impacts caused by water-related problems associated with the climate change in the Asia-Pacific region.

It was agreed that well-coordinated scientific research initiatives along with a combination of global Earth observations and integrated data provided by GEOSS are essential to adequately address these issues.

Message to the GEO ministerial summit:

The Summit is requested to recognize the direction and achievements by GEOSS/AWCI as one of the most effective regional approaches for climate change adaptations and to endorse its activities in each country and the Asia-Pacific region in improving the efficiency of operational water resources management.

2.1 Hydrometeorological-Related Disaster and Water Resources Management – full report

Floods, droughts and water pollution are commonly severe problems in Asia-Pacific region. In addition to the rapid population growth and urban expansion, climate change is changing the water

cycle. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) projected more frequent heavy precipitation events, an increase in the area affected by drought, and more intense tropical cyclones (typhoons and hurricanes) associated with global warming (IPCC, 2007). Changes in water resources, from melting glaciers to increased floods, droughts, and sea level rise, amongst others, will impact significantly on socio-economic development and the environment in unprecedented ways. GEOSS is strongly expected to provide usable information for sound decision making on climate change adaptations in the field of water resources management.

The objective of this parallel session was to review various plans and on-going actions in the Asia-Pacific regions and discuss how to cooperate and coordinate regionally and globally in order to accelerate sharing of implementation experiences, as well as data product availability and requirements of contributing systems within GEOSS.

The session agenda

Morning session: Co-Chairs: **Rick Lawford & Leonarda B. Ibnu Said**

09:00-09:10 ***Opening Water Session***

09:00-09:05	Welcome and introduction to session Objectives	Session Co-Chairs
09:05-09:15	Introduction to Hydrometeorological-Related Disaster and Water Resources Management	Toshio Koike (University of Tokyo (UT))

09:15-09:50 ***Report form the 5th GEOSS/AWCI International Coordination Group Meeting***

Drought	Rasul Ghulam (PMD)
Typhoon and Cyclone	Kazuhiko Fukami (ICHARM)
Snow, Glacier, and GLOF	Toshio Koike (UT)
Climate Change Adaptation	Mafizur Rahman (BUET)

10:00-12:00 ***Short country reports on "Climate Change Impact Assessment and Adaptation"***
GEOSS/AWCI participating countries: Australia, Bangladesh, Bhutan, Cambodia, China, Indonesia, Japan, Malaysia, Mongolia, Myanmar, Pakistan, Philippines, Sri Lanka, Thailand, Uzbekistan, Vietnam

Afternoon session: Co-Chairs: **Toshio Koike and Eddy Hermawan**

13:00 – 14:00 ***Short reports on "What is on-going and/or planned"***

Geo-Water	Rick Lawford (Canada)
Global Mapping	Shuhei Kojima (Japan)
Water Management	Hidayat Pawitan (MHI, Indonesia)
Indonesian Climate Model	Didi Satiadi (LAPAN, Indonesia)

14:00 – 15:40 ***Socio-Economic and Political Approach***

APWF Water and Climate Change Steering Group	Toshio Koike (Japan)
Policy-Science-Engineering Collaboration	Wu Xun, Gopi Rethinaraj, Priyanka Anand (NUS)
Water quality: an inseparable perspective of Disaster and Water Resources Management	Bilqis A. Hoque (Bangladesh)
Discussion for Implementation	Moderators: Wu Xun, Gopi Rethinaraj (NUS)

15:40 – 16:00 ***Closing Session***

Session summary	Co-Chairs
Closing remarks	Co-Chairs

Opening

The session was opened by session Co-Chairs Rick Lawford (GEO Water: IGWCO) and Leonarda B. Ibnu Said (Ministry of Public Work of Indonesia) who provided welcome remarks and stressed out the importance of regional collaboration for pursuing assessments of climate change impacts on water resources and hydrometeorological-related hazards as well as for development and implementation of adaptation plans.

Prof. Toshio Koike then introduced evolution of the Hydrometeorological-Related Disaster and Water Resources Management theme since the 3rd GEOSS Asian Pacific Symposium that was held in Kyoto, Japan, February 2009. At that Symposium, participants discussed on how to cooperate and coordinate among different societal benefit areas, Climate, Water cycle and Disasters, and to make plans for carrying the ideas into actions. Four main focus areas were identified for collaboration including: (i) Typhoon, cyclone, and induced floods, (ii) Drought, (iii) Cold surge, and (iv) Snow, glaciers, and GLOF. Nevertheless from the ensuing survey was concluded that the interest of GEOSS/AWCI participating countries in the Cold surge is not as significant as in other three areas and thus the Cold surge theme has not been considered for further discussion. On the other hand, the Climate Change adaptation issue has been brought up as an overarching, key focus of the GEOSS/AWCI activities.

In general for all the proposed focus areas, key actions were proposed that included: (i) Activating modeling activity and accumulating knowledge, (ii) Promoting collaboration among data integration centers, and (iii) Considering the characteristic meteorological environment in the Equatorial region. Particular steps to implement the proposed activities were outlined:

- Countries and organizations would submit proposal on the targeting topic(s)
- A three-day workshop would be held in fall 2009 to discuss:
    1. Sharing Societal Needs, Scientific Ideas, Observation Capability, Modeling Capability, Experiences
    2. Seeking Data Sharing Possibility: Data Policy, Meta Data Generation and Data Infrastructure
    3. Establishing Cooperation Framework under GEO
- Implementation Plan discussion
- Reporting to the 4th GEOSS AP Symposium in Bali, Indonesia, 2010

Per the proposed schedule, a four day meeting event was held in Tokyo, 15 – 18 December 2009 that included the 5th GEOSS/AWCI ICG meeting, a part of which was the IWRA-GEOSS/AWCI Joint Symposium, and the Joint Training Workshop on the Application of Remote Sensing Products on Drought Monitoring in Asia. The meeting was directed “Toward regional and interdisciplinary collaboration for addressing our common water-related issues in Asia by making maximum use of GEOSS” and the discussion focused on collaboration with on-going AWCI Demonstration Projects and with the Water Quality group, and on data and capacity building needs for promoting the activities. The discussions were led in the context of Climate Change Adaptations and it was concluded that “End to End approach” (Fig. 1) was necessary for successful implementation of the envisioned activities.

Further, Prof. Koike provided updated status of the GEOSS/AWCI Demonstration basins data submissions to the DIAS data system as well as the Demonstration Project implementation progress. More than 70% of expected demonstration basin data has been submitted and quality-checked and multiple studies have been carried out at these basins as part of Demonstration Projects. In addition, plenty of further data including in-situ and satellite observation data and model outputs is now available at DIAS and can be exploited for implementing the GEOSS/AWCI activities.

Report from the 5th GEOSS/AWCI ICG Meeting

Outcomes of the discussions per individual focus areas at the 5th GEOSS/AWCI ICG Meeting were presented during this session.

The **Drought theme** was represented by Dr. Ghulam Rasul who introduced its four main objectives that include: (i) to build up a drought monitoring and researching network of member Asian countries, (ii) to share and improve the drought monitoring data/capability in various Asian countries, (iii) to make a collaboration with the demonstration projects studying climate change, and (iv) to help developing the early warning system of drought hazard in member countries. Objectives (i) and (ii) are now being implemented using number of soil moisture observation stations in participating countries (Bangladesh, China, Mongolia, Pakistan, Vietnam) as well as satellite observation data (AMSR-E, MODIS), while the latter ones will begin to be implemented in 2010. Closer collaboration with GEOSS/AWCI demonstration projects in participating countries is being sought and also linkages with the water quality themes have been identified.

Dr. Kazuhiko Fukami presented the outcomes of the **Typhoon and Cyclone theme** discussions. The targets and activities include: (i) to promote sharing state-of-the-art knowledge and capacity building so as to reduce and mitigate flood disasters caused by typhoons/cyclones, through Flood WG activities of GEOSS/AWCI, (ii) to promote climate change impact analysis on flood disasters / water resources and policy-making for climate change adaptation strategy, (iii) to enhance

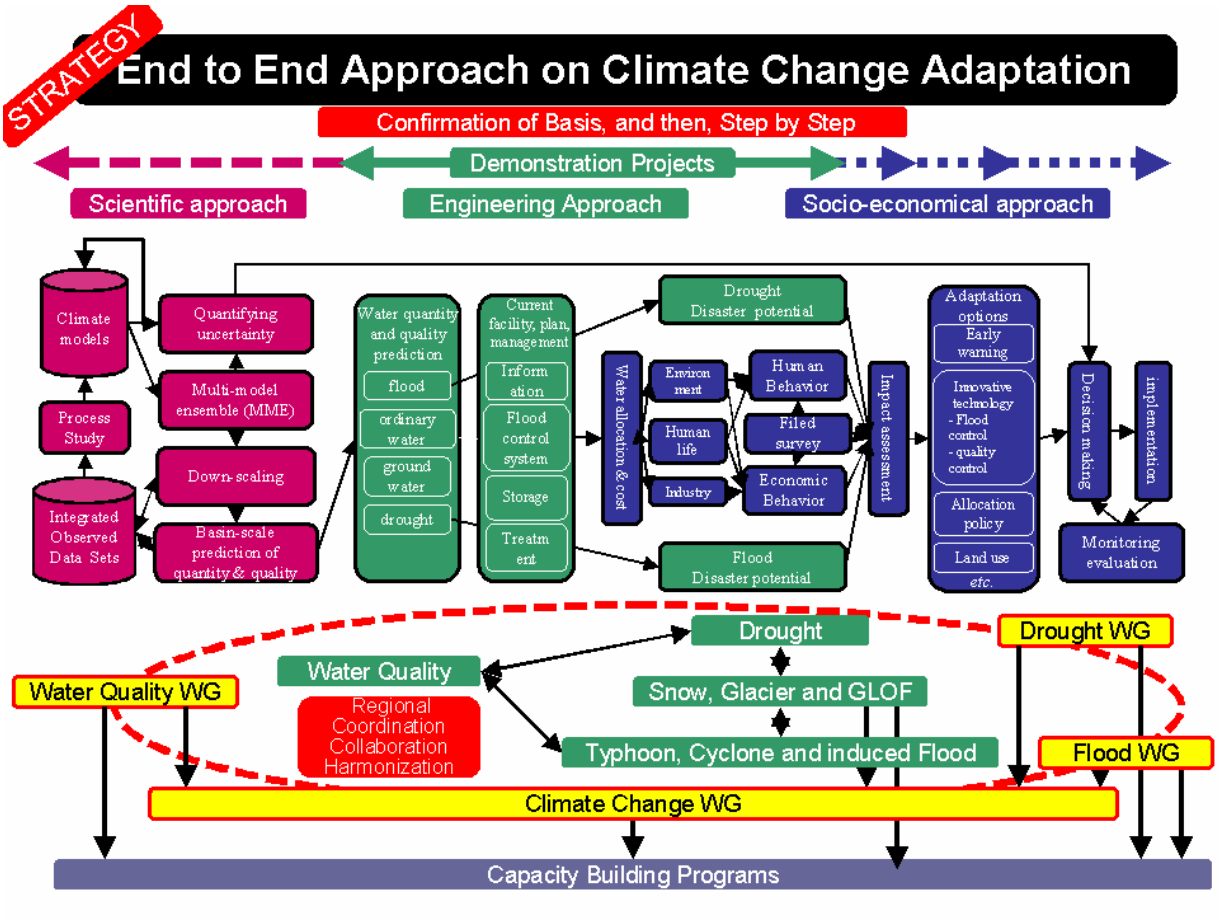

Figure 1: Scheme of the End to End Approach on Climate Change Adaptation

integrated flood/water resources management based on combined use of a state-of-the-art model with GEOSS data and in-situ data, and (iv) to share long-term historical meteorological and hydrological databases to enhance climate change impact analyses and adaptation studies through GEOSS. A flowchart of an Assessment of the climate change impact on flood disaster risk and its reduction measures over the globe and specific vulnerable areas was introduced that involves number of models from an atmospheric one to inundation and risk assessment models. To promote its activities the Typhoon and Cyclone theme seek for: (i) long-term historical extreme data (flood and low flow), (ii) most accurate DEM data (ASTER DEM), (iii) high quality in-situ hydrological data, and (iv) technical standards to determine a design flow (and/or rainfall) for planning river works.

The **Snow, Glacier and GLOF theme** outcomes were presented by Prof. Toshio Koike who reported the need of scoping discussion among the involved members (Pakistan, Mongolia, Nepal and possibly Bhutan, India, Uzbekistan), related projects (CEOP-HE, CEOP Cold regions, ICIMOD), and experts in this field. To activate the theme efforts, a model intercomparison project in various cold regions was proposed that would include appropriate GEOSS/AWCI Demonstration projects or even dedicated cold region demonstration basins in participating countries. Existing tools/models will be investigated and employed. The needed data include: (i) high special resolution without cloud for glacier – for shorter period: ALOS; SPOT, Aster30, (ii) Longer-term Landsat data (by GEO), (iii) long term in-situ data: temperature, precipitation; mountain reg. Data, (iv) DEM – from global data SRTM30 + more precise local data. Capacity building is desirable in the field of (i) glacier physics and modeling, (ii) spatial distribution of snow model, and (iii) satellite remote sensing application to glacier and mountainous regions.

Overview of the **Climate Change Adaptation** focus was given by Prof. Mafizur Rahman who emphasized the relevance of the IPCC climate change projection scenarios for climate change impact assessment. Climate change impact assessment studies are proposed as part of the GEOSS/AWCI

activities. In addition, Prof. Rahman introduced a complex climate change adaptation strategy of Bangladesh, very vulnerable country to the climate change impacts.

Short country reports on "Climate Change Impact Assessment and Adaptation

Representatives of GEOSS/AWCI participating countries, namely *Australia, Bangladesh, Bhutan, Cambodia, China, Indonesia, Japan, Malaysia, Mongolia, Myanmar, Pakistan, Philippines, Sri Lanka, Thailand, Uzbekistan, Vietnam*, introduced their country activities focused on Climate change impact assessment and adaptation. A wide range of water-related risks associated with climate change was reported. All countries also reported that climate change impacts and need of adaptation measures were understood by their governments and dedicated national climate change adaptation plans and strategies have been proposed and their implementation set off.

Short reports on "What is on-going and/or planned"

Four presentations were provided in this session that introduced on-going and planned activities focusing on further convergence and harmonization of observations, analytical and down-scaling techniques, improvement of modeling capabilities, interoperability arrangements, and effective and comprehensive data management. These included GEO Water by Dr. Rick Lawford, Global Mapping by Dr. Shuhei Kojima, Water Management by Dr. Hidayat Pawitan, and Indonesian Climate Model by Dr. Didi Satiadi. It was stated that the IGWCO activity had provided a framework for developing and advancing GEO Water and that the progress had been satisfactory, although uneven in some areas. Importance of the role AWCI plays in GEO Water and IGWCO was mentioned. Capabilities provided by Global Map (www.iscgm.org) were found very usable for sound decision making on GEOSS SBAs. In addition, further encouraging of collaborative research and information exchange among scientists as well as water resources professionals in Asian-Pacific region is highly desirable. Certain specifics of continent-maritime region climate were introduced that are posing special requirements for climate models, including need of high-resolution observation, dynamical modeling and improved representation of convection in the models.

Socio-Economic and Political Approach

This session initiated discussion on strategies on how to bridge policy, science, and engineering arenas for effective collaboration that is essential for improving the efficiency of operational water resources management and for climate change adaptation plans preparation and implementation.

The session was opened by Prof. Toshio Koike, who introduced the Asian Pacific Water Forum (APWF) framework and its mission and goals and mentioned upcoming Asia-Pacific Water Ministers' Forum that will take place in Singapore, on 28 June 2010. He further explained the roles of the APWF Water and Climate Change Steering Group that include advising leaders, guiding knowledge networking, and progress reporting. The steering group's composition of about 15 members including: (i) experts in water and climate change projections, impact assessments, technical and socio-economic aspects of adaptation, and capacity development; (ii) leaders from government and civil society, from two large and two small countries; and (iii) representatives from international and bilateral funding agencies, will assure good collaboration among the science, engineering, and policy arenas as well as funding agencies.

A team of experts from the Institute of Water Policy, National University of Singapore including Drs. Priyanka Anand, Gopi Rethinaraj, and Wu Xun, delivered a very informative talk focusing on (i) relationship between climate change and urbanization and implications for city planning strategies; (ii) relevance of science and technology inputs for policy making; and (iii) Integrated Policy-Making for Sustainable Development – a process by which governments translate the objectives of sustainable development into policy actions in a given policy environment. At the end of this session, the team moderated the "discussion for implementation" to discuss next steps for developing better communication methods for more informed and effective policy making for the future.

Dr. Bilqis A. Hoque introduced Water quality aspect as an inseparable perspective of Disaster and Water Resources Management and emphasized conjunction of water quantity and water quality issues especially in the context of climate change impacts on water resources. Dr. Hoque presented examples of studies focusing on flood/drought events considering both water quantity and water quality aspects.

Closing session

The meeting presentations and discussions were summarized and overall message proposed and agreed:

GEOSS Asian Water Cycle Initiative (AWCI), including four working groups, flood, drought, water quality and climate change, has been building a **regionally cooperative framework** by involving experts from 20 countries in sharing data, models, experiences and knowledge and implementing capacity development programs.

The participants considered further **convergence and harmonization of observational activities, analytical and down-scaling techniques, interoperability arrangements, and effective and comprehensive data management** as the most fundamental elements that can mobilize the efforts by GEOSS/AWCI to create societal benefits.

2.2 The 6th International Coordination Group Meeting of the GEOSS AWCI ICG – full report

To accelerate the GEOSS/AWCI coordination, it was discussed how to promote regional cooperation and coordination on climate change adaptations.

The meeting agenda

09:00 – 9:20 **Opening**
Hirota Tani, Director, Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan
Koki Iwao, GEO Representative

09:20 –10:00 **AWCI Activity Reports**
Summary Report including Updates of the Demonstration Projects
Working Group Reports (Flood, Drought, Water Quality, Climate Change)

10:10 –10:25 **Welcome a new member**
Australia Dr Stuart Minchin

10:40 – 11:40 **"Capacity Building" Implementation Plan Development**
Srikantha Herath (UNU), Chu Ishida (JAXA)

11:40 – 12:00 **Breakout Sessions for Implementation**
1. Climate Change Adaptations – Drought
2. Climate Change Adaptations – Snow, Glacier and GLOF
3. Climate Change Adaptations – Typhoon, Cyclone, and Induced Floods
- Basic Strategy
- Technical Approaches
- Political Approach

13:00 – 14:00 **Breakout Sessions for Implementation – continued**

14:00 – 14:45 **Short Plenary for Breakout Session Reports**

15:00 – 16:00 **Short Training Course 1: "Data quality check and meta data registration"**

16:00 – 16:30 **Short Training Course 2: "Flood Management"**
1
16:30 –17:30 **General Discussion**
17:30 **Closing**

Opening

The meeting was opened by Dr. Hirota Tani, Director, MEXT, Japan, and Dr. Koki Iwao, GEO Secretariat.

Dr. Tani acknowledged the progress of the AWCI activities and emphasized the importance of regional collaboration as well as collaboration between GEOSS, AWCI, and DIAS that has already

resulted in development of approaches for addressing water-related issues associated with climate change. He also regarded the transferability of these approaches that is demonstrated by the developing African Water Cycle Coordination Initiative.

Dr. Iwao mentioned the GEO ministerial summit in Beijing, November 2010 and introduced potential GEO success stories to be presented at the summit. One candidate is the Asian regional showcase that includes GEOSS/AWCI. This high evaluation of AWCI activities is true acknowledgment of great efforts contributed by participating countries and collaborating organizations

Station Name	Basic Info.	Data Upload	Quality Control Status	%
Bangladesh	Complete	Complete		0
Bhutan	Complete	Complete		1
Cambodia	Complete	Complete		100
India	Complete	Complete		88
Indonesia	Complete	Complete		38
Japan	Complete	Complete		100
Korea	Complete	Complete		100
Lao	Ongoing			0
Malaysia	Complete	Ongoing		0
Mongolia	Complete	Complete		0
Myanmar	Complete	Complete		100
Nepal	Complete	Complete		100
Pakistan	Complete	Complete		0
Philippines	Complete	Complete		0
Sri Lanka	Complete	Complete		100
Thailand	Complete	Complete		100
Uzbekistan	Complete	Complete		100
Vietnam	Complete	Complete		100

Figure 2: Status of the AWCI demonstration project data submissions and quality control

and initiatives.

AWCI Activity Reports

Prof.Toshio Koike provided an overview of the 11 years GEOSS Water and the 5 years of AWCI history pointing out the main achievements of these initiatives. In case of AWCI, it included a very important agreement on data policy, adopting the demonstration project (DP) approach and initiating their implementation in 18 river basins in participating countries, data collection activity in cooperation with DIAS (UT), and the capacity building program with its number of accomplished as well as on-going and planned activities. In particular, he mentioned that more than 50% of the data commitments for the DPs had been submitted and quality checked through the DIAS tools and reported on the status of DPs (Fig. 2 and 3). In addition, opportunities for climate change impact assessment studies in the AWCI participating countries were introduced that have arisen due to the DIAS stored data, especially climate projection models outputs.

Flood group: Dr. Kazuhiko Fukami reported on the major activities of the AWCI flood group that included generic template for demonstration projects in GEO on use of satellite information for flood risk management, flood-focused demonstration projects update, identification of member countries' needs and resources for capacity building, and the 2-year APN funded project under the ARCP program that aims "To build up a scientific basis for sound decision-making and developing policy options for most suitable flood risk management for each country and region in Asia, through the full

#	Country	Basin Name	Status		
			Partners	Topics	Fundings
1	Bangladesh	Meghna	MD/BMD, BUET, JAXA, ADB	Flood/Storm Alarming by Mobile Phone	To be expected from ADB
2	Bhutan	Punatsangchhu	Hydro-met Services, UT	Supporting to GLOF Prediction	to be expected
3	Cambodia	Sangker	MOWRAM/DHRW, UT, JAXA	Water management and Local Water Circulation	APRSAF/SAFE by JAXA
4	India	Seonath			
5	Indonesia	Mamberamo			
		Citarum, Solo, Brantas	MPW, UT, ADB	Climate Change Adaptation	To be expected from ADB
6	Japan	Tone	MLIT, UT	Optimization al the dam operation for flood control and water use	DIAS
7	Korea	Upper Chungju-dam	National Project	Climate Change Adaptation	
8	Lao PDR	Sebangfai			
9	Malaysia	Langat	National Project	Climate Change Adaptation	
10	Mongolia	Selbe	Institute of Meteorology and hydrology, Mongolia, National Geo information center, IHP-Japan	Water balance monitoring, Use of Remote senising for land cover changes	Sciense and technology foundation, Mongolia,
11	Myanmar	Shwegyin			
12	Nepal	Bagmati	considering snow, glaciar, GLOF		
13	Pakistan	Gilgit	TMD, UT	Monitoring and prediction capability of snow, glacier and soil moisture	APRSAF/SAFE by JAXA
		Indus	FFC, WAPDA, KUT	Water resources management for climate change adaptation	to be expected from JICA
14	Philippines	Pampanga	PAGASA, UT	Optimization al the dam operation for flood control and water use	to be expected
15	Sri Lanka	Kalu Ganga	University of Peradeniya, United Nations University, Irrigation Dept, Meteorology Dept	Adaptation to extereme floods caused by climate change, Weather Modelling and downscaling by GCM	Reseach facilities by University of Peradeniya, Scholarships to researchers by UNU, Data from Irrigation and Meteorology Departments
16	Thailand	Mae Wang	GAME-T	Flood Early Warning System	JEPP by MEXT
17	Uzbekistan	Chirchik-Okhangaran			
18	Vietnam	Huong	NHMS, MAHASRI	forecasting, warning capability for Central Region	3.7 M USD (2008-2013)
			NHMS, UT/GCOE	Flood-Water Quality- Health Public Awareness	to be expected

Figure 3: Status of the AWCI Demonstration Projects

utilization of new opportunities on global, regional and in-situ dataset under the scheme of GEOSS/AWCI". Specifically, the project addressed the following objectives: (i) converting observations and data, both through space-borne platforms and data integration initiatives, to usable information for flood reduction; (ii) improvement of quantitative forecasts for coupled precipitation - flood-forecasting systems; and (iii) facilitate risk assessment through the provision of scenarios and data for exposure estimation. Enhancement and utilization of regional cooperation using the resources and knowledge available at various specialized institutions was pointed out. Training programs on the use of tools and data formed the basis for capacity development activities. These included IFAS and GFAS training workshops in 2008 and 2009.

In a **short-term** perspective, the group plans to: (i) continue in-situ observations to get enough validation data; (ii) improve the demonstration systems/scenarios and to make final validations of them with the archived & analyzed data; and (iii) develop capacity building tools for shifting the demonstration systems to operational ones for the next-stage AWCI. In addition **mid-term** plans were outlined as to: (i) promote each demonstration project of each member country according to its own specific objectives and the dissemination of its achievements through papers/presentations; (ii) identify and share any problems to promote demonstration projects, and to support how to cope with them through our mutual cooperation, so that we will figure out what the next action should be, toward their operational uses; and (iii) ask each AWCI member to give us any materials, including the information of presentations & submissions of papers, to summarize final achievements for two-year activities related to flood issues for the APN-ARCP project around December 2010 (TBD). The importance of intense communication between the AWCI meetings was emphasized.

Drought group: Dr. Ghulam Rasul reiterated the objectives of the AWCI Drought working group (see Section 2.1 above) and explained linkages of drought group activities with demonstration projects that primarily address hydrological drought phenomenon, i.e. lesser flow in streams than long-term

average, yet other drought phenomena including meteorological, agricultural, and socio-economic droughts are closely related and can/will be covered by the drought-oriented DPs. The group had several opportunities to meet and discuss the achievements and plans at several meeting events in 2009 including: the 4th AWCI ICG meeting in Feb 2009 in Kyoto, the Drought group scientific meeting in Bangkok on 15-16 May 2009, the Drought group scientific meeting in Chiang Mai on 1-2 Oct 2009, the 5th AWCI ICG meeting in Tokyo, on 15-17 Dec 2009, and the Joint drought training workshop in Tokyo, on 17-18 Dec 2009.

The group is currently working on a data bank including soil moisture, temperature and meteorological observation data from selected stations in Bangladesh, Mongolia, Pakistan, China, and Vietnam. In addition, supplementary data, in particular soil properties, is being collected where available. Further, the group is working on soil moisture retrieval and drought indices determination using remote sensing data, especially MODIS and AMSR-E data. Certain water quality issues associated with drought conditions have been identified and are the group plans to address some of these in collaboration with water quality group. An APN CAPaBLE program proposal was submitted in 2009 for the drought-oriented project “Drought monitoring system development by integrating in-situ data, satellite data and numerical output“, led by Prof. Ichirow Kaihotsu, and has been approved for funding.

Plans for 2010 and 2011 were introduced that include, among others: (i) continuing in building up the drought monitoring and researching network for AWCI and providing and sharing the soil moisture and other metrological data of the ground-based and satellite monitoring including development of a mechanism to share the data (data bank); (ii) building a closer collaboration with other AWCI groups and reviewing demonstration projects to step in their adaptation activities; (iii) call for contributions for the drought working group report; (iv) improving standard of drought monitoring and assessment; (v) organize workshops in member countries to develop capacity and exchanging the experience and expertise; and (vi) providing the trial early warning system for drought hazard in related countries.

Water Quality group: Dr. Petra Koudelova presented updates of the Water quality working group on behalf of Dr. Hoque and Prof. Furumai. It was emphasized that a demonstration project in the Huong river basin in Vietnam had been initiated under the leadership of Prof. Furumai. The project focuses on sustainable water management in the basin and in particular in the Hue city including water quality issues under the flood conditions. In addition, a study on associations between drought and water quality in a rural coastal area in Bangladesh is being prepared in cooperation with Environment and Population Research Centre (EPRC), Bangladesh, and may be expanded to include climate change adaptation, health impacts, and other aspects if funds are available.

The group’s activities further include: (i) identification of hydrological models that can be coupled with water quality models, (ii) exploring possibilities to use remote sensing data for water quality issues and an access to such data for watershed management monitoring, and (iii) utilizing on-going capacity building initiatives to help water quality experts to use satellite data/explore collaboration with other Groups. It was also noted that communication through conference calls was found very useful for advancing the group activities.

Welcome New Member

A new member, Australia, has joined the AWCI community and Dr. Stuart Minchin introduced the Australian approach to a deepening problem of water scarcity in the country that arises mainly due to 8 factors including: warming and drying climate due to global climate change, environmental flows imperative, growing urban demand, over-allocation to irrigation, uncapped groundwater extraction, expanding plantations, expanding farm dams, and bushfire recovery impacts. Dr. Minchin pointed out that in Australia, major part of precipitation - the only water supply of the country - evaporated and dam reservoirs were essential components of the water resources system. Water has become a property right and the ability to adequately measure it is essential for its management. The Australian Bureau of Meteorology has devised and implements an ambitious plan of water data integration that poses a great data interoperability challenge since the data are provided by more than 600 agencies. A system for water resources management has been developed through fusion of in-situ observation, satellite observation, and biophysical models. With this system, for example, the Murray-Darling Basin Sustainable Yield Project is examining security of water supply for every demand node in the river basin under 16 future scenarios over 150 years. The Bureau of Meteorology is responsible for data integration as well as operational delivery of the information. An advanced visualization tools involving Google Earth maps and Google earth interactive interfaces have been developed to present the water resources related information to decision makers and public.

		Bangladesh					Bhutan	Cambodia	China	Indonesia	Lao PDR	Mongolia			Myanmar	Phillipines					Sri Lanka	Thailand				Vietnam		
Legend: 3: being applied 2: applicable 1: potentially applicable 0: not applicable		RS data	On-site monitoring	Software	Training	Information dissemination sys	Flood forecasting and EWS	Flood forecasting and warning	Flood and drought forecasting	Flood and drought risk map	Flood	Flood and drought forecasting	Remote sensing application	Drought	Flash flood forecast	Radar and sat data use training	Access to GCM output	In-situ and sat data integration	Flood hazard map	Climate change scenario	Capacity building	Data assimilation	Climate model for long range forecast	Radar interpretation	Meteorological EWS	Flood forecasting	Water quality	Drought forecasting
CEOP	data integration service	2	2	0	0	0	2	2	2	2	2	2	2	2	2	0	2	2	0	0	0	2	0	0	0	2	1	1
	QC service	2	2	0	0	0	2	2	2	2	2	2	2	2	2	0	2	2	0	0	0	2	0	0	0	2	1	1
GWSP	Global DB(Digital Atlas, Dam)	1	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	0	0	0	1	0	0
	training &research workshop	0	0	0	1	0	1	1	1	1	1	1	0	1	1	0	0	1	1	0	1	0	1	0	0	1	1	1
	University curricula	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Web-based teaching package	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	2	0	0	0
UNU	flood inundation modelling	0	0	1	1	0	2	2	3	3	2	2	0	1	2	0	0	0	3	0	3	0	2	0	2	3	0	1
	loss estimation	0	0	0	1	0	1	1	3	3	1	1	0	1	1	0	0	0	3	0	3	0	0	0	1	3	0	1
	rainfall downscaling and forecast	0	0	0	1	0	2	2	3	3	2	2	0	1	2	0	0	0	3	0	3	2	2	2	1	3	0	1
ICHARM	Global Flood Alert System	2	0	0	0	0	2	2	2	2	2	2	2	0	2	0	0	0	2	0	0	0	0	0	1	2	0	0
	flood hazard map training	0	0	0	2	0	1	1	1	1	1	1	0	0	1	0	0	0	1	0	2	0	0	1	2	1	0	0
	river and dam engineering training	0	0	0	2	0	1	1	1	1	1	1	0	0	1	0	0	0	1	0	2	0	0	0	0	1	0	0
	Master course on flood mitigation	0	0	0	2	0	1	1	1	1	1	1	0	0	1	0	0	0	1	0	2	0	0	0	1	1	0	0
MRC	river basin management training	0	0	0	2	0	1	1	1	1	1	1	0	0	1	0	0	0	1	0	2	0	0	0	1	1	1	0
	water quality analysis training	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0
	flood hazard mapping training	0	0	0	2	0	2	2	2	2	2	2	0	0	2	0	0	0	2	0	2	0	0	1	2	2	0	0
	flood emergency management training	0	0	0	2	0	2	2	2	2	2	2	0	0	2	0	0	0	2	0	2	0	0	0	0	2	0	0
	mathematical modelling training	0	0	0	2	0	1	1	1	1	1	1	0	0	1	0	0	0	1	0	2	0	2	0	0	1	0	1
	satellite rain estimation training	0	0	0	2	0	1	1	1	1	1	1	0	0	1	0	0	0	1	0	2	0	2	0	2	1	0	1
China	flood and drought management system	0	0	0	0	1	1	1	2	1	1	1	0	1	1	0	0	0	1	0	0	0	0	0	2	1	0	1
	training	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	1	0	0	0
	Data & product access	1	1	0	2	2	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2	2	1	0	2	0	0	0
PUB	WGs and projects	0	0	0	1	0	1	1	1	1	1	1	0	1	1	0	0	0	1	0	1	1	1	0	0	1	0	0
JAXA/AIT	Mini-projects	3	2	1	3	0	2	3	2	2	3	2	3	3	2	0	0	2	2	0	3	0	0	1	2	3	0	0
	Sentinel Asia (Operational training)	1	0	0	3	3	2	2	2	2	3	2	1	0	2	0	0	2	2	0	3	0	0	0	0	2	0	0
MAIRS	Enhanced observation	1	1	0	1	1	1	1	2	1	1	2	1	1	1	0	0	1	1	0	1	0	2	2	2	1	0	0
	regional model development	0	0	0	1	1	0	0	3	0	0	2	0	3	0	0	0	0	0	0	0	2	2	1	1	0	0	1
*EPRC	Monitoring WQ in normal and disasters (in-situ) 3	0	0	0	3	0	0	0	0	0	0	0	0	0													3	
	Monitoring water related health and social impacts	0	0	0	3	0	0	0	0	0	0																3	
	Management of safe drinking water in floods, cyclones	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	
	Development of environmental health (including WQ, sanitation) training materials for TOT of teachers, local govt., NGOs, communities, etc. by itself/in collaboration with others	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	
	Community based hazard/risk mapping	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	

*EPRC does those in Bangladesh and can do for other country

Figure 4: GEOSS/AWCI Capacity Building Needs vs. Resources Matrix

Capacity Building Implementation Plan Development

This session was organized by Prof. Srikantha Herath and by Mr. Chu Ishida, who firstly reiterated the history of development of the Capacity Building (CB) program under the framework of GEOSS/AWCI and highlighted the matrixes on CB resources in the Asia Pacific region. The updated version of the CB matrix – needs versus resources – is provided in Fig. 4. He also reiterated that the goal of the capacity development program of the GEOSS/AWCI was to facilitate and develop sustainable mechanisms for the countries in Asia Pacific to use advanced earth observations systems, associated data and tools for water cycle research and water resources management under the GEOSS framework. The capacity development activities are designed and carried out concurrently in support of applications in 18 Asian basins being studied within the GEOSS/AWCI for clarification of basin water cycle and the development of appropriate water management practices. Specific objectives of the CB program include: (i) downscaling regional and global information to basin scale and improving accuracy required by operational water management applications through a combination of numerical forecasting and fusion of local observations; (ii) identifying reliable and efficient tools to convert the available observations and data to useful information for flood management through data transformations, interpolation, classification, and estimation algorithms; and (iii) conversion of information to water resources management applications, both for operational use and scenario based assessments for planning purposes.

Prof. Herath clarified respective roles of and linkages among GEOSS/AWCI demonstration projects, working group activities, and capacity development component, as illustrated in Fig. 5. The effective strategy includes: (i) setting **objectives** of a demonstration project, (ii) proposing **methodology** for achieving the objectives, (iii) identifying **development needs** for achieving the objectives, and (iv) identifying and exploiting **available resources** for supporting capacity

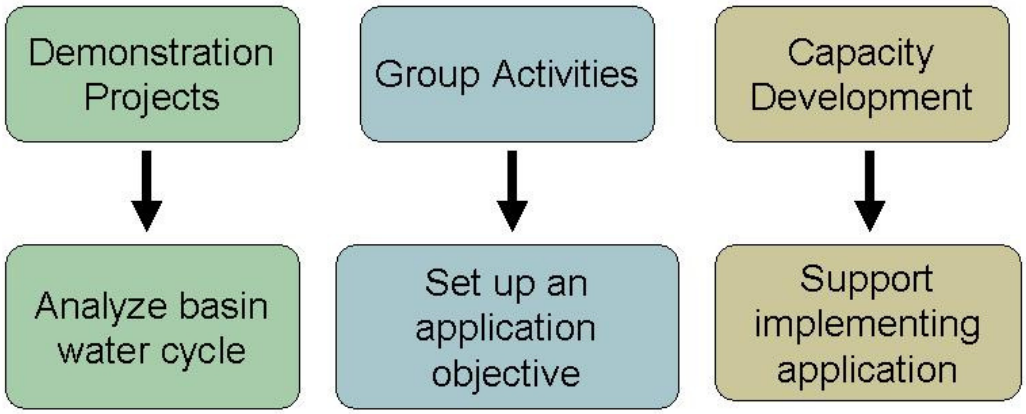

Figure 5: Linkages among GEOSS/AWCI demonstration projects, working group activities and capacity development.

development. An example of a flood demonstration project was introduced with its priority areas: National Database, Rainfall, Downscaling, Radar use, Satellite based data, Inundation modeling, Flood forecasting, Flash flood forecasting, Risk assessment, Use of Space observation for analysis data preparation, Use of Space Observation for post disaster response, and Land classification for risk assessment. Based on these, requested training modules can be identified and a capacity building plan for that specific project outlined.

In addition, Prof. Herath reiterated that an on-line repository of available training modules had been devised by the UNU team and could be accessed and edited by all AWCI members (http://unufms.net:8080/seaside/gcs/AWCI). It includes a module information template for organizations to provide information on available training modules. Any proposed training module should include the following items:

1. Title
2. The component of the flood problem the module would solve
3. Suggested duration
4. Expected number of participants and the maximum number allowed
5. Data to be prepared by participants in advance
6. Type of facilities (please list OS and min. ram for PC machines)
7. Any background training the participants are expected to have
8. Resources to be prepared in country by hosting agencies to carry out training seminar
9. Any other materials providing detailed descriptions of the modules
10. Availability (tentative and if possible) schedule for 2009-2010 (2011)

Four basic types of training modules were recognized including:

- *Type A:* **Multi-country teams**, use local data sets, long duration, generally a two-phase program.
- *Type B:* Demonstration data set. Short duration and participants are **multi-country teams.**
- *Type C*: **Site (local) data** for training and application. **Participants are all from the host country.**
- *Type D*: Training using a demonstration data set in a country. Program is of short duration and **participants are all from the host country.**

The overview of the accomplished training courses was presented that showed a wide range of activities provided by various organizations (Fig. 6). In addition other proposal for organizing so called Roving Seminars (type D) by several countries including Indonesia, Lao PDR, and Philippines were presented.

Further, Prof. Herath stressed out the need to integrate Research, Capacity Development and Applications including capacity development programs for training a large number of competent persons and higher education research. Demonstration projects provide opportunities for such integration as shown in Fig. 7. Another opportunity for collaboration especially in the higher education field is The University Network for Climate and Ecosystems Change Adaptation Research (UN-CECAR; http://cecar.unu.edu) that was established in 2009 by leading universities in the Asia Pacific region to strengthen the higher education sector to respond effectively to climate and ecosystems change. UN-CECAR has been working on a common curriculum, joint research, and a needs assessment.

ORGANIZATION	COURSE	Bangladesh	Bhutan	Cambodia	China	India	Indonesia	Japan	Korea	Lao PDR	Malaysia	Mongolia	Myanmar	Nepal	Pakistan	Philippines	Sri Lanka	Thailand	Uzbekistan	Vietnam
ICHARM/PWRI	GEOSS-AWCI Seminar						D: 2008/7/2-3													
	JICA Seminar						C: 2009/2/2-3													
	WMO/IFNet/ICHARM							A: 2008/10/3-8												
	ICHARM/IFNet/ APN							A: 2009/8/3-7												
	ICHARM Seminar													D: 2009/8/26-27						
JAXA	Mini Project 2008	A		A						A										A
	Mini Project 2007	A								A			A	A			A			
	Mini Project 2006	A		A						A				A						
	1st Training	B		B		B	B		B	B		B	B	B		B	B	B		B
	2nd Training	B	B				B			B	B	B		B		B	B	B		B
	3rd Training	B		B		B	B		B	B		B	B	B		B	B	B		B
	4th Training	B	B				B			B		B	B	B		B	B	B		B
University of Tokyo EDITORIA	JICA 2008				C															
	UT-Winter 2009							C												
	UT-Summer 2009							C												
	JICA 2009				D															
	AWCI/SAFE 2008																			
	UT-Summer 2009						D													D
	AWCI, 2008							C												
	JICA 2008				C, D															
UNU-ISP	2007-2009				A									A, D		A	A, D	A		A, D
	2007-2009				A									A, D		A	A, D	A		A, D
	2007-2009				A									A, D		A	A, D	A		A, D

Figure 6: Table of the accomplished training activities relevant to the GEOSS/AWCI.

Figure 7: Scheme of integration of research, capacity development, and application activities along DP.

Finally, the plans for 2010 and 2011 were introduced that include:

2010: (i) Development of **web tutorials** for the existing modules including **theory, tutorial** (data, models), and **an example** to be followed by a participant (providing results for comparison).
(ii) Engagement of task groups in each working group to support the activity.

2011: (i) Conduct several **roving seminars** for application **in selected demonstration basins**. Basic background will be covered through web tutorials and a number of resources organizations will arrange with local proposals.
(ii) Selection of demonstration basin clusters (based on country and focus - 3 or 4) should be done in 2010

This session was followed by a lively discussion that yielded several proposals for additional training modules. In particular multiple countries (e.g. Philippines, Bangladesh, Indonesia, Pakistan, Myanmar) reported the need of training in **rainfall estimation and downscaling** as well as setting and running **hydrological models**. It was agreed that the country representatives provide description of proposed modules in accordance with the list of 10 necessary information items listed above and

then potential contributors to these modules will be identified and tutorials prepared. It was also suggested that in case of hydrological modeling a certain sample dataset from the demonstration project database be prepared for a tutorial example. The data in the tutorial should have the same policy as the GEOSS/AWCI database. In this context, Dr. Minchin voiced that the Monash University provided a Hydrological toolkit including 50 different models and related material for hydrological modeling. Though developed for Australia, the toolkit should be applicable in the whole Asia Pacific region.

The need of better **rainfall forecast skills**, in particular forecasting extreme events, was also pointed out but the current GEOSS/AWCI network does not involve adequate experts in the weather forecasting field. Nevertheless, Dr. Iwao mentioned that the **GEO Weather group** was focusing on this issue and would be willing to collaborate with the AWCI community.

Policy Making Tool for Water Management

Prof. Seigo Nasu, Kochi University of Technology, Japan, presented their research devoted to the **water resources demand management** and policy making. He introduced development of a tool designed for policy making for water management that is based on **equilibrium analysis and evaluation**. The tool consists of a set of models including an End-to-End model of natural and social phenomena, an application model to utilize the End-to-End model, and an implementation procedure model and regional management model. The End-to-End model encompasses number of components including water demand model considering public awareness, water supply model, hydrological model, social welfare logic model, and equilibrium analysis model that considers multiple water demand control measures such as infrastructure, pricing policy, laws and regulations, etc.

Prof. Nasu provided examples of practical application of their tool including equilibrium an analysis of water demand and supply in future and an analysis and prediction of water demand in Pakistan. In addition, he introduced their work on developing a water quality model using satellite data that has a great potential for monitoring surface water quality.

At the end of his presentation, Prof. Nasu outlined a way forward for water resources demand management that includes three aspects:

1. Policy: Effective water pricing policy. A plan for safe, adequate, equitable, sustainable, and affordable water services.
2. Legislation: The extraction of groundwater should be regulated and more efficiently monitored. Development of water quality and quantity standards.
3. Programme: Actions at regional, local and users levels. Building new social framework including community participation. Capacity Building of institutions/NGOs & community.

Breakout Sessions for Implementation

Three breakout groups were organized to discuss and propose strategy for implementation of activities focusing on climate change adaptations. These groups, namely (i) Drought, (ii) Snow, Glacier, and GLOF; and (iii) Typhoon, Cyclone, and Induced Floods, were provided with a flowchart displaying a possible approach toward assessing impacts of climate change using the CMIP3/20 and CMIP3/future climate projection scenarios and were asked to consider following questions:

- What should be added, removed and modified in the provided chart?
- What are bottlenecks for implementation, e.g. data, models, capacity and/or funding?
- How to coordinate, especially with socio-economic partners in each country and in the region as a whole?
- Schedule?

Drought group report

The Drought group proposed that water sharing models based on policy rules are incorporated in the assessment part of the scheme in order to clarify impact on individual water users and determining socio-economic response. Changes in hydrograph itself do not reveal the real impact. Also, the group felt that employing a range of scenarios instead of a single one would provide more reliable outputs through a range of possible responses. A watershed scale and water sharing models were considered main bottlenecks in the flowchart. Coordination of implementation may be enhanced by an awareness campaign supported by policy. As for the schedule, the group recommended systematic training as well as intensive work on the model during the first year. The suggested changes were incorporated into the final flowchart (Fig. 8).

Snow, Glacier, and GLOF group report

The Snow, Glacier, and GLOF group agreed with the overall structure of the flowchart but recognized several bottlenecks for a study focused on the cold region features including insufficient long-term monitoring system, in particular glacier and GLOF, and hydrological prediction models

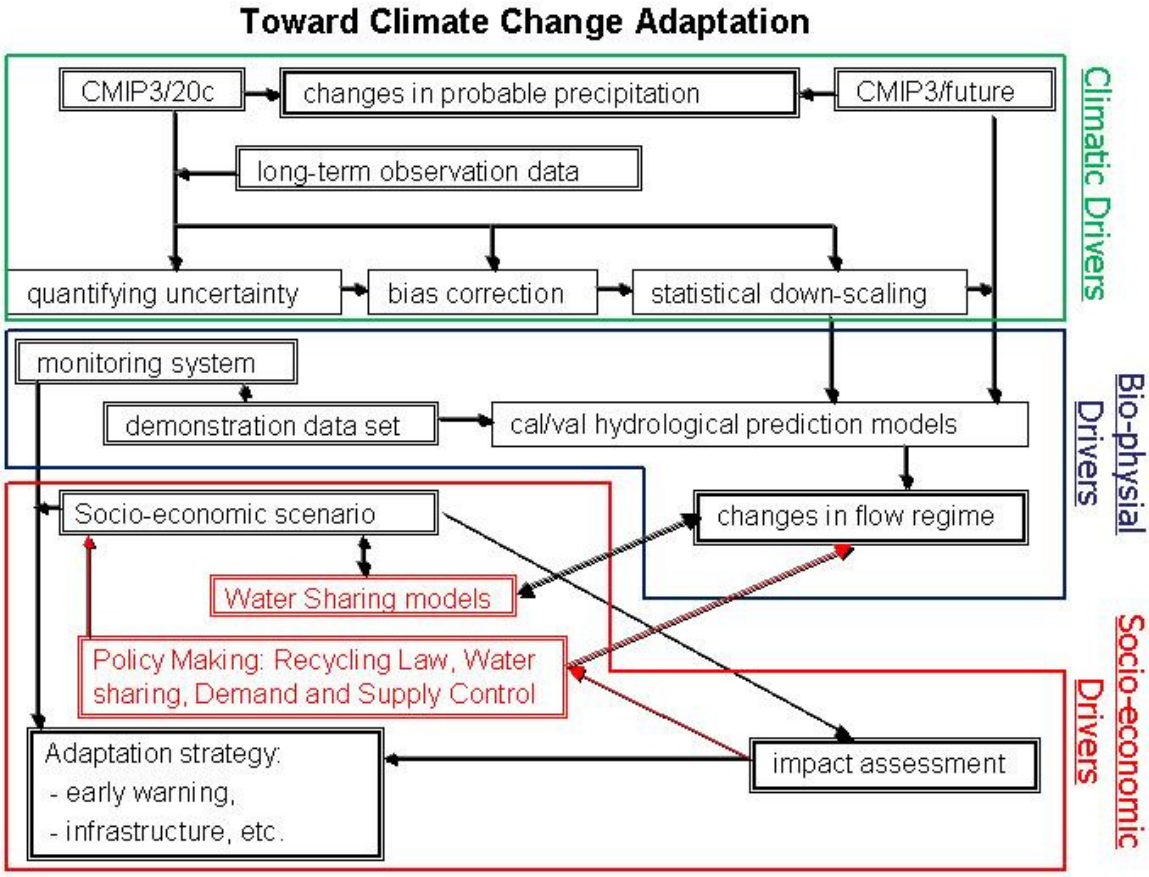

Figure 8: Flowchart of an implementation plan toward assessing impacts of climate change and preparing adaptation strategy – resulting version from breakout group discussions.

suitable for snow and glacier phenomena. Limited funding was also mentioned as a constraining issue. Since quantifying uncertainty and bias correction is difficult without long-term observation data, the group proposed to use satellite data for glacier change monitoring, namely Landsat data and the high resolution ASTER GDEM. Also collaboration with activities focusing on special dataset generation in the mountain region (e.g. CEOP-High Elevation group or Dr. Yatagai's group) was recommended. A **strategy** for the model output quantification was suggested as: To generate a **statistical value** of a **snow covered area** from the output of climate projection model combined with hydrological model and compare with Landsat data to evaluate climate prediction model. It is important to encourage communication between observers and modelers with focus on data interoperability.

The participants further concluded that the main socio-economic partners would be **national committees or institutions** appointed to deal with the climate change related issues including adaptation plans and policies. In addition, a need to communicate the issues on the **regional level** was stressed out because in many areas the issues are of **transboundary** character and negotiation among involved countries is essential. A rough schedule of the proposed activities was also outlined up to March 2012:

1. -> *September 2010*: **Hydrological model** development for mountain regions (ongoing, by UT group).
2. -> *December 2010*: Collection of satellite (MODIS, Landsat, ALOS) data used for the Altai mountain **glaciers monitoring and assessmen**t of their change (ongoing, under the framework of DIAS).
3. -> *March 2011*: Archive satellite data targeting 2 – 3 areas and develop monitoring system for these areas based on satellite data coupled with recently established in-situ station in Mongolia; Uzbekistan and other countries – possibly study in DP basin.
4. *September 2010 – September 2011*: **Coupling** climate projection model with the developed hydrological model.
5. *September 2011 – March 2012*: Generate the **statistical value** of a snow covered area and compare with Landsat data –> climate projection **model evaluation.**

Typhoon, Cyclone, and Induced Floods group report

The group suggested several modifications to the provided flowchart that were incorporated into the final version (Fig. 8). It was pointed out that an alternate approach to statistical downscaling should be adopted if long-term observation data are not available. Such approach include (i) criteria for sufficiency as long-term observation, (ii) methodology for supplementing/reconstructing/restoring long-term observation data, and (iii) use of dynamical downscaling approach if the existing data does not satisfy the criteria. Lack of data, manpower, and funding for capacity building and infrastructure were felt as the main bottlenecks for the typhoon, cyclone and induced floods study.

As for coordination, raising awareness was emphasized for policy makers, the public, private sectors, etc., about the importance of integrated flood management with climate change adaptation strategy not only for disaster mitigation itself but also for nationwide economic/welfare development. A two-year schedule was proposed considering capacity building for data arrangement, downscaling, modeling, etc. for the first year and first case studies in the demonstration project basins in the second year.

Short training courses

Two short training courses were provided in the afternoon that included: (i) the **Data quality check and metadata registration** course and (ii) the **Flood Management** course.

During the first one, Drs. Ikoma and Kinutani provided guidelines on how to perform data quality check and metadata registration using the on-line tools provided by the University of Tokyo in cooperation with DIAS that were designed taking into account the needs of the AWCI data providers. The attendees actively participated in the course running the system on their own PCs connected to a server that was brought and installed by Drs. Ikoma and Kinutani especially for this purpose. During the course, several demonstration basins' metadata were successfully registered.

In the Flood Management course, a demonstration of the Integrated Flood Analysis System (IFAS) developed at ICHARM was provided by Dr. Fukami for a real catchment in the Kyushu island of Japan. The system enables to use available global dataset for both catchment settings and forcing data and thus can also be used for basins with very limited observations. The system is available for download free of charge at the ICHARM website:
(http://www.icharm.pwri.go.jp/research/ifas/index.html).

Closing session

At the end of the day, Prof. Koike summarized the outcomes of the GEOSS/AWCI ICG Meeting as well as the preceding GEOSS Symposium. He acknowledged significant progress that was recognized during the meeting events, in particular great progress in data submission. He summarized the evolution of the GEOSS/AWCI framework and activities reiterating that four target groups had been established (flood, drought, water quality and climate change), objectives set up, data policy agreed, 18 demonstration river basins selected, data from the basins archived, and metadata registered. CEOP integrated datasets and DIAS archive including climate model projection outputs are available, capacity needs have been identified and based on these a capacity building program has been designed and needed activities launched. In addition, climate change adaptation activities in countries have been identified, socio-economic aspects included, and linkages with policy-making experts established.

The meeting reviewed what has been done and is being done and a general implementation chart toward climate change impact assessment and adaptation strategy (Fig.8) was proposed with certain specifics for three focus areas, namely Drought; Snow, glacier and GLOF; and Typhoon, cyclone and induced floods. Further convergence and harmonization of observational activities, analytical and down-scaling techniques, interoperability arrangements, and effective and comprehensive data management were considered as the most fundamental elements that can mobilize the efforts by GEOSS/AWCI to create societal benefits.

The list of past meeting events related to the GEOSS/AWCI was presented and the next event was proposed be The 4th Asian Water Cycle Symposium was proposed held before the GEO Ministerial Summit in November 2010, most probably in October in Tokyo, Japan, in conjunction with a related ministerial-level meeting organized by MLIT, Japan. Confirmation and further details will be announced in due course.

Concluding messages were formulated:

Although climate change adaptation requires socially and economically efficient and sustainable management of the world's limited supplies of freshwater, this precious resource cannot be managed unless we know where the water is, its quantity and quality, and how its variability will change in the future.

This knowledge base relies upon our ability to measure and monitor precipitation, water quantity and quality and our continued efforts to improve our physical, chemical, biological, and ecological understanding of the water cycle.

Based on the reports and discussions at the GEOSS-AP symposium and the ICG meeting, the participants recognized the commonality and regionality of water-related issues and socio-economic impacts caused by water-related problems associated with the climate change in the Asia-Pacific region.

It was agreed that well-coordinated scientific research initiatives along with a combination of global Earth observations and integrated data provided by GEOSS are essential to adequately address these issues.

Message to the GEO ministerial summit:

The Summit is requested to recognize the direction and achievements by GEOSS/AWCI as one of the most effective regional approaches for climate change adaptations and to endorse its activities in each country and the Asia-Pacific region in improving the efficiency of operational water resources management.