Report
on the
2nd Asian Water Cycle Symposium

The University of Tokyo, Hongo Campus, Tokyo, Japan, 9-10 January 2007
(http://www.prime-intl.co.jp/awcs07/index.php)

1. Introduction

Large fluctuations of regional and local water cycles intensify water scarcity, threats to freshwater ecosystems, and water-related diseases and associated impacts on society. International recognition of water-related risks has been increasing since the beginning of this century. There is a growing concern about global and regional water-related issues and the need to address them in a more coordinated way.

In recognition of the need for accurate, timely, long-term, water cycle information as a basis for sound and effective water resources and risk management in the Asian region, an Asian Water Cycle Initiative (AWCI) was proposed at the 1st Asian Water Cycle Symposium (AWCS) held in Tokyo, Japan, 2 – 4 November 2005. Through the reports and discussions at the first AWCS, the guiding goal of AWCI was identified and formulated as:

> *Toward convergence of observation and capacity building for promoting the Integrated Water Resources Management (IWRM) approach through application of integrated earth observation data, model output, downscaling techniques, and other tools to address local water resources management issues in a river basin.*

To initiate the AWCI activities, an International Task Team (ITT) has been established consisting of representatives of participating countries and scientific projects. Members of this task team met at the AWCI ITT workshop in Bangkok, Thailand, 25 September and discussed the strategy of implementation. The discussions resulted in proposing demonstration projects in Asia that would demonstrate effectiveness of downscaling from global to local scale and show the value of the global integrated data sets to decision makers through the actual use of the data by the projects.

The AWCI ITT working session was held in conjunction with the Asian Water Resources Management Capacity Building Workshop that took place in Bangkok from 26 – 28 September 2006 and that aimed at exchanging information on best practices in the application of earth observations for water resource management and capacity building activities in the region. It was agreed that capacity building programmes in different modules and at different stakeholder levels should be proposed and implemented in order to utilize the emerging earth observation data and associated techniques from different sources. As the first step, the workshop recommended initiation of demonstration projects for capacity building in the water resource management.

Reflecting on mutually related issues and common targets of AWCI and the Capacity Building Workshop and considering the GEOSS Work Plan for 2007 – 2009 that includes the following three tasks: (i) WA-06-07: Capacity Building Program for Water Resource Management, (ii) WA-07-01: global Water Quality Monitoring, and (iii) WA-07-02: Satellite Water Quantity Measurements and Integration with In-situ Data, a baseline framework for an “Asian Water Cycle Initiative contributing to GEOSS” (GEOSS/AWCI) has been proposed including both aspects the “integration of earth observation data” and the “capacity building”. With this framework, which is shown in Fig. 1, the GEOSS/AWCI activities will benefit from synergy among individual components and participating subjects. Following this strategy, the 2nd Asian Water Cycle Symposium was proposed to take place in conjunction with the GEOSS Symposium on Integrated Observation for Sustainable Development in the Asia-Pacific Region (GEOSS AP Symposium) that was held in Tokyo, Japan, 11 – 12 January 2007.

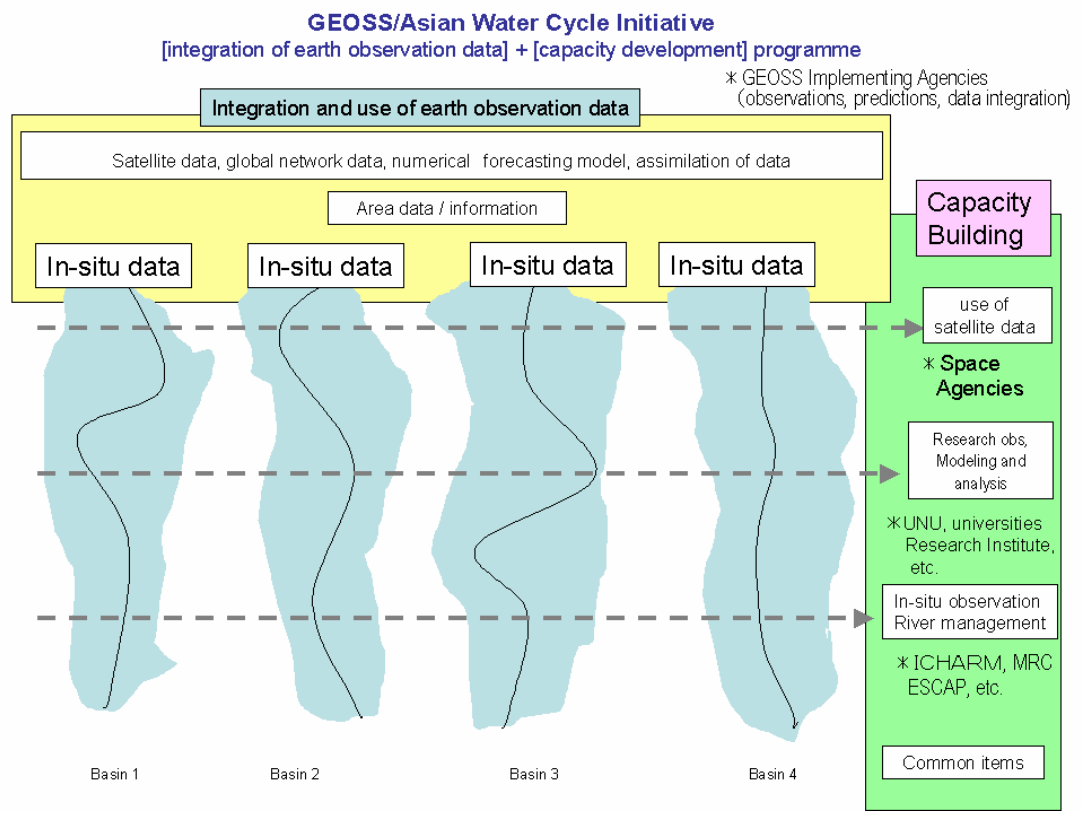

Figure 1: Framework of GEOSS/AWCI

2. Objectives of the 2nd Asian Water Cycle Symposium

The main aim of the 2nd Asian Water Cycle Symposium was to review and discuss a baseline implementation plan of the demonstration projects (DP) and respective proposals for the DP on nominated river basins in individual countries including the main local water resources issues, existing observation capability, and data availability.

3. Co-hosting, sponsoring and supporting organizations and subjects

The Symposium was co-hosted by the Group on Earth Observations (GEO), Cabinet Office, Government of Japan (CAO), Japan Science and Technology Agency (JST), Japan Aerospace Exploration Agency (JAXA), the University of Tokyo (UT), and Japan Agency for Marine-Earth Science and Technology (JAMSTEC). The sponsoring and supporting organizations included the Asia-Pacific Network (APN), UT, JAXA, JAMSTEC, the Office for Coordination of Climate Change Observation (OCCCO), MEXT, United Nations University (UNU), Japanese International Cooperation Agency (JICA),…

4. Opening and introduction of GEOSS and APN, and of the UT activities related to the Asian Water Cycle

4.1 Opening

The Symposium was opened by Prof. K. Musiake, Chairman of the Organizing Committee, Dr. O. Ochiai, GEO Secretary, Dr. S. Sakamoto, MEXT, and Prof. T. Koike, the University of Tokyo. The speakers emphasized the importance of multi-lateral international cooperation and interdisciplinary approach towards addressing the Asian Water Cycle issues and underlined the key role of water resources in other eight GEO socio-benefit areas. Also stressed was the need for convergence of observation and new data integration approach that considers combining and integrating data from diverse sources and different disciplines.

The speakers highlighted a great opportunity offered by the 2nd Asian Water Cycle Symposium to discuss and outline an effective implementation of the AWCI objectives in highly cooperative manner with existing projects, programs and systems and in line with the

GEO strategy of convergence of observation and data integration and information fusion for supporting the Integrated Water Resources Management (IWRM) approach.

4.2 GEO and GEOSS

Dr. Jose Achache, Director of the GEO Secretariat, introduced the background, structure and main mission of the Group on Earth Observation (GEO) and the objectives of the Global Earth Observation System of Systems (GEOSS) targeted by GEO. He emphasized that main aim of GEO was to serve public by providing support for informed decision making through GEOSS - a global, coordinated, comprehensive and sustained system of observing systems for 9 recognized societal benefit areas. One of the key aspects of GEOSS is its architecture that is based on interoperability among the system components that is assured by sets of specification for collecting, processing, storing and disseminating data and products and by defining how the system components should interface to be contributed to GEOSS. The emphasis is also put on data quality assurance, recalibration of observing systems and improvement of algorithms for space observation. In addition, GEO will foster interdisciplinary developments including, for example, IWRM strategies.

Specifically in the Water area, GEO mainly aims to:

1. establish an integrated global hydrological observing system, with distinct components such as Runoff, Precipitation, Lakes/Reservoirs, Ground Water, Cryosphere and Soil Moisture;
2. provide an integrated and interoperable global hydrological observing system contributing in a cross-cutting fashion to all societal benefit areas of GEO; and
3. fill gaps in measurement capability and ensure interoperability of observing systems and standardization of data.

4.3 Asia-Pacific Network for Global Change Research (APN) (http://www.apn-gcr.org/en/indexe.html)

Dr. Andrew Matthews introduced the Asia-Pacific Network for Global Change Research (APN) – an inter-governmental network for the promotion of global environmental change research and links between science and policy making in the Asia-Pacific Region. Water cycle as one of the fundamental components of environment and associated water resources issues are recognized among the key topics on the APN agenda.

Dr. Matthews noted the issue of increasing fresh water deficit worldwide but emphasized that the fast growing deficit in some parts of Asia, e.g. China, would affect the world economy through its impacts on agriculture and thus food prices. He pointed out that the withdrawals of groundwater in Asia had increased 20 times over the 40 years and stressed the importance of monitoring of the groundwater resources to support proper decisions on water management. One of the key issues is increasing water consumption per capita with growing economy, and growing urbanization.

4.4 University of Tokyo activities

Prof. Toshio Koike introduced the Earth observation Data InTegration and fusiOn Research InitiAtive (EDITORIA) that has been established jointly by the University of Tokyo (UT), the Japan Aerospace Exploration Agency (JAXA), and the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) with the support of the Ministry of Education, Culture, Sports, Science, and Technology of Japan (MEXT) and that aims to develop a new data integration and analysis system through cooperation among multiple disciplines including computer sciences, information technology sciences, hydrology, meteorology, oceanography, and others.

In addition, Prof. Koike presented a dynamical downscaling technique for downscaling the atmospheric global model output onto the basin scale. The system can be coupled with a distributed hydrological model and applied at various basins in the world, however the local data, validation and calibration is needed. This system as well as a distributed hydrological model developed at the University of Tokyo will be available for the AWCI activities.

Dr. Masaru Kitsuregawa introduced a Centralized data integration system developed by his team at the University of Tokyo. The system has been originally designed for the CEOP data but is currently being expanded to serve for a wider range of data from diverse sources. The

system enables to retrieve data, perform multiparameter analyses of various features, and visualize single or multiple overlaid data in 2D or 3D mode. It was emphasized that for development and enhancement of such system, the synergy between IT specialist and earth scientists was indispensable.

Dr. Ryosuke Shibasaki presented their work on interoperability arrangements that are essential for successful integrating data from diverse sources. Interoperability arrangements include two types: (i) syntactic interoperability (data format, interface definition, etc.) and (ii) semantic interoperability (definition of data, data names, terminology). The semantic interoperability requires ontology – specification of a conceptualization, i.e. description of the concepts and relationships that can exist for an agent or a community of agents.

4.5 Application to Agriculture

Dr. Seishi Ninomiya, National Agriculture and Food Research Organization (NARO), introduced examples of integrated data application to support decisions in the agriculture arena, especially at the farmers' level.

5. GEOSS/AWCI introduction, activity report

5.1 GEOSS/AWCI introduction and report

Prof T. Koike introduced the background of GEOSS/AWCI and its evolvement since the 1st Asian Water Cycle Symposium in November 2005 (see Section 1). He reported that the AWCI International Task Team (ITT) had been formed consisting of representatives of participating countries and scientific projects on a voluntary basis. The ITT members had been asked to nominate candidate basins in their countries suitable for demonstration projects (DP) of AWCI and identify the main water-related issues in those basins. Based on the collected information, the ITT members had discussed the DP objectives, possible strategies and cooperation with existing programmes and projects, data policy and tentative schedule of implementation at the AWCI ITT working session in Bangkok, 25 September 2006 and following Capacity Building Workshop in Bangkok 26 – 28 September 2006.

The ITT Working session and associated action items had resulted in the proposal of the baseline of the GEOSS/AWCI and its DPs. In total, 32 basins in 14 Asian countries had been proposed for DP. The locations of the proposed basins are shown in Fig. 2.

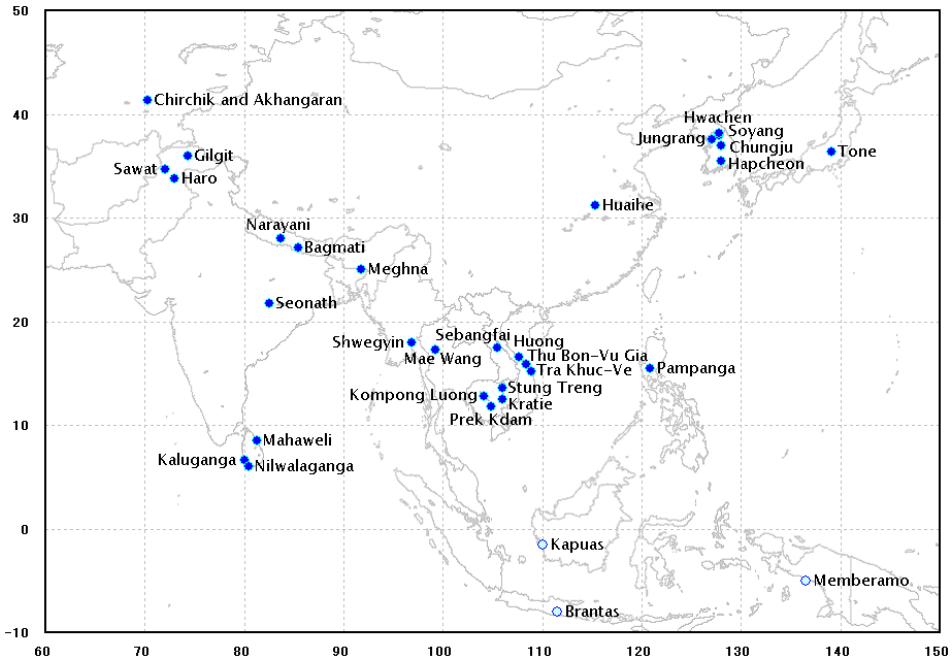

Figure 2: Locations of proposed GEOSS/AWCI DP basins.

The baseline was reviewed at the discussion session and the outcomes of the participants' deliberations on this point are summarized in Section 8 below.

5.2 Asian Water Resources Management Capacity Building Workshop Outcomes

Mr. C. Ishida introduced water resources capacity building activities in Asia within the context of IGOS and GEO and reported on the outcomes of the workshop held in Bangkok, 26 – 28 September 2006. The first day of the workshop was dedicated to the policy makers and it was highlighted that:

(i) Floods, droughts and water quality problems had been occurring with increasing frequency and severity
(ii) Capacities for IWRM, modeling and satellite data use had been found rapidly emerging in the region

The second and third day of the workshop were mainly intended for the water resources managers and included both plenary sessions and breakout sessions for three working groups (WG): Flood, Drought, and Water Quality. The main outcomes of deliberations included:

(i) Recommendation to initiate capacity building demonstration projects (DP) by all three WGs based on regional needs. Subsequently, DPs were proposed by all three WGs.
(ii) Requirement for better access to satellite data by all three WGs.
(iii) Recognition of needs for regular workshops to address WRM issues.
(iv) Water quality WG reported arsenic contamination of drinking water in Bangladesh and serious needs for alternative water resources. It was proposed to submit an urgent proposal on this specific task to GEO.

At the final plenary session it was emphasized that:

(i) Further development of the proposals, partnership and mobilization of funding were necessary.
(ii) It is anticipated that the 2nd Asian Water Cycle Symposium and the GEOSS Asia Pacific Symposium provide an opportunity to combine "convergence of observation" and "capacity building" for WRM and to develop demonstration projects.

6. Country reports and proposals

Representatives of 18 countries including Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Japan, Korea, Laos, Mongolia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, Uzbekistan and Vietnam introduced the current status and future directions of water resources management policies in their respective countries. Despite of the different water-related issues the countries are facing to and the level of development of the water resources monitoring and management tools, there is a common focus on IWRM strategies and international cooperation within the region, in particular in case of transboundary river basins. The policy of de-centralization of WRM decisions was also mentioned with emphasis on involving the local authorities as well as local people in the decision process, which is closely linked to the educational capacity building efforts and needs.

In addition, the country representatives introduced the river basins proposed for the GEOSS/AWCI DPs and explained the main issues that need to be addressed. Most of the countries reported problems associated with floods and sought for better flood warning systems. Several countries highlighted droughts as the most pressing issue and the urgent need to develop more sophisticated drought monitoring and predicting systems for scales ranging from local to regional. Only few presentations mentioned water quality as the most critical problem but through the following discussion it was recognized that water quality issues are also significant in the region and must not be neglected. Moreover, the relation between water quality and quantity (flood/drought) was pointed out suggesting the need of close collaboration between water quality and water quantity specialists.

7. Cooperative Existing Projects, Programs, and Systems

Following the country reports, 12 international and national organizations and existing projects and programs introduced their on-going and planned activities focused on water-related issues in Asia. The organizations and project included:

1. International Centre for Water Hazard and Risk Management (ICHARM, http://www.icharm.pwri.go.jp/)
2. United Nations University (UNU, http://www.unu.edu/)
3. Mekong River Commission (MRC, http://www.mrcmekong.org/)
4. Japan Aerospace Exploration Agency (JAXA, http://www.jaxa.jp/index_e.html)
5. Japan Agency for Marine-Earth Science and Technology (JAMSTEC, http://www.jamstec.go.jp/jamstec-e/index-e.html)
6. Office for Coordination of Climate Change Observation (OCCCO, http://occco.nies.go.jp/e_index.html)
7. Global Water System Project (GWSP, www.gwsp.org)
8. Coordinated Enhanced Observing Period (CEOP, http://www.ceop.net/)
9. Monsoon Asian Hydro-Atmosphere Scientific Research and Prediction Initiative (MAHASRI, http://mahasri.cr.chiba-u.ac.jp/)
10. Monsoon Asia Integrated Regional Study (MAIRS, http://www.mairs-essp.org/)
11. Prediction in Ungauged Basins (PUB, http://www.pub.iwmi.org), and
12. Japanese EOS Promotion Program (JEPP)

The scope of presented activities was wide covering the enhancement of in-situ observation systems including data transmission infrastructure, satellite data provision, research into the Asian Water Cycle in relation to Monsoon, climate change, aerosols and human activities and their mutual interactions, development of water cycle simulation and prediction tools, development of hydrometeorological warning systems mostly focused on flood forecasting, water-related hazards risk management strategies with emphasis on integrated risk management, data archiving and integration systems focusing on interoperability, education and training programs designed for researchers, technical support, water resources managers, policy makers as well as general public, and earth observation and IWRM promoting programs.

The participants recognized multiple mutual benefits arising from the potential cooperation between AWCI and introduced existing activities since these are offering various capacities that had been reported lacking by certain participating countries. It was recommended that further discussion follow-up to investigate more specifically how the introduced programs could contribute to implementation of the AWCI goals starting with the demonstration projects.

8. "Toward Convergence: GEOSS/AWCI"

The discussion session resulted in the following version of the baseline of the GEOSS/AWCI implementation plan that was endorsed by the participants.

8.1 Objectives

1. To develop an information system of systems for promoting the implementation of integrated water resources management (IWRM).
2. To make a bridge between the data and information from the global scale to a river basin scale for sound decision making.
3. To shift from research activities and achievements to operational use for contributing to societal benefits.

8.2 Targeted River Basin Criteria for Demonstration Projects

1. Importance of the basin from the viewpoint of the socio-economic benefit area and hydrological sciences
2. Minimum requirement of data availability:
    a. Data type: rainfall, streamflow, weather station data (air temp., wind speed, pressure, humidity)
    b. Spatial density of observation stations: according to the WMO standard but local specifics to be considered;
    c. Watershed characteristics information
3. Highly expected data:
    a. Upper air observation is highly recommended
    b. Near-real time data availability is highly recommended;
    c. Ground water and water quality data availability for the river basins where those problems should be addressed.
4. Size of the watershed: 100 km^2 – 1,000,000 km^2

8.3 Data Interoperability

1. Metadata design
2. Metadata registration
3. Data quality check and archive
4. Data format unification
5. Data integration function
6. Distributed- and Centralized data distribution

8.4 User Interface

1. Data request: global/regional/local, observed/modeled, natural science/socio-economic
2. Function request: data integration, information fusion, analysis, prediction, dissemination

8.5 Data Policy – compliant with CEOP in-situ data policy

1. Release of Data in Compliance with WMO Resolution 40 (CG-XII) and WMO Resolution 25 (CG-XIII)
2. No Commercial Use or Exploitation
3. No Data Transfer to Third Parties *(data should be disseminated through the data centers which assure proper metadata is provided together with the data and which monitor who is using the data in case users should be informed about any update or change to the data or metadata provided by PIs.)*
4. Timing for Release of AWCI River Basin Data from the CDA Archive
    a. category 1 - standard data - data release after 6 months
    b. category 2 - special data - data release after 15 months

    - Streamflow data - (i) operational - category 1 data; (ii) research site maintained by university, through a project - category 2 data; also remote sites need to be included in category 2 data

    - A suggestion was made to also consider exchange of real-time or near-real-time data (category 0) that are crucial for improving weather forecasts and hence flood forecasting. This will be considered for later phase AWCI dedicated to transition to operational issues. For the demonstration projects, the categories 1 and 2 should be sufficient.
5. Acknowledgement and Citation
6. Co-operation between AWCI Data Users and AWCI River Basin Principal Investigators (PIs)
7. Co-Authorship for AWCI River Basin Principal Investigators (PIs)
8. AWCI Publication Library

8.6 Timeline

2007: Pre-phase: survey of capabilities; Completion of implementation plan; Input to the task sheets; Test archive: metadata, observed data during CEOP Phase 1 (EOP3, EOP4), a basin in each country in the archive
2008 – 2011: Data archive for data collection 2007-2010; Demonstration project implementation
2009 – 2010: Preparation for shifting from more-research to more-operational phase

8.7 Demonstration projects – next step

As the first step, only one river basin in a country will be considered for DP and country representatives have an action to select the most adequate one according the criteria above. The country representatives will also identify the most pressing issue in the basin, review the data availability table according the data requirements above, and will specify the capacity building needs. For that purpose the AWCI secretariat (see Section 9) will prepare template questionnaires.

Consequently, specific proposals for DPs will be drafted by the country representatives in cooperation with the AWCI secretariat

9. Closing

Prof. Koike summarized the outcomes of the symposium and acknowledged the presenters for their excellent contributions and thanked all of the participants for their fruitful discussions and important suggestions. He pointed out the need of active following-up on the discussed GEOSS/AWCI baseline implementation plan and emphasized the importance of collaboration with existing activities, especially in the capacity building aspect.

To move forward and implement the plan a series of smaller focused workshops is needed throughout the whole period. The activities will be coordinated by the AWCI secretariat at the University of Tokyo and an International Coordination Group (ICG) – a successor of the International Task Team (ITT) – that will consist of a one representative from each participating country and from cooperative programs/organizations.