

## Summary of the 2<sup>nd</sup> GEOSS African Water Cycle Symposium

### Addis Ababa, 23-25 February 2011

As a follow-up to the 1<sup>st</sup> Global Earth Observation System of Systems (GEOSS) African Water Cycle Symposium (Tunis, 2009) at which the participants recognized the commonality and regionality of water-related issues and socio-economic impacts caused by water-related disasters in Africa, the 2<sup>nd</sup> GEOSS African Water Cycle Symposium was convened at the United Nations Conference Centre in Addis Ababa, Ethiopia, on 23-25 February 2011 to explore making use of the international Group on Earth Observations (GEO) framework to develop a plan for an “African Water Cycle Coordination Initiative.” More than 70 participants, including representatives from 21 African nations and River Basin Authorities as well as North America, Asia, and Europe met to consider how GEOSS could provide fundamental services to support water management in Africa, including convergence and harmonization of observational activities, new techniques, interoperability arrangements, and effective and comprehensive data management to strengthen the various on-going and planned water-related activities in Africa.

The opening session of the 2<sup>nd</sup> GEOSS African Water Cycle Symposium began with a review of the 1<sup>st</sup> Symposium and its findings by the GEO Secretariat. Next, the African Ministers' Council on Water (AMCOW) noted that, according to the Intergovernmental Panel on Climate Change (IPCC) 4<sup>th</sup> Assessment Report, the continent of Africa is one of the most vulnerable places on Earth with respect to the impacts of climate change. Each year, Africa loses approximately 5% of its GDP and 2% of water access due to climate change. It is indeed difficult to fully appreciate the impacts of climate change due to a lack of appropriate and accurate information, and a lack of dissemination capabilities which would allow the right decisions to be made at the right time. AMCOW shares the findings from the 1<sup>st</sup> Symposium that despite the commonality of water issues such as floods droughts, scarcity, and river basin management, efforts that respond to these are often operating in isolation across Africa. AMCOW therefore welcomes the collaboration with GEO and shares its conviction that Earth observation coordination is needed to improve efficiency and effectively respond to these water-related issues. The United Nations Economic Commission for Africa (UNECA) stressed that achievements towards the Millennium Development Goals (MDGs) are falling short, particularly with regards to the water sector. UNECA therefore congratulated the Symposium participants for their efforts at fostering better use of Earth observations in Africa, necessary to accelerate progress towards sustainable water development. Finally, the Ethiopian Ministry of Water and Energy observed that the nation of Ethiopia was no stranger to the impacts of extreme weather events. Moreover, adverse impacts in Ethiopia could have knock-on effects with respect to neighboring countries, due to transboundary nature of major rivers. Thus, proper river basin stewardship requires high-level management and multi-national cooperation, which in turn implies the capacity to share information should be developed and enhanced.

In Session 2, a series of keynote presentations further illustrated the water-related needs and challenges facing Africa, and how GEOSS can serve as a framework for delivering observations, services, data integration and capacity building in support of informed decision-making to respond to these challenges. The United Nations Educational, Scientific and Cultural Organization (UNESCO) provided specific figures to illustrate the extent of the issues: 350 million people in African lack access to clean water; 600 million do not have access to adequate sanitation; some areas have experienced up to 50% reduction in river discharge (Lake Chad) due to climate and land-use changes; and less than 7% of Africa's hydropower potential actually been developed. Although Africa does possess great water resources, the main problem is equitable distribution, especially in urban areas. On the one hand there is a great need for investments (approximately US\$ 20 billion are required to in order to achieve the African Water Vision for 2025, adopted by majority of African nations (3rd World Water Forum, 2000). At the same time, an increase in integrated water resource management (IWRM) would go a long way towards addressing these challenges. More information is needed for informed policy-making, in addition retention and enhancement of existing capacities. *Thus, an important message is there is an urgent need for not only more data, but also data sharing and capacity building across Africa.* The GEO Secretariat provided an overview of the data and services currently available through the GEOSS Common Infrastructure (GCI), as well as GEONETCast and DevCoCast. The World Meteorological Organization (WMO) informed the participants of the types of hydrological information being collected and coordinated through satellite observations, while the University of Tokyo demonstrated the Data Integration and Analysis System (DIAS) as a means of harmonizing and processing

data streams from diverse platforms to produce tools for monitoring and reduce risk from extreme events. The Faculty of Geo-Information Science and Earth Observation (ITC) concluded the session by reviewing its capacity building programs which feature the GEONETCast “Toolbox” and use of in-situ networks accessible via web-based or direct communication systems such as the Human Sensor Web.

Reports from representatives of the Lake Chad Basin Commission (LCBC), the Volta Basin Authority (VBA), the Niger Basin Authority (NBA), and the Nile Basin Initiative (NBI) constituted Session 3 of the Symposium. Across each of these agencies, many messages were similar:

- The number one issue is that data is needed to generate assessments; however, data sharing is simply not happening, and data sharing guidelines are often lacking.
- Lack of funds and infrastructure are also hampering efforts to effectively manage the basins.
- Given the transboundary nature of the basins, political cooperation among the bordering nations is crucial; however this cooperation is not always forthcoming, and in many cases lacking altogether despite signed agreements and cooperative frameworks.
- Politicians often do not pay attention to technologies that could inform their decision-making either because they are unaware of those technologies or do not understand them. Yet without the involvement at the political level, nothing will be accomplished.
- There is often a disconnect between various players involved in basin management: the agents responsible for providing funding are ministries at the federal level; however data providers and collectors are at a lower level.

***Recommendations:***

- Increased African membership in GEO is encouraged.
- The African Union would be a key ally as a Participating Organization in GEO.
- There is an urgent need to increase country commitment by demonstrating the benefits of cooperation under the GEO framework.
- For governments that are GEO Members as well as part of a basin authority, guidance is needed in effectively applying GEOSS Data Sharing Principals.
- An important first step would be to look at how data is shared among other basins. Perhaps some basins are more successful than others which could then provide an example of best practices.
- Pilot projects within specified basins could be a first step towards improved cooperation and data sharing, as well as demonstrating increased use and application of Earth observations for effective management.

Session 4 featured a review of programs and research projects addressing water-related issues in Africa. Some of the programs/projects reviewed included:

- The African World Hydrological Cycle Observing System (WHYCOS) initiated by the WMO, developed in response to the scarcity or absence of accurate and timely accessible data and information in real or near real time on freshwater resources in many parts of the world, particularly the developing countries, caused by the obsolescence of many observing networks and insufficient data management capabilities. GEO can make a difference by encouraging Member governments to engage more strongly in WHYCOS. Also satellite and remote observations can supplement goals of WHYCOS, filling spatial and temporal gaps inherent in in-situ networks.
- Princeton University drought monitoring for Africa. Princeton University is developing a drought index based on hydrological model profiles of soil moisture over a 49-day window. A metric of deviations from the climatological norm is derived through comparisons between current situation and the mean, with results binned into quantiles. Global forcing dataset available freely on web, from downscaled observed data. Princeton University is working with UNESCO and other local organizations such as the SADC Climate Service Centre in order to evaluate and operationalize the tool, and also educate scientists. Next step is to promote tool for decision making.
- The New Partnership for Africa's Development (NEPAD) is an African Union strategic framework for pan-African socio-economic development, to address critical challenges facing the continent such as poverty, development, water resources and Africa's marginalization internationally. Centers of excellence are being established, and work is being done in cooperation with AGHRYMET to develop a more effective drought early warning system in the context of the African Monsoon Multidisciplinary Analyses (AMMA) II.

- The European Commission 7<sup>th</sup> Framework Programme is funding a cluster of African water-related research projects aimed at improving the exchange between science and policy. Projects include:
  - FlaFloM: Early warning system for flash floods (Egypt - Red Sea coast)
  - WETwin: Tools for wetland management (Mali, South Africa, Uganda)
  - EUROGEOSS: Internet services for water management and interoperability
  - AFROMAISON: adaptive natural resources management (pan-Africa)
  - DEWFORA: Drought early warning and vulnerability reduction (river basins, pan-Africa)
  - EAU4FOOD: Food security (Mali, Tunisia)
- The establishment of West African Science Service Center on Climate Change and Adapted Land Use (WASCAL) supported by the German government, with the goal of significantly improving the climate change research infrastructure and capacity in West Africa through a 3-pillar program consisting of establishment of a competence center, a core research program, and a graduate research program. One center has already been developed in Ouagadougou, Burkina Faso, and others are planned across West Africa.
- The Somalia Water and Land Information Management (SWALIM) project works to provide integrated water resources management (IWRM) for Somali administrations, UN organizations, development agencies and NGOs. An information management framework is used to process and quality-control hydrological monitoring across Somalia, before producing databases and GIS layers for rainfall, floods, water resources, land cover and land-use changes, and other variables. All information is aggregated and made available through the SWALIM website.
- South Africa's Council for Scientific and Industrial Research (CSIR) is actively working on providing tools to monitor aspects of the water cycle based on remote sensing. Through the SWEOS program, the capabilities of remote sensing for water quality research and operational applications in coastal/inland areas around are being demonstrated with an operational water quality observation system providing water quality products in near real time.
- The European Commission's Joint Research Council (JRC) is developing a pan-African flood forecasting and early warning system, based on its European counterpart, the European Flood Alert System (EFAS). The system would be complementary to the many ongoing institutional flood forecasting initiatives across Africa, and provide early warning based on medium-range precipitation forecasts. Test results across 3 pilot river catchments in Africa have shown promising results.
- The World Health Organization (WHO) is establishing the Global Information Management System on Environmental Health (GIMS) to respond to the challenges in meeting the MDGs, especially across Africa. GIMS is a comprehensive web-enabled data management system designed to foster interoperability and incrementally provide an early warning system for water-borne diseases by integrating real-time data on selected environmental determinants and health (such as vulnerability to climate and cholera). It will also provide tools for data collection, charting, monitoring, and reporting.
- High precision groundwater information is being developed through case studies at the Addis Ababa University, based on satellite monitoring from the Gravity Recovery and Climate Experiment (GRACE). Regions analyzed include select portion of the Nile Basin and the city of Addis Ababa.
- UNESCO is working towards establishing the Integrated Flood Analysis System (IFAS) as it develops the IWRM Guidelines at River Basin Level initiative to provide the tools to improve river basin management globally.

Several space agencies reviewed their programs with respect to hydrological activities across Africa in Session 5.

- The European Space Agency (ESA) featured the second phase of its TIGER program, designed to support IWRM across Africa through a combination of African-led research, development of information services, capacity building, and 20 pilot projects making use of Earth observations.
- The Japan Aerospace Exploration Agency (JAXA) is making available global rainfall maps in near real time based on TRMM, AMSR-E and other satellite information, on a 0.1 lat/lon grid, as well as developing a Global Flood Alert System (GFAS).
- EUMETSAT is committed to supporting environmental (and water cycle) monitoring across Africa through its Preparation for the Use of Meteosat second generation in Africa (PUMA) program, in which downlink stations in 53 African countries have been established for receiving EUMETSAT data in real time, and 350 African technicians have been trained in the use of PUMA receiving

stations. Further, the African Monitoring of the Environment for Sustainable Development (AMESD) program is developing capacity and applications from the PUMA stations in the areas of water management, land degradation, and coastal monitoring across 5 regions of Africa.

- The US National Aeronautics and Space Administration (NASA) provides rain, flood and landslide detection and prediction information globally from a variety of its satellites. The Project Nile has recently been established to improve hydrometeorological information for research, planning and water management across the Nile Basin. Additionally, based on successes in Latin America, the SERVIR program is being extended to Africa to provide a flood potential early warning and other services across the continent, while the Famine Early Warning Systems Network (FEWSNET) makes use of land models and satellite monitoring to forecast crop yields across Africa.
- Precipitation (global, 3-hourly), snow cover (North America, daily), aerosol concentrations, solar radiation, and archival of climate record data (global) are just a few of the products and services freely available from the US National Oceanic and Atmospheric Administration (NOAA). Additionally, NOAA has offers free long-distance learning for use of Earth observations through its COMET program.
- Through the establishment of its Earth Observation Centre (EOC), the South African National Space Agency (SANSA) is providing data extraction and processing, archiving, and production of national datasets in the domains of hydrology, land use and land cover, and DEM/DTM. SANSA is also working in partnership with TIGER II to develop capacity, and providing specifications for sensors on South African satellites.
- Nigeria's National Space Research and Development Agency (NSRDA) is actively seeking to develop and promote the use of space technology as a key driver for socio-economic development. Thousands of images for research purposes from NigeriaSat 1 are freely available. To be launched in 2011, NigeriaSat-2/X will provide high-resolution panchromatic and multi-spectral images (blue, green, red, NIR) for Africa, and will be a key component in capacity building efforts.
- The African Association of Remote Sensing of the Environment (AARSE) is working towards greater utilization of Earth observations for Africa's development through promotion of greater cooperation of efforts among African countries, institutions and industries, and its application to natural resources and environmental issues. It also aim to facilitate improved research, teaching and training in remote sensing and GIS, and to disseminate results in remotes sensing activities world-wide through the organization of biennial conferences, annual workshops, symposia, and tutorials.

UNECA, the African Development Bank and the Italian Development Cooperation reviewed their mandates regional and national activities, and potential for partnerships with GEO in session 6. The Work Bank emphasized the needs and effectiveness of the earth observations and predictions within the official development aids especially in Africa where available data and information are very limited. The Japan International Cooperation Agency (JICA) introduced its activities in cooperation with GEOSS, including the Handbook on Climate Change Adaptation in Water Sector, the flood management plans in Malaysia and Sri Lanka, and the nationwide water resources master plan in Kenya. JICA also expected possible collaboration with GEOSS for promoting integrated community-based flood management.

The Symposium participants undertook the hard work of mapping out the next steps for implementation of the African Water Cycle Coordination Initiative (AfWCCI) during the final sessions of the Symposium. Over the 2 days of presentations, the key messages with respect to the challenges facing Africa in the water sector were summarized as:

- lack of access to data and data sharing;
- lack of infrastructure;
- lack of funding;
- need for capacity building, enhancement, and retention;
- political buy-in and role of national government is critical to the success of any initiative;
  - need to communicate back to the community the point of research and experiments (i.e. project output must be relevant to, and taken up by, end users in order to secure future funding);
  - need to communicate in language that politicians can understand.

Against the backdrop of these issues, and using the white paper on “GEO Capacity Building and Water Resource in Africa” served as a basis for discussion, three breakout groups were convened along the thematic lines of:

- 1) Capacity Building for Individuals and Institutions
- 2) Projects to Demonstrate GEO Principals
- 3) Infrastructure for demonstration and capacity building.

to consider how through GEO, a system will be developed for Africa that will enable water and other resource managers, policy makers and assessment groups to make decisions using the best water and related data and decision support tools to ensure that the concerns of water security, food security, health and personal well-being and prosperity will be realized. This system should consist of people (in a community of practice), including interdisciplinary experts, infrastructure and common practices encompassing principles of GEO and IWRM. This vision will not only benefit Africa but relate to the overall strategic target for the GEO Water Societal Benefit Area (SBA).

The breakout groups concluded that

***Gaps exist:***

- 1) River Basin Authorities (RBAs) do not have access to full set of data and information for their basins for multiple reasons (funding, lack of knowledge about the data existence, lack of access to appropriate data bases). This gap should be remedied for transboundary basins as well as national basins where upstream/downstream issues are important.
- 2) Cooperation is lacking between groups and nations where the full and open exchange of information and data is nonexistent.
- 3) The web is full of data and information ranging in quality from excellent to totally misleading. Those not familiar and without the proper background may choose information that is not best suited to their needs.
- 4) GEO has not had a great deal of experience with transboundary basins. RBAs and initiatives in Africa provide a good opportunity for exploring the applications of GEO in transboundary basins.
- 5) At the project level there is good collaboration and exchange between projects. However in new areas such as Climate Change, IWRM and Biodiversity, the mechanisms for information exchange and collaboration are only now being developed.
- 6) An information and data base with linkages and usability at international, national and community levels does not exist. This lack means there is inconsistency in the information available.
- 7) MDG goals in Africa are not being realized as quickly as hoped. Earth Observations have not played a significant role in monitoring and achieving these goals.
- 8) Some Space agencies and data providers see GEO as just one more way of disseminating services and may not be in support of AfWCCI without some clear definition of an area where they can provide value and receive benefit.
- 9) Although countries may not share their data, there may be a better opportunity to get them to share their metadata. However it does not appear that such an inventory has been developed.
- 10) User groups need to play a bigger role in the definition/classification of projects and data.
- 11) The ownership of AfWCCI needs to be clarified and roles and responsibilities assigned.
- 12) There is a need for a framework to develop plans and information systems that account for governance at the international, national, state and community levels.

***Recommended actions:***

- 1) An information system should be established that would provide data and information for a basin and its surrounding area in both near-real-time and historically, for several River Basin Authorities (RBAs) in Africa. In turn the RBAs should serve as a test-bed for interoperability, validation data, model and technique development. In order to fully demonstrate the value of information it is recommended that at least two basins should be selected where there are tensions between different political boundaries of the basin so the benefits of a shared data system will become evident. The system should be built on a perspective that addresses issues of IWRM, climate change, biodiversity, health and development perspectives.
- 2) A home page (possibly similar to CIEHLYC at [watercycleforum.com](http://watercycleforum.com) or the TIGER homepage) should be developed and managed as a step in establishing an AfWCCI Community of Practice (CoP). This site should serve as an information clearinghouse for Water-related projects in Africa that have the potential to utilize GEO information and principles. This web site/portal should not only include information for professionals but also information that can be used by the public.

- 3) Develop a “workbench” whereby scientists and professionals can together to test out and validate tools and make them freely available to experts for informed water resource decisions. Make use of OGC to ensure formats, standards, and tools are open source.
- 4) A study and assessment of the various services, projects and plans in water-related sectors needs to be developed along with the identification of gaps and needs for future action by GEO and the AfWCCI.
- 5) AfWCCI should open a dialogue with development agencies to assist them in making decisions on funding projects and to work with them to launch initiatives that will advance AfWCCI plans in specific basins.
- 6) The private sector should be included in partnerships regarding select pilot projects of AfWCCI, as they often have resources available to allow for infrastructure improvements. Lack of adequate infrastructure is particularly acute in Africa, and partnering with the private sector in this regard may provide a viable model of interaction between it and GEO.

Taking these recommendations into consideration, the Symposium participants decided that the African Water Cycle Coordination Initiative (AfWCCI) should focus initial efforts on two river basin authorities/initiatives, with the specific aims to enhance current capacity through improved data collection, analysis, integration, and sharing among the nations comprising the river basins. The GEO framework will also be utilized to develop the political consensus needed to effectively manage the trans-boundary nature of the chosen river basins.

The timeline for elaboration of the AfWCCI implementation plan consists of:

- **March 2011:** preliminary draft of 2<sup>nd</sup> GEOSS African Water Cycle Symposium report.
- **April 2011:** reorganization of AfWCCI Task Team into steering committee for 3<sup>rd</sup> GEOSS African Water Cycle Symposium.
- **June 2011:** submission of 2<sup>nd</sup> GEOSS African Water Cycle Symposium report to Preliminary African Caucus consultation in preparation for RIO+20.
- **August/September 2011:** workshop to select two candidate River Basins for AfWCCI implementation.
- **November 2011:** AfWCCI submission to Broad African Caucus consultation in preparation for Rio+20, organized by UNECA.
- **December 2011/January 2012:** 3<sup>rd</sup> GEOSS African Water Cycle Symposium.
- **March 2012:** present AfWCCI at World Water Forum during side-event on Africa; solicit AMCOW/African caucus support to introduce into Ministerial Declaration.
- **June 2010:** submission of AfWCCI to Rio+20.
- **August 2012:** announce AfWCCI at World Water Week.

In concluding remarks, the European Union (EU) delegation to the African Union (AU) reiterated the EU’s full support of the AfWCCI, and reminded participants of the relevance of the EU Water Initiative, launched in 2002, to efforts of the AfWCCI. The EU initiative features River Basin Management plans, in connection with European Water framework directives, and may provide guidance for the AfWCCI. The EU also noted the importance of partnership with several agencies, such as AMESD coordinated by the AU, GMES-Africa (African-owned program that the EU is supporting, which will set a medium- and long-term action plan for Africa making full use of space for sustainable monitoring of environment), DevCoCast (allowing wide variety of users to access meteorological data via GEONETCast), GCOS’s ClimDev Africa, and the African Climate Policy Centre (ACPC). UN Economic Commission for Africa (ECA) thanked the participants for their hard work, and observed that African landscape is a peculiar one. Ownership and leverage are very important in Africa as experience has shown with GCOS and the establishment of the African Climate Policy Centre for which the support of UNECA was crucial. Likewise, in the case of the AfWCCI, there are perhaps several gaps that are not being taking on board which the ECA can help identify and define steps for action in an implementation document. The ECA stressed that, though laudable, the GEOSS initiative cannot do everything on its own: African support will be pivotal and should be central for whatever activities the AfWCCI embarks on. The AfWCCI is encouraged must not to be reductionist in its point of view as it sharpens its vision to clearly chart the way forward. UNESCO expressed pleasure at inclusion in the Symposia since the 1<sup>st</sup> meeting in Tunis, and noted that the AfWCCI and UNESCO have similar objectives with it International Hydrological Program 3 pillars, 1) science knowledge to inform policy and development, 2) peaceful management of water resources, foster peaceful interactions among transboundary

nations, 3) capacity building to enhance the ability of African institutions to complete the job. The University of Tokyo thanked all participants for their contributions to Symposium. In particular, thanks went to JICA, UNESCO and NASA for financial support, and the GEO Secretariat for both financial support and organization. Finally, the GEO Secretariat thanked all participants for their dedication and perseverance, and contributions to a stimulating discussion. The Secretariat noted we must not be overwhelmed by the size of the task at hand, but recall that, in words of the Chinese proverb, “the journey of a thousand miles begins with the first step.” With the conclusion of the 2<sup>nd</sup> GEOSS African Water Cycle Symposium, we have all taken two steps down that road.