

AGENDA ITEM 3: REVIEW OF ACTIVITIES SINCE PREVIOUS WG SESSION

1. This document contains a brief report of the activities undertaken in the last intersessional period (2009-2012) under the framework of the Hydrology and Water Resources Programme, which Cg-XVI had adopted as per Resolution 12 (Cg-XVI) and the programme description given in Annex I, and also provides progress on activities following CHy-14 in November 2012. Specific detailed information from CHy-14 and activities subsequent to it such as the first session of the CHy Advisory Working Group (CHy-14) are also provided under Agenda Item 5 (Doc.5).

2. Detailed discussions of various topics will be addressed under relevant agenda items of the WGHS session.

BASIC SYSTEMS IN HYDROLOGY

Quality Management Framework – Hydrology

3. Congress, through [Resolution 13 \(Cg-XVI\)](#) decided to establish a Quality Management Framework – Hydrology (QMF-H), within the overall WMO QMF, covering hydrological observations as well as hydrological products and services in accordance with the recommendation of CHy-XIII. [The Quality Management Framework-Hydrology \(QMF-H\)](#) is aimed at ensuring that all of the activities necessary to design, develop and deliver a hydrological product or service are conducted efficiently and effectively and are based on established science and best practice. CHy-14 reaffirmed its commitment to quality management and to the further development and wider use of the Quality Management Framework – Hydrology. This area forms an important thrust within the future work of the Commission during the intersessional period following CHy-14. (See Doc. 5 for more details and the [report of CHy-14](#)).

4. During the intersessional period, the following publications were issued according to the new peer review process approved during CHy-XIII:

Guide to Hydrological Practices

- [6th edition](#) is available in English, Russian and Spanish. French is to be issued in late 2014 or early 2015.

Manuals on hydrology and water resources

- 2nd edition of the Manual on Stream Gauging;
- Manual on Low Flow Estimation and Prediction;
- Manual on Estimation of Probable Maximum Precipitation (PMP);
- Manual on Flood Forecasting and Warning;
- 3rd edition of the UNESCO/WMO International Glossary of Hydrology.

The manuals are available [here](#).

Guidelines in hydrology and water resources

- [Guidelines for the Assessment of Uncertainty of Hydrometric Measurements.](#)

Technical reports

- Climate and Meteorological Information Requirements for Water Management (WMO-No. 1094);
- Planning of Water Quality Monitoring Systems (WMO-No. 1113);
- Technical Material for Water Resources Assessment (WMO-No.1095).

The technical reports are available [here](#).

5. In addition, following the request of CHy-XIII, comprehensive training material has been developed and made available for the Manual on Stream Gauging and the Manual on Flood Forecasting and Warning, while it is being developed for the Manual on Low Flow Estimation and Prediction.

6. The Work Plan of the Project on the *Assessment of the Performance of Flow Measurement Equipment* established through Resolution 2 (CHy-XIII) continues to evolve, with the most up-to-date version being available on the working Website of the project:

<http://www.wmo.int/pages/prog/hwrp/Flow/index.php>. The continuation of the Project was further reinforced by the adoption of Resolution 2 (CHy-14). The project currently comprises seven core project activities and its main outputs consist of the publication of the Guidelines for the assessment of uncertainty of hydrometric measurements, the report on the survey on field discharge measurement instrumentation and techniques used operationally, the development of a database of discharge techniques, as well as the progress achieved in the development of an Uncertainty Analysis Decision-Aid Tool (UADAT), the preparation of guidelines for conducting and reporting on the calibration and verification of the performance of discharge measurement instruments, and the initiation of work in preparing guidelines for the estimation of uncertainty analysis of discharge determination via various techniques. Detailed information on the different outputs as described within the Project work plan can be found at the main project Website: http://www.wmo.int/pages/prog/hwrp/Flow/flow_tech/workplan.php

7. The project is being implemented through collaboration with the International Association of Hydro-Environment Engineering and Research (IAHR), the International Association of Hydrological Sciences (IAHS), the International Organization for Standardization (ISO), and the Association of Hydro-Meteorological Equipment Industry (HMEI). As decided at CHy-XIII and CHy-14, the Advisory Working Group (AWG) has assumed the role of Steering Committee of the project, providing general guidance to it, while representatives of the above organizations, together with a representative of the WMO Regional Working Groups on Hydrology (/RWGHs) and invited experts, under the chairmanship of the representative of CHy, constitute the Management Committee, responsible for its day-to-day implementation. The tenure of the Management Committee established by CHy-XIII ended at CHy-14; and, in order to continue with the smooth implementation of the project, the membership for the next intersessional period was decided at CHy-14, and documented in [Resolution 2 \(CHy-14\)](#). The group met in December 2103 and have continued their effort using teleconferences and other electronic means of communication.

8. The cooperation with the International Organization for Standardization (ISO) in the field of hydrometry increased during the intersessional period, especially in the areas of water data transfer formats and Acoustic Doppler Current Profilers (ADCPs), and further cooperation in the future is envisaged. With input from WMO, ISO made improvements to standards ISO 772 Vocabulary and ISO 3455 Calibration of Current Meters.

9. The Commission had recommended in Resolution 6 (CHy-XIII) that the Global Runoff Data Centre (GRDC) should undertake the development of the metadata profile, in collaboration with interested parties, under the overall guidance of WIS/WMO Integrated Global Observing System (WIGOS) to form part of the WMO Core Profile of the International Organization for Standardization (ISO) Metadata Standard. In October 2012, GRDC submitted a summary document of the Hydrology Metadata, available as background document [here](#), as basis for discussions at CHy-14. The document refers to ongoing work and will be further developed into the detailed description of the Hydrology Metadata concept.

10. During the last intersessional period (CHy-XIII to CHy-14), the Commission had contributed to the work of the joint WMO/Open Geospatial Consortium (OGC) Hydrology Domain Working Group, through its designated expert Ulrich Looser. In particular, this has led to the adoption of WaterML 2.0, (available [here](#)), as an OGC Standard and to progress in the development of a Hydrologic Feature Model (HY_Features) (discussion paper available [here](#)). WaterML 2.0, is an encoding standard for the representation of in-situ hydrological observations data. OGC WaterML 2.0 supports encoding of hydrological and hydrogeological observation data in a variety of exchange scenarios. CHy-14 discussed its role in the eventual adoption of WaterML 2.0 and HY-Features as WMO standards and adopted Resolution 3 (CHy-14). This Resolution requests Members to actively participate in testing and applying WaterML2.0 in pilot projects and operational applications. CHy-14 re-appointed Ulrich Looser and appointed Tony Boston (Member of the Advisory Working Group) on the WMO/OGC Hydrology Domain Working Group. Silvano Pecora (Italy) was appointed to the same group and has been actively testing WaterML.2.0.

World Hydrological Cycle Observing System (WHYCOS)

11. Congress (Resolution 14 (Cg-XVI)) requested the Secretary-General to carry out an independent external evaluation of the World Hydrological Cycle Observing System (WHYCOS) programme as a follow-up to the first review conducted in 2005. In addition, Congress requested a review of the WHYCOS International Advisory Group (WIAG) mechanism to make it more responsive to the new challenges facing the WHYCOS programme. The 2011 WHYCOS Review was undertaken in late 2011 by Mr Pilon (Canada) and Mr Kidane (Ethiopia). Mr Pilon and/or Mr Kidane visited the Niger-HYCOS, the Mekong-HYCOS and the Carib-HYCOS as well as being briefed on other HYCOS Projects by the Secretariat. The recommendations from the review were considered by the ninth meeting of the WIAG and the CHy Advisory Working Group in December 2011. The recommendations, along with draft responses as compiled by the WIAG and the CHy AWG, were reviewed and revised by CHy-14. Resolution 4 (CHy-X14) was adopted on WHCOS and requested the Secretary General to report to EC-65 on the review and the responses to its recommendations by the Commission. In response to this reporting to EC-65, [Resolution 8 \(EC-65\)](#) was adopted requesting the president of the Commission for Hydrology, as Chair of the WIAG, to oversee the adoption of the recommendations of the external evaluation, taking into consideration the Commission's responses, as endorsed by the Executive Council.

12. A number of WHYCOS component projects continue development and/or implementation in various regions in the current intersessional period. All of these projects were demand-driven and helped strengthen national hydrological activities as well as regional cooperation in water-related matters. In particular Volta-HYCOS was instrumental in contributing to the establishment of a new international river basin authority in the Volta River Basin.

13. RA I remains the Region with most of the components under implementation or planned. Niger-HYCOS has entered a second phase of implementation since 2011, to consolidate and expand on the achievements of the previous one, in terms of data collection and management, and information dissemination. In 2009 responsibility of Volta-HYCOS implementation was transferred

from WMO to the newly established Volta Basin Authority (VBA) and negotiations on funding project activities are ongoing. WMO has implemented in 2011-2012 the preparatory phase of IGAD-HYCOS, and, following the adoption of the project document, has engaged, starting in July 2012, in its implementation for a further period of three years. Project documents have been developed in collaboration with relevant basin authorities for Senegal-HYCOS and Congo-HYCOS, and negotiations with prospective funding partners for their implementation are well advanced. SADC-HYCOS phase II was completed in 2010, having achieved considerable results in the establishment of the observing network and the improvement of data management; unfortunately, funding of an eventual third phase is being delayed.

14. In Region IV, the final steering committee meeting of Carib-HYCOS was held in November 2012, where proposals on the continuation of activities beyond 2012 will be discussed. In Region II, Mekong-HYCOS, which contributed to strengthening field observations, improved data-management practices and providing data to flood forecasting activities, was completed in 2012. A second phase of HKH-HYCOS has been implemented since 2009 and is expected to be completed by the end of 2014, providing fast regional exchange of flood-related data. In Region V, Pacific-HYCOS was completed in 2011 and data from the project stations contributed to the preparation of the Catalogue of Rivers for the Pacific Islands. Finally, Arctic-HYCOS is self-funded, is characterized by a more science-oriented approach, and was originally conceived as a WMO contribution to the International Polar Year. This component has commenced and is aimed at making data and products available and in providing better coordination and integration in data management among participating countries and other scientific programmes and initiatives in the area.

15. Projects have been the object of mid-term and final reviews by third party independent experts, which have provided useful insight on the success factors as well as difficulties encountered in project implementation and hints on ways to overcome them. Elements from these reviews were input into the independent external evaluation of the WHYCOS programme (see above) and in the preparation of the new version of the WHYCOS Guidelines.

16. On most of the above projects, WMO acts as a supervising agency, providing technical advice and support (e.g. tendering processes, training design) and ensuring coherence of project implementation with the agreed project document and the general WHYCOS principles. Only in exceptional cases, when local institutional arrangements or specific donors' requirements demand so, is WMO more directly engaged as implementing agency (Volta-HYCOS and IGAD-HYCOS).

17. The WMO Secretariat expresses its appreciation to the various donors and the other partners for the financial and technical support provided to the HYCOS components. The WHYCOS International Advisory Group (WIAG) met on three occasions during the past five years, February 2009, December 2011 and October 2013. Reports on these meetings are available at: <http://www.whycos.org/whycos/documents-and-technical-material>.

18. In response to the Congress Resolution 30 (Cg-XV), Resolution 6 (CHy-XIII), WMO Integrated Global Observing System (WIGOS) and WMO Information System (WIS), proposed the integration of SADC-HYCOS and the Southern Africa Region Flash Flood Guidance System (SARFFG) as pilot projects under WIGOS/WIS. The aim of this integration is to demonstrate the benefits of the WIGOS/WIS information flow and output, including associated metadata, in hydrology and water resources. A one day regional consultation meeting was organized for the development of the WIS/WIGOS Pilot Project on hydrology and to identify potential contribution from other major projects in the region in December 2009. Participants supported WMO's proposal to develop a WIGOS/WIS pilot project in the region and made specific recommendations for the development of the pilot project. Since then, progress has not been as expected (primarily due to

delays in implementing the SADC-HYCOS Phase III) and renewed efforts will be required during the next intersessional period as the concepts of WIGOS/WIS become more firmly established.

Water Resources Assessment

19. The application of Water Resources Assessment (WRA) activities in the framework of the HWRP is an essential tool in supporting Member States, through their NHSs, in enhancing socio-economic development, and it can also contribute to advancing knowledge for reducing the risks and potential impacts of hazards caused by weather, climate, water and related environmental elements. Note that the International Glossary of Hydrology defines WRA as the “determination of the sources, extent, dependability and quality of water resources frothier utilization and control.” It also defines water resources as “water available, or capable of being made available, or use in sufficient quantity and quality at a location and over a period of time appropriate for an identifiable demand.”

20. During the intersessional period, a Technical Material for Water Resources Assessment report has been published. In addition, three brief draft reports on “Methodological Approaches to Assessment of Basic Moisture Regime Characteristics - Soil Moisture and Evaporation – A Review”, “Current problems of hydrological networks design and optimization” and “Review on Remote Sensing of the Snow Cover and on Methods of Mapping Snow” have been prepared.

21. With a view to assisting the Commission in deciding the way forward in this area (for instance, whether the preparation of a WRA Manual under the QMF-H is still needed and if so, what should its contents be) and as a way to take into consideration regional needs, a [Workshop on Development of Water Resources Assessment Methodologies and Establishment of an Information System for WRA](#) in RA II was held in Seoul in October 2012, and a [similar meeting](#) for RA IV was held in 2013 in Panama. The recommendations from these meetings were presented to the CHy-14.

23. During the last intersessional period, a new online version of INFOHYDRO was launched. This version is more user friendly than the previous one, is based on a data base and not on pdf documents, and includes the changes suggested by CHy-XIII regarding the clarification on some of the terms used in INFOHYDRO. As of October 2012, updated information from 44 countries was included in the database. The WGH of the RAs have been extremely helpful in encouraging National Hydrological Services (NHSs) of their Regions to provide the information related to their countries into INFOHYDRO. However, it has been observed that progress in populating this important database is still slow.

24. Through the technical cooperation project PROMMA (Programme for the Modernization of Water Resources Management (Mexico)), a water and climate database management system suited to the needs of the Mexican National Water Commission was developed (in Spanish). At the end of the project, Mexico made it available to the Programme of Cooperation for the Iberoamerican National Meteorological and Hydrological Services (NMHSs), which, thanks to a Trust Fund established by Spain in WMO to support its activities, added a meteorological component and adapted it to the needs of a more general audience. During Cg-XVI, this open-source, freely available software was transferred to WMO, which has now translated it into English and French. This software, termed [MCH](#) (Meteorological, Climatological and Hydrological database management system) was installed in Ghana, Belize, Curaçao and Saint Marteen, Albania, Bosnia and Herzegovina, with several other countries to be added in the next few months. In all cases, NHS staff have been trained in the operation and management of the system. Members are encouraged to take advantage of the availability of this open source software. The functionality of the system has increased over time. NMHSs in need of such a system can apply to the WMO Secretariat for its installation and related training programme. An online community of users of the

system has been launched, to promote exchange of experiences and share eventual future developments.

FORECASTING AND APPLICATIONS IN HYDROLOGY

WMO Flood Forecasting Initiative

25. The WMO Flood Forecasting Initiative is the basic implementation framework related to hydrological forecasting and flood management. Its principal objective is to enhance the capability of NMSs and NHSs to cooperate in an effective manner in the provision of improved flood forecasting services.

26. A number of initiatives and projects are being implemented in the framework of the [Strategy and Action Plan of the WMO Flood Forecasting Initiative \(FFI\)](#), involving NHSs, NMSs and other stakeholders, including:

- (a) The Flash Flood Guidance System (FFGS) project with global coverage, endorsed by Resolution 21 (Cg-XV) as a FFI component, that had been developed by the WMO Commission for Hydrology (CHy) jointly with the WMO Commission for Basic Systems (CBS) and in collaboration with the US National Weather Service, the US Hydrologic Research Centre and USAID/OFDA. Currently five components are being implemented: in Central America (since 2004), in the Southern African Region (since July 2009), in the Mekong River Basin (since March 2008), in the Black Sea and Middle East Regions (since March 2010), and in Mexico (since November 2010). Additional projects are planned for the next intersessional period, including in South East Europe (SEFFG), Central Asia and South Asia, with work having since progressed on SSEFG and South Asia. Discussions are underway regarding a planning meeting for Central Asia;
- (b) A project to develop a Strategy for Flood Forecasting and Early Warning in the Zambezi River Basin, implemented with support from USAID. This effort has not progressed for various reasons;
- (c) The establishment of PROHIMET (Red Iberoamericana para el monitoreo y pronóstico de fenómenos hidrometeorológicos), which is a regional initiative supported by WMO and the Government of Spain that promotes pilot projects, training courses and working groups on thematic areas such as hydrological forecasting models and observing network management and maintenance in the Ibero-American countries. The Ibero-American Network on monitoring and forecasting of hydrometeorological phenomena (PROHIMET) involves the implementation of pilot projects, where meteorologists and hydrologists of most of the Ibero-American countries are contributing their expertise;
- (d) A PROHIMET pilot project for the development of a hydrometeorological system in the catchments of the rivers Nare and Guatape (Antioquia Department, Colombia) to improve civil protection response and dam operations;
- (e) A PROHIMET flood early warning pilot project for the river Yí, which floods the city of Durazno (Uruguay), to improve the emergency response of the civil protection;
- (f) The [Coastal Inundation Forecasting Demonstration Project \(CIFDP\)](#), initiated jointly by CHy and the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) which aims to provide combined forecasting of storm surges and coastal flooding in four countries, namely Bangladesh, Indonesia, Fiji and the Dominican Republic.

27. Other activities currently progressing include a task group working on the intercomparison of flood forecasting models to provide guidance on the applicability of forecasting models under different environments and institutional settings. The task group proposal for the Development of a Decision-Aiding Tool for the Selection of Flood Forecasting Models is available [here](#). Another task group is working on the assessment of the efficiency of flood forecasting services. The draft report

of the workshop on “Improving the Effectiveness of Flood Forecasting Services” - Development of a Framework for the Assessment of Service Delivery Capabilities of Hydrological Services”, held in Geneva in October 2011.

28. [Resolution 15 \(Cg-XVI\)](#) called for the establishment of an overarching Advisory Group for the Flood Forecasting Initiative (FFI-AG) to provide technical oversight on the hydrological forecasting elements of these initiatives. The first meeting of the FFI-AG was held in October 2013 and a work plan for the FFI-AG has been developed.

29. The CHy Statement on the scientific basis for, and limitations of, river discharge and stage forecasting, which appears on the CHy Website, provides a perspective on the current state of hydrological forecasting, including an overview and a summary of factors affecting forecast accuracy and lead-time.
(http://www.wmo.int/pages/prog/hwarp/publications/statements/stmnt_limitations08042010.pdf),

30. The first project in the ANADIA (Assessment of Natural Disaster Impacts on Agriculture) programme, which is currently being implemented in Mali, addresses impacts of floods and drought on agriculture and rural systems. This project, funded by Italy, is implemented in cooperation with NMS and NHS of Mali and other local institutions, including the Institute of Rural Economy and the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT).

Associated Programme on Flood Management (APFM)

31. The APFM, a joint initiative with the Global Water Partnership (GWP), was established in 2001 in order to promote the concept of Integrated Flood Management (IFM) and to facilitate its application from the concept to practice. The IFM concept provides the rationale and means to shift from the traditional reactive ‘flood control’ approach, focusing mainly on engineering measures, to a more proactive, integrated and multi-disciplinary approach.

32. Phase I (August 2001-July 2006) of the APFM has seen the principles of IFM being established through a Concept Paper supported by a Flood Management Policy Series, and a first application of these concepts in various regional pilot projects. Phase II of the programme (2006-2010) has consolidated these achievements developing capacities in the countries by supporting local and regional actions that advocate, support or demonstrate the IFM principles, and by collecting, synthesizing and disseminating flood management case studies through its Website.

33. Phase III (started in 2010 and ending in 2014) is being characterized by an intensification and improvement of activities and services established in the previous phases. Particular focus on the demand-driven assistance facility is provided through the HelpDesk on IFM. The overall goal of the APFM Phase III was to improve field-effectiveness of IFM practices and outreach. The Advisory and Management Committees of the APFM are meeting September 8-9, 2014 and will consider the direction of the programme during its Phase IV, whose overall goal is to mainstream IFM into practice, while keeping active the production of guidance materials and maintaining the services provided through the HelpDesk.

34. The Governments of Japan, Switzerland, United States of America, the Netherlands, Italy and Germany have provided support to the programme financially or in-kind; moreover, the Government of Spain has supported specific associated activities. Additional details are available through the [Associated Programme on Flood Management Website](#), the annual reports of the APFM (available as reference materials at [this site](#) for the period 2008-2012, [here](#) for the period 2012-2013 and at [this link](#) for the period 2013-2014), and in CD format upon request from the [Technical Support Unit](#) of the APFM.

35. During the current and last intersessional periods, a wide range of activities have been undertaken through the APFM, with particular regard to capacity building activities, both in the form of guidance materials and training courses (including training of trainers), or in the implementation of projects aimed at the development of local capacities and capabilities in flood management. Notably, publications such as the policy series or the IFM tools have been updated and further developed; trainings have been held and training manuals have been published in cooperation with other agencies and institutions; national or regional workshops on IFM strategies formulation have been implemented; and advocacy and outreach activities have been carried on. In addition, the [HelpDesk for IFM](#) was launched in 2009 as a mechanism for transferring knowledge and skills on flood management issues to managers and decision makers. In its *Help Yourself* function it provides a large number of technical tools and publications covering flood management issues from different perspectives. In its *GetHelp* function, the HelpDesk provides multi-disciplinary technical assistance in close cooperation with cooperating institutions, termed Support Base Partners. Approximately 20 Support Base Partners have so far signed agreements with WMO for mutual cooperation in the framework of activities related to the HelpDesk.

36. Since its launch in June 2009, the HelpDesk has received around 130 requests either through the Website interface or direct contacts to the APFM Technical Support Unit (TSU). About 85% of these requests were successfully fulfilled, or are currently being processed, in the form of training workshops, assistance in national strategy development, or simple rapid guidance on specific information related to IFM. These requests were not only coming from governmental agencies or institutions, but also from universities, NGOs and the private sector. This proves that the HelpDesk is an excellent tool to allow access to information, dissemination and advocacy of the IFM concept. Moreover, the HelpDesk acts as a hub for exchange of information and expertise between relevant competent institutions (Support Base Partners) and the requesting parties.

37. The third edition of the Concept Paper on IFM, taking into due consideration urban flood management and climate change issues, has been published and translated into English, French, Spanish, Russian, Chinese and Japanese. The Policy Series is also available in English, French and Spanish, with the only exception of “Economic aspects of flood management”, which is only available in English (a second edition is foreseen in the next future). These publications ([available from the APFM Website](#)) have been widely distributed during training and advocacy workshops, as well as to Hydrological Advisors, various universities and institutions with curricula relevant to Integrated Water Resources Management (IWRM) or IFM. The publications were also delivered to NGOs and other government organizations.

38. IFM Tools are guiding materials for flood management practitioners for various specific purposes. These tools are intended to provide substantive guidance to the practitioner and a clear perspective of how different aspects of flood management fit together forming an integrated approach. The Tools serve as resource material and are living documents to be updated regularly, based on experiences of members of CHy and various other partners. As such, the IFM Tools series is published only electronically and is available for download from the [APFM website](#). So far 20 Tools have been published, and another 7 are currently under development. Further details on tools under development can be found in the [APFM annual report 2013-2014](#).

39. In addition to these publications, training manuals, e-learning and other guidance materials were produced in collaboration with partners such as CapNet, the World Health Organization (WHO), the United Nations Economic Commission for Europe (UNECE), University of Hamburg-Harburg or the World Bank on topics related to flood management covering also urban, transboundary, community-based, sanitation, or climate change issues. As per the training courses, twenty five were organized in Africa, Asia, South America and Europe during the reporting period, of which ten in collaboration with CapNet, six with the Japan International Cooperation Agency (JICA), and another nine exclusively by the APFM.

40. Several national or regional workshops on IFM strategies formulation have been implemented, with additional ones currently undergoing development. Strategy formulation workshops took place in Pakistan, Thailand, Lao PDR, South East Europe, in Iowa State, in the Dniester, Sava and Neman river basins (with UNECE). Other activities are being currently planned to be implemented in Bangladesh, Nepal, West Africa, and in the Amur River basin for the development of Action Plans to implement IFM practices.

41. Advocacy and outreach activities have also been carried out in the reporting period, with APFM participating in over thirty six major international conferences. Outreach has also been improved through the planning and inception of a series of educational multimedia activities (namely with Project WET, the Danish Hydraulic Institute (DHI), and Metameta). The development and implementation of a Communication Strategy, including a restyling of the APFM website and of its editorial products, has led to an increase of visibility of the APFM through social media and other specialized networks dealing with flood management and disaster risk reduction issues.

Water, climate and risk management

42. Noting that water resources are significantly affected by climatic variability and potential climate change, the important role that HWRP can play in helping Members to understand better the role of water resources management in mitigating the risks of hydrological extremes and in developing adequate response and mitigation measures has been recognized. Various initiatives aimed at fostering cooperation between the hydrological and climatological communities, the development of national adaptation strategies and the reinforcement of capabilities for managing risks to natural hazards are being implemented.

43. CHy-XIII had decided to actively participate in the development of a WMO initiative to encourage provision and dissemination of climate and hydrological information in support of hydrology and climate research, adaptation to climate change and climate variability, and in providing feedback from the water community. Please refer to Doc. 5 for the terms of reference and activities in water, climate and risk management adopted by CHy-14.

44. A Regional Workshop on Integration of Seasonal Forecasts and Hydrological Information for Water-related Sectors in the Western Coast of South America (WCSA) was held in Guayaquil, Ecuador in January 2010, in cooperation with the Centro Internacional para la Investigación del Fenómeno de El Niño (CIIFEN), to foster the interaction between the hydrologic and climatic communities for the implementation of hydrological outlooks based on climate outlooks in the region, as a first contribution from the region to the implementation of the GFCS. The Workshop proposed a regional action plan, which is being implemented, including a Training of three Trainers in the headquarters of the International Research Institute (IRI) in Palisades, USA, in September 2010, on techniques and approaches such as statistical flow forecasts and methods to produce probabilistic hydrological outlooks based on seasonal precipitation forecasts disaggregated in daily time series. These methods were later discussed at the Tenth Climate Outlook Forum for the West Coast of South America (COF-WCSA) in Quito, on November 2010, as well as at the 11th COF-WCSA in Santiago, in December 2011.

45. An Experts Meeting on Extended Hydrological Prediction workshop was held in July 2011 in Melbourne, Australia. The report is available at http://www.wmo.int/pages/prog/hwrrp/documents/EHP_Final_Report_2011_Melbourne.pdf. The recommendations of the workshop included the identification of steps for the preparation of guidance materials for extended hydrological forecasting, including through the compilation of case studies, and to establish an action plan for the production of the guidance materials. These

recommendations will be discussed under agenda item 10 of the present session of the Commission.

46. The Global Terrestrial Network – Hydrology (GTN-H) continues to promote improved access to hydrometeorological data and information through its alliance of major global data centres. The development of joint data products on global scales is a main driver of the programme that is supported by CHy and the Global Climate Observing System (GCOS). Coordination of the GTN-H has recently changed from the CrossRoads Initiative of the City College of New York (CCNY) to the Federal Institute of Hydrology, Germany.

CAPACITY BUILDING IN HYDROLOGY AND WATER RESOURCES MANAGEMENT

47. Cg-XVI endorsed the revised Strategy on Education and Training in Hydrology and Water Resources adopted by the Commission through Resolution 5 (CHy-XIII). Resolution 6 (CHy-14) encourages Members to implement the Strategy, which is provided as an annex to the resolution. The revised strategy offers a framework for responding better to the capacity building needs of Members. Congress also invited the Secretariat to pursue the provision of training according to the guidelines defined by the Commission, particularly in developing further distance- and blended-learning training courses, and in developing systematic training for the NHSs and other professionals based on the manuals and guidelines produced as part of the QMF-H.

48. In accordance with the Strategy, training needs have been determined in consultation with Members and Regional Associations Working Groups on Hydrology, CHy and its subsidiary bodies based on the surveys undertaken by the WMO Secretariat. Accordingly, a number of training events have been organized in the last intersessional period, namely:

- (a) Roving Seminars on Operation and Maintenance of Automatic Hydrometeorological Stations were organized in 11 Iberoamerican countries, training more than 300 professionals (sponsored by Spain);
- (b) Training of Trainers Course on Climate and Water Affairs held in April 2009 in Skopje, (co-sponsored by the UN-Water Decade Programme on Capacity Development (UNW-DPC));
- (c) Training on Acoustic Doppler Current Profiler (ADCP) flow measurements in South Africa, attended by 68 hydrologists, engineers and technicians from NHSs and WHYCOS Project Pilot Regional Centres from RA I (Jointly with the European Space Agency (ESA));
- (d) Regional Course on Measurement and Computation of Discharge for RA V, held in October 2010 in Bekasi and Bandung, Indonesia, with 46 participants from 10 countries of the Region;
- (e) Training Course on the Manual on Low-Flow Estimation and Prediction, organized in conjunction with the meeting of the RA V Working Group on Hydrology in Bandung (Indonesia) in December 2009;
- (f) Training Course on the Role, Operation and Management of NHSs (based on WMO-No. 1003) in Kinshasa, RDC in April 2012, in cooperation with the Office International de l'Eau.

Since the last intersessional period, distance learning courses in Basic Hydrological Sciences were held in 2013 for Asia and Africa, and a second course for Asia was held in March 2014. These courses are jointly organized by WMO, COMET and NOAA and a local WMO Regional Training Centre (RTC); the India National Water Academy (in the case of Asia) and the Institute for Meteorological Training and Research (IMTR) of Kenya (for Africa). In addition, CIMH organized a Basic Surface Water Modelling Distance Learning Course in September 2013, the Iberoamerican network Prohimet held a workshop on early warning of hydrometeorological phenomena in Aguascalientes, Mexico, in November 2013 and a training course for the Western Balkans on flood loss assessment was organized by the Associated Programme on Flood Management (APFM) in Sarajevo from 7 to 9 May 2014.

49. CHy-XIII recommended that under the QMF-Hydrology, training activities should be undertaken at the global level on the utilization of the Guides and Manuals. The annex to Resolution 6 (CHy-14) supported this and further identified priority areas for education and training in Hydrology and Water Resources. For Regional Association II, these were identified as :

- (a) Use of Hydrological Models
- (b) Use of remote sensing applications in hydrology and water resources management
- (c) New methodologies in water resources assessment.

50. With the objective of designing and planning the preparation of training material and organizing future courses and roving seminars on the use of the WMO Manual on Stream Gauging, a Planning Meeting for Trainers of the IAHR/WMO Stream Gauging Course was held in Geneva in November 2009. In cooperation with IAHR, two versions of the course on stream gauging based on the second edition of the WMO Manual were designed: a short one (three class days plus one field day) for the IAHR audience and a two-week (which could be reduced to one-week depending on resources availability) one for WMO's audience (staff of NMHSs). The first course in the IAHR version was held in Brescia, Italy in September 2011, the second in Andong, Republic of Korea in September 2013, and a third has been planned to be held in Hanoi, Viet Nam in September, 2014. The first course in the WMO version was held in December 2012 in Ghana. The training material has been translated in Spanish and is currently being utilized in courses organized in the framework of technical assistance projects in Mexico and Dominican Republic. A training of trainers for Spanish-speaking instructors on stream gauging had been held in Mexico from 11 to 15 November 2013. The community of practice of instructors in stream gauging was being developed and was activated in 2014. A workshop on stream gauging for French-speaking countries of RA I is scheduled for the last quarter of 2014. The French version of the *Manual on Flood Forecasting and Warning* (WMO-No. 1072) is being finalized. The training material on Flood Forecasting and Warning has also been prepared and was used in the training course on the subject, held in Nanjing, China in October 2011. In both cases, an online community of trainers will be established, to share, adapt and translate, if necessary, the training material which has been developed by CHy experts.

51. The first International Basic Hydrologic Sciences Distance Learning Course, held from 19 October to 14 December 2009, and jointly organized by COMET, the National Oceanic and Atmospheric Administration (NOAA), and WMO, was attended by 54 students from 39 countries covering all six WMO Regions. The last two weeks were dedicated to the preparation of a final written assignment. The course was very positively received by the students, who demonstrated a high level of participation, with twenty of them earning a diploma. Subsequently, COMET, at the request of WMO, adapted eight basic hydrological modules to an international audience; these modules were used to deliver two additional Distance Learning Courses in 2011, a basic one for RA V and an advanced one for Eastern European countries. In order to multiply the offer of these very popular courses and involve WMO Regional Training Centres (RTCs) and interested academic institutions, a Training of Trainers Workshop on Distance Learning Delivery of Hydrology Courses was held in COMET's headquarters in Boulder, USA, from 29 November to 9 December 2011 with 11 participants from eight training institutions, potentially covering all WMO Regions. An agreement was reached that the participating institutions will deliver at least a WMO Distance Learning course in their respective Region every two years, with limited support from WMO and COMET. An online community has been established, where participants of the workshop and experts from COMET and WMO share their experiences in planning, organizing and delivering distance learning courses.

52. The WMO Strategy for Education and Training (ETR) in Hydrology and Water Resources (HWR) called for particular attention to be given to the establishment of new WMO RTCs with a special focus in hydrology and water resources, in view of the decision of the EC-LVIII to widen the

scope of WMO RTCs to include other areas of interest of WMO. In the past intersessional period this approach resulted in the approval by EC-64 in 2012 of the National Water Academy in Pune, India and the training facilities of BMKG and the Research Center for Water Resources (RCWR) in Indonesia as a component of the RTC in India and a new RTC respectively.

53. As approved by Cg-XV, the *Guidelines for the Education and Training of Personnel in Meteorology and Operational Hydrology*, Volume II: Hydrology (WMO-No. 258) was published in all the official languages in November 2008 and is now available on the WMO Website. CHy-14 considered the replacement of this publication following the requests by Cg-XVI on this matter.

COOPERATION IN WATER-RELATED ISSUES

54. During the last intersessional period, the activities of the various water-related UN agencies continued being efficiently coordinated by UN-Water. This coordination mechanism has actually increased its relevance in the international water arena in recent years. In particular, in 2011 the decision was taken to elevate the level of its Chair to that of Chief Executive, and as a consequence since February 2012, the Secretary-General of WMO has assumed the role of Chair for a period of two years. The benefits deriving from the WMO Secretary-General chairmanship of UN-Water for the period 2012-2013 are, among others: (i) the opportunity to strengthen the engagement of other UN agencies in GFCS; (ii) the enhanced visibility of WMO's water-related activities; (iii) the multiple opportunities to advocate for the importance of supporting the activities of the NMHSs; and (iv) the renewed interest from donors in WMO Programmes.

55. In addition, since 2008, WMO has been coordinating the UN-Water Task Force on Water and Climate Change, later transformed into the Water and Climate Change Thematic Priority Area (WCC-TPA), which is aimed at strengthening UN System coordination on activities related to water and climate change in order to facilitate adoption of strategies for meeting the challenges of climate change, both for adaptation and mitigation in the related water sub-sectors. An extensive UN-Water Policy Brief on "Climate Change Adaptation: The Pivotal Role of Water", has been prepared by the TPA (http://www.unwater.org/downloads/unw_ccpol_web.pdf). Earlier, a one-page statement "Climate Change Adaptation is Mainly about Water", prepared by the Task Force, was presented at the UNFCCC 2009 COP 15 (Copenhagen, Denmark). As coordinator of the TPA, WMO participated in the Deutsche Welle Global Media Forum (June 2010, Bonn, Germany). A Guidance Note on Water-related Adaptation to Climate Change, developed by a group of experts from various UN-Water member agencies and partners to address the needs of UN Country Teams and other professionals dealing with the impact of climate change on water resources, is scheduled to be issued in late 2012. Its main objective is to enable UN organizations to effectively assist Member States in preparing and implementing coherent strategies to tackle the impacts of climate change on the management of water resources.

56. WMO regularly contributes to the preparation of the previous four editions of the World Water Development Reports (WWDR) under the aegis of UN-Water and is actively participating in the current restructuring of the report undertaken to respond to the comments received through a wide ranging survey.

57. WMO has also continued to support UN-Water/Africa and the African Ministerial Council on Water (AMCOW) and AMCOW Technical Advisory Committee (AMCOW TAC). WMO actively participated and contributed to the preparations and organization of the four Africa Water Weeks held since 2008, the last being held in May 2012 in Cairo.

58. Jointly with the United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Strategy for Disaster Reduction (ISDR), IAHS and the United Nations University (UNU), WMO is participating in the International Flood Initiative, with its secretariat in the

International Centre for Water Hazard and Risk Management (ICHARM). WMO has also actively participated in the High-level Panel on Disaster under the UN SG's Advisory Board on Water and Sanitation.

59. WMO's functional synergy with UNESCO has continued and the UNESCO/WMO Liaison Committee plays an important coordination role. WMO and UNESCO are in the process of reviewing and updating the working arrangements between the two agencies. There has been effective and fruitful cooperation between WMO and UNESCO for example, involving the provision of technical assistance to Pakistan in direct response to the 2010 flood disaster and also in respect to flood forecasting and early warning activities being undertaken in the Zambezi River Basin.

60. Cooperation with IAHS, IAHR, ISO, the International Commission on Irrigation and Drainage (ICID), GWP and other intergovernmental and non-governmental organizations has expanded in the last intersessional period. This cooperation provides a useful mechanism for pursuing the objectives of the HWRP as well as a vehicle for exploring the climate services needs of the water sector.

61. Cooperation also continued with the Group on Earth Observations (GEO) Integrated Global Water Cycle Observations (IGWCO) Community of Practice through its ongoing programme activities.

REGIONAL ACTIVITIES

62. A range of different institutional arrangements have been adopted by the WMO Regional Associations for addressing issues relevant to hydrology and water resources in their respective Regions.

63. The AWG, in order to incorporate the regional needs in the work programme of CHy, has continued to conduct extensive consultations with the Regional Hydrological Advisers, both through informal meetings during sessions of the Executive Council and by inviting them to participate in its third meeting in December 2011, dedicated to the planning for CHy-14.

64. In order to better address the regional needs in the work of CHy, Regional Hydrological Advisers (RHAs) were therefore requested to provide input from the Regional Working Groups on Hydrology to the preparation of the proposed future Programme of Work of the Commission.

65. With the goal of streamlining the use of resources and better responding to the regional needs, the regional associations during the present intersessional period have established, among their subsidiary bodies, the following bodies to deal with water related matters:

1. RA I: Working Group on Hydrology (2010)
2. RA II: Working Group on Hydrological Services (2012)
3. RA III: Working Group on Hydrology and Water Resources (2014)
4. RA IV: Working Group on Hydrology [and a Hydrology Forum] (2013)
5. RA V: Working Group on Hydrological Services (2014)
6. RA VI: Working Group on Climate and Hydrology [and a Hydrology Forum] (2013)

SUPPORT TO CHy

66. The Secretariat supported the president of CHy in the organization of three AWG meetings during the intersessional period preceding CHy-14. The first meeting was held in Geneva in February 2009. That meeting approved the work plan of all the AWG members. In the second meeting, convened in Brisbane, Australia in April 2010, the AWG appointed an additional expert to

work in the Hydrological Forecasting and Prediction theme area, and took some steps to continue preparing the Manual on Flood Forecasting and Warning. The third meeting, held in Geneva in December 2011, prepared a proposal for the future programme of work of the Commission. The first AWG meeting following CHy-14 was held in Geneva in February 2013. This meeting established the work plans of all the AWG members (see Doc. 5 for additional details). The second meeting of the AWG is scheduled the week of September 15, 2014 in Prague. The President of CHy, Dr Harry Lins, also issued his first circular letter on 21 July 2014. This letter provides additional details on activities associated with CHy, and it is provided in Appendix II.

PRESIDENTS OF TECHNICAL COMMISSIONS (PTCs)

67. Activities undertaken by the PTC of relevance to RA-II WGHS include the following:
- Uncertainty in modelling and observations;
 - Disaster Risk Reduction;
 - Global Framework for Climate Services; and
 - Relationships with Presidents of Regional Associations.

PRESIDENTS OF REGIONAL ASSOCIATIONS (PRAs)

68. Activities undertaken by the PRA of relevance to RA-II WGHS include the following:
- Structures of the Regional Associations; and
 - Relationships with the Technical Commissions.

Appendices: 2

PROGRAMME DESCRIPTION

HYDROLOGY AND WATER RESOURCES PROGRAMME (HWRP)

1. Overall objective

1.1 The overall objective of HWRP is to apply hydrology in meeting the needs for sustainable water resources development through integration of hydrological, meteorological and climatological information and forecasts for use in water resources management; prevention and mitigation of water-related disasters; and in climate change adaptation in the water sector at national, regional and international levels.

2. Purpose and scope

2.1 HWRP fulfils one of the major purposes of WMO, namely to promote application of hydrology and to further close cooperation between Meteorological and Hydrological Services (paragraph (e) of Article 2 of the Organization's Convention).

2.2 HWRP promotes improvements in the capabilities of Members, particularly in developing countries and those in transition, through technology transfer and capacity-building, so as to enable them to assess their water resources on a continuous basis, and respond, through risk management strategies, to the threats of floods and droughts; and thus to meet the requirements for water and its use and management for a range of purposes. The Programme aims at providing hydrologic information to various national development agencies, the civil society and the general public so that they can effectively use water resources for various development activities. At the same time the Programme endeavors to underscore the importance of hydrology and the role of National Hydrological Services (NHSs) in the development activities of various sectors through water resources management.

2.3 The Programme takes into consideration the existence of climate variability and change and its hydrological impacts. It promotes increased collaboration between NHSs and National Meteorological Services (NMSs), particularly in the provision of timely and accurate hydrological forecasts, ranging from flash floods guidance to seasonal predictions as a contribution to the protection of life and property and overall climate risk management.

2.4 The Programme supports activities that contribute to the improved accuracy and usefulness of hydrological forecasts, resulting in the protection of life and property, and increased information and knowledge in support of sustainable socio-economic and environmental development and use of water. The activities of HWRP encompass the following broad areas:

- (a) Measurement of basic hydrological elements from networks of hydrological, climatological and meteorological stations;
- (b) Collection, processing, storage, retrieval and publication of hydrological data, including data on the quantity and quality of both surface water and groundwater;
- (c) Implementation of a quality management framework in hydrologic activities;
- (d) Provision of hydrologic data and related information for use in planning and operation of water resources projects and for monitoring the state of the freshwater resources;
- (e) Installation and operation of hydrological forecasting systems;
- (f) Development of flood management policies and strategies;
- (g) Integration of meteorological and climatological information and forecasts into water resources management;

- (h) Climate change adaptation in water resources management; and
- (i) Evaluation of hydrological research outcomes for their potential benefits for application by NMHSs.

2.5 The Programme effectively contributes to the implementation of all the Expected Results (ER) in the WMO Strategic Plan and particularly to ER 3 along with ER 2 and ER 4 (2012-2015). Many of the activities under the HWRP are strongly linked with other Programmes, in particular the World Weather Watch Programme, the World Climate Programme, the Tropical Cyclone Programme, the Education and Training Programme, and contributes to the overall objectives of the Disaster Risk Reduction Programme, the Regional Programme and the Least Developed Countries Programme. The Programme will act as an interlocutor and conduit to provide climate services under GFCS for use in the water sector.

3. HWRP Governance

3.1 The technical guidance for the HWRP is provided by the Commission for Hydrology (CHy). The Commission interacts closely with the Commission for Climatology and Commission for Agrometeorology on the Global Framework for Climate Services (GFCS) and the Commission for Basic Systems on WIGOS.

4. HWRP structure

4.1 The HWRP is implemented through three mutually supporting components:

- (a) Basic Systems in Hydrology;
- (b) Forecasting and Applications in Hydrology;
- (c) Capacity Building in Hydrology and Water Resources Management.

5. Basic Systems in Hydrology (BSH)

Long-term objective

5.1 The long-term objective of the component is to provide guidance to, and support for, NHTs in hydrometry and its application for monitoring freshwater resources, with an emphasis on quality assurance.

Purpose and scope

5.2 BSH provides the basic building blocks and framework for the hydrometric support for hydrology and water resources management. It covers the collection, transmission and storage of data, implementation of Quality Management Framework within Hydrology, the further development of WHYCOS including its internal and external coordination, establishment of hydrologic information systems, assessment of water resources, applications of hydrologic information and socio-economic benefit analysis of hydrologic networks. The component will contribute to the implementation of ER 3, and support meeting the objectives of ER 4 through enhancing integration (WIGOS) and communication systems for delivering information (WIS); the BSH component, through WHYCOS activities, assists the LDCs by enhancing capacity of NMHSs, thus contributing to ER 6.

6. Forecasting and Applications in Hydrology (FAH)

Long-term objective

6.1 The long-term objective of the component is to apply hydrometric observations for hydrological forecasting, flood risk assessment and management, prevention and mitigation of water-related disasters, and to better understand the implications of climate variability and change for water management.

Purpose and scope

6.2 The purpose of FAH is to support NHSs in the application of hydrological analysis through hydrologic modelling, development of flood forecasts, provision of flash flood guidance, studies on low season flows, storm surge coastal flooding, and design flood, in order to meet water resources management objectives. The component will undertake regular review of operational requirements for flood forecasts and warnings and keep up to date with new technological developments. The component organizes activities in support of integrated flood management and provides support to countries through a HelpDesk on flood management. Through its activities closely linked to flood prevention, mitigation and response, it contributes to the implementation of ER 2. The component will support climate change adaptation and environmental protection, and serve as the provider of climate information to the water sector users, and, as envisaged under the GFCS, serve as an arm of the User Interface Programme and thus contribute to ER 3. The component works through increased collaboration between NMSs and NHSs, which is promoted and facilitated. The component will continue to closely link its activities with the World Climate Programme (WCP), the Tropical Climate Programme (TCP) and the Marine Meteorology and Oceanography Programme (MMOP).

7. Capacity Building in Hydrology and Water Resources Management (CBH)

Long-term objective

7.1 The long-term objective of the component is to assist the rational development, management and operation of NHSs, including the education and training of their staff, strengthening institutional coordination with NMSs and increasing general awareness of the importance of hydrological work.

Purpose and scope

7.2 The purpose of CBH is to provide guidance to NHSs on the institutional management within the hydrological and water resources development context and to build their capacities to serve their respective countries, through the implementation of the Hydrological Operational Multipurpose System (HOMS) for technology transfer and staff education and training. The component supports informing and educating the public, stakeholders and other government institutions about the socio-economic benefits of hydrologic services. The component also supports the technical cooperation activities in the developing and least developed countries and thus contributes to ER 6. This is a cross-cutting component that has strong linkages to other components within HWRP and will contribute to their implementation.

Our ref.: CLW/HWR/CHy

GENEVA, 21 July 2014

First Circular Letter (December 2012-June 2014)

Dear Colleagues,

Typically, the first circular letter from the president of the Commission for Hydrology (CHy) for a new intersessional period is transmitted shortly after the Commission session, but before the Advisory Working Group (AWG) has had time to fully engage the many activities for which it is responsible. However, it became clear soon after CHy-14 that we were entering an unusually busy period at the World Meteorological Organization (WMO), particularly within CHy. Thus, I decided to defer preparing this update until after the AWG had been able to initiate the broad array of activities within its Terms of Reference. As a result, this circular letter is longer than would usually be expected. However, as you will see, much has been accomplished in the eighteen months since CHy-14, and I hope that you will agree that the AWG has made an outstanding start to fulfilling the goals established by you at the fourteenth session.

Fourteenth session of CHy

The fourteenth session of CHy was held in Geneva from 8-14 November 2012. The abridged final report of the session is available at:

http://www.wmo.int/pages/prog/hwrrp/chy/chy14/documents/final_report/1105_en.pdf.

The programme of work adopted by the Commission for the period 2013-2016 focuses on five thematic areas: Quality Management Framework – Hydrology; Data Operations and Management; Water Resources Assessment; Hydrological Forecasting and Prediction; and Water, Climate and Risk Management. Data Operations and Management is a new theme, while the others continue and expand on activities from the previous period. The new Data Operations and Management theme was established largely to oversee the testing, evaluation, and potential adoption of WaterML 2.0 as a WMO standard for information exchange. WaterML 2.0 is designed to facilitate the exchange of hydrological data in a common format. If the recommendation is made to adopt it, and CHy concurs, then WaterML 2.0 could be registered as a joint WMO/ISO standard. In addition to the five thematic areas, Congress has tasked the Commission with contributing to several WMO priorities, including the Global Framework on Climate Services (GFCS), the WMO Integrated Global Observing System (WIGOS), Disaster Risk Reduction (DRR) and Capacity Development. The following update is organized around these themes and issues.

Activities of the president of CHy (Harry Lins)

The president of CHy maintains general responsibility for guiding and coordinating the activities of the Commission and its Advisory Working Group between sessions of the Commission. He is also charged with executing specific actions prescribed by decisions of Congress and the Executive Council, as well as by the regulations of the Organization. Not surprisingly, in an Organization as complex and dynamic as WMO, this can entail numerous and varied tasks. This has certainly been the case during the past 18 months. Highlights of the president's activities follow.

Advisory Working Group (AWG)

The president chaired the first meeting of the CHy AWG in February 2013. The modes of operation of the AWG, as well as the work plans for each member of the AWG, were finalized and approved. In addition, there was a thorough review of cooperation with the regional associations related to hydrology and water resources, the World Hydrological Cycle Observing System (WHYCOS), capacity development, particularly as related to education and training, and cooperation with other international organizations. Details associated with the actions and work plans of each AWG member will appear in subsequent sections of this circular letter.

Presidents of Technical Commissions (PTC)

Two meetings of the PTC have been held since CHy-14. The first was held in January 2013. It addressed a number of inter-commission issues and cross-cutting activities, which included: responsibilities of technical commissions in the revision of Technical Regulations Volume I (how to write standards and where Volume I requires attention); progress in adjusting the operating plans of technical commissions to meet the decisions of Cg-XVI with respect to WMO polar activities; progress in developing programme-specific additions to the Practical Guide for the Implementation of a Quality Management System for National Meteorological and Hydrological Services; inter-commission consultations on data policy issues related to GFCS and contributions to the EC Task Team; the develop of common ISO/WMO standards; changes to the WMO Core Metadata Profile and the method of authorizing changes; the Severe Weather Forecasting Demonstration Project (SWFDP); progress on the implementation of WIGOS; the Flood Forecasting Initiative Advisory Group; the implementation plan for the WMO strategy for service delivery; a discussion of the limitations of climate modelling; and progress regarding WMO strategic and operational planning.

At the second PTC meeting, in January 2014, the presidents reviewed the efficiency and effectiveness of inter-commission task teams and working groups; evaluated the recurring problem of a lack of quorum in voting by correspondence for the election of technical commission (TC) vice-presidents (this is an issue that affected CHy during the last intersessional period) and with reaching a quorum even during TC sessions; follow-up actions related to implementation of the WMO Strategy for Service Delivery; progress made in the establishment of the Disaster Risk Reduction Focal Points within technical commissions and technical programmes; impact-based forecasting and risk-based warnings; the WMO emergency response to typhoon Haiyan; the International Cloud Atlas; a new proposed approach to the approval process for WIGOS Regulatory Material (WRM); the WMO Strategic Plan 2016-2019; and the major decisions of the First Session of the Intergovernmental Board on Climate Services (IBCS).

WHYCOS

The president chaired the tenth meeting of the WHYCOS International Advisory Group (WIAG-10) in October 2013. The meeting was informed that the WMO Secretariat is taking action on the recommendations of the WHYCOS independent evaluation conducted at the request of Congress in 2011, and is studying the best operational arrangements in the Secretariat to provide maximum support to the implementation of the programme and its components. Some of the recommendations are also being addressed in the ongoing review of the WHYCOS Guidelines. There was also recognition at the meeting that HYCOS projects cannot continue to stand alone and must be mainstreamed into NHSS networks and activities, linked to other activities of river basin organizations, directed to meet data, information and service needs of society and contribute to value-adding initiatives like GFCS, disaster risk reduction and flood forecasting systems. Meeting participants also underlined the need to develop and pursue a strategy to communicate, publicize and market the benefits of WHYCOS to governments, donors, the private sector, international programmes, private foundations and society at large in order to attract funding.

Flood Forecasting Initiative Advisory Group (FFI-AG)

The president chaired the first meeting of the FFI-AG in October 2013, which had been established in 2011 by Sixteenth Congress (Resolution 15 (Cg-XVI)) to provide guidance and advice on the hydrological forecasting elements of a number of flood-related initiatives and programmes ongoing within WMO, and to provide broad-based support to improve collaboration between the meteorological and hydrological communities for more effective flood forecasting related practices. The primary outcome of the meeting was the development of a workplan for the Advisory Group, which consists of nine activities: (1) advise on the concept, objectives, expected benefits/costs, strategy and action plan, and future development of the WMO FFI; (2) review and assess the FFI status and propose strategies for remedial action as necessary; (3) review and assess the progress of FFI projects upon request; (4) advise on standards for the implementation of the FFI; (5) review the relationship of the FFI with other relevant international programmes; (6) identify and evaluate constraints on and risks to the future implementation of the FFI; (7) consider and propose plans for effective advocacy of the FFI; (8) promote awareness about raising the social and economic benefits and value of flood forecasting systems; and finally, (9) review and advise on the FFI's terms of reference and composition. One area in which particular progress has resulted is in closer collaboration between the SWFDP and the Flash Flood Guidance System (FFGS) with Global Coverage.

Associated Programme on Flood Management (APFM)

The president represented CHy at the June 2013 meeting of the APFM Advisory Committee (AC). The AC reviewed programme activities during 2012-13, and discussed issues related to publications, APFM tools, HelpDesk operations, field demonstration projects, capacity building, outreach, and cooperation with support base partners and the Global Water Partnership (GWP). The AC made several recommendations of particular note, including: (1) that there was a need to develop success and performance indicators, using a results-based monitoring framework, and making use of the experience from the GWP; (2) that a concerted effort should be made to connect APFM and Integrated Drought Management Programme (IDMP) activities with GFCS; and (3) that the GWP should offer financial support to APFM activities under GWP's Water and Climate Programme.

Integrated Drought Management Programme (IDMP)

A joint GWP and WMO preparatory meeting for the IDMP was held in June 2013, immediately following the APFM meeting. The president represented the Commission at this meeting as well. The GWP underscored its commitment to IDMP and stressed the obvious links between IDMP and the APFM. A series of actions/decisions were forthcoming from the meeting, although two were of particular importance. First, highlight IDMP's association with GFCS with promotional material including website links, and second, establish an intermediate, including a "Help Yourself" section that would contain tools and concept papers.

WMO Integrated Global Observing System (WIGOS)

WIGOS is an integrated, comprehensive, and coordinated system comprised of the existing WMO global observing systems, particularly the in-situ and space-based components of the Global Observing System (GOS), the Global Atmosphere Watch (GAW), the WMO Hydrological Observing Systems (WHOS, including WHYCOS) and the observing component of the Global Cryosphere Watch (GCW), including their surface-based and space-based components. The president is a member of the Inter-Commission Group WIGOS (ICG-WIGOS), the body charged by EC, in accordance with Congress, to establish Inter-Commission Task Teams as and

when required with representatives of international partner organizations to address WIGOS standardization process, WMO regulatory material issues, and improvement of WIGOS observing components. Since CHy-14, there have been two meetings of the ICG-WIGOS wherein WIGOS key activity areas have been reviewed. These include: (a) management of WIGOS Implementation; (b) collaboration with the WMO co-sponsored observing systems and international partner organizations and programmes; (c) design, planning and optimized evolution of WIGOS and its regional, sub-regional and national component observing systems; (d) observing system operation and maintenance; (e) quality management; (f) standardization, system interoperability and data compatibility; (g) The WIGOS Operational Information Resource, (h) Data Discovery, Delivery and Archival, (i) capacity development; and (j) communications and outreach. The Inter-Commission Group further agreed on an updated version of the WIGOS Framework Implementation Plan (WIP) to be submitted to EC-66 in June 2014.

WHOS

One of the first issues that the president of CHy confronted in working with the ICG-WIGOS was a broad misperception of what WHYCOS actually is and does. Throughout WMO there was a pervasive impression that WHYCOS was the hydrological counterpart of the Global Climate Observing System (GCOS), the Global Terrestrial Observing System (GTOS), and the Global Ocean Observing System (GOOS). Although when WHYCOS was established in the early 1990s there was a proposal to build an observing network of roughly 1,000 existing stations worldwide, that proposal never materialized. Soon after its creation, WHYCOS became a capacity-building activity that was implemented through the establishment of regional HYCOSs, aimed at assisting developing countries in building an observing capability. As a result, the focus of WHYCOS has always been on facilitating the development of an observing network rather than on providing data from a worldwide network of hydrologic stations. Given the advent of WIGOS, and the emphasis on the data from “integrated global observing systems,” it was clear that CHy had to address the need for an easily accessible database of high-quality, continuous, and near real-time hydrological observations from around the world. To meet this need, the president of CHy has proposed the establishment of WHOS. WHOS is conceived as a portal to facilitate access to already available on-line real-time and historical data, drawing from the water information systems of countries around the world that make their data freely and openly available, including HYCOS projects. Currently, the president and members of the Advisory Working Group are working with a CHy expert to establish a prototype WHOS portal for review by the Commission during 2014.

Re-establishment of the Regional Working Group on Hydrology in RA IV

The president of CHy, working with Hydrological Advisers and experts across RA IV, developed a proposal for the re-establishment of the RA IV Working Group on Hydrology (WGH), which had been disbanded in 2009 as part of a reorganization of management structures within the Region. The proposal included new and specific terms of reference, as well as the establishment of a regional hydrology forum to provide a platform where all the issues and challenges related to the operation of hydrological networks and services can be discussed among interested professionals and other stakeholders. The proposal was debated and approved at the sixteenth session of RA IV in 2013 in Curaçao, and the WGH was subsequently re-established. The Regional Hydrology Forum was developed as an online communications platform in early 2014 to support the RA IV WGH, and is now operating at http://www.whycos.org/chy/WGH_RAIV/.

Activities of the vice-president of CHy (Zhiyu Liu)

The vice-president of CHy is responsible for a diverse suite of Commission activities. One of the more important tasks involves coordinating the review and production of CHy publications. In this regard, the *Note on Stationarity and Non-stationarity* was reviewed and

approved, and has now been published on the CHy website. (See http://www.wmo.int/pages/prog/hwrp/publications/statements/Stationarity_CHy_Statement.pdf.) In addition, *The Guidelines on Hydrological Data Rescue* was reviewed by five specialists, and is being revised by the author. Publication is planned for later this year.

The vice-president is also charged with monitoring and updating the Hydrological Information Referral Service (INFOHYDRO). In support of this activity, a call to hydrological advisers to update the information for their countries contained in INFOHYDRO was issued. The INFOHYDRO website was subsequently updated by the WMO Secretariat in response to the replies received.

Identifying and leading actions associated with the education and training requirements of Commission activities are critical tasks for the vice-president, and several items within this work element have been accomplished to date.

The training material on the WMO Manual on Stream gauging has been translated into Spanish and is being translated into French and a Training of Trainers for Spanish-speaking Instructors on Stream Gauging was held in Mexico from 11 to 15 November 2013. The community of practice of instructors in stream gauging is being developed and is intended to be activated by July 2014.

Distance Learning Courses in Basic Hydrology Sciences were held in 2013 for Asia and Africa, with a second edition for Asia held in March and April 2014. These courses are jointly organized by WMO, COMET, the National Oceanic and Atmospheric Administration (NOAA) and a local WMO Regional Training Centre (RTC), India National Water Academy in the case of Asia and the Institute for Meteorological Training and Research (IMTR) of Kenya for Africa.

One other training-related element of the vice-president's workplan involves the provision of guidance, advice and training on the spatial estimation of rainfall and other hydrological parameters, including the use of remote sensing (e.g. radars and satellites). To assist him in this duty, WMO supported his attendance at the Weather Radar and Hydrology (WRaH) International Symposium, which was sponsored by the American Society of Civil Engineers in Washington, DC in April 2014.

Quality Management Framework(QMF) – Hydrology (Paul Pilon)

An important element of the QMF-Hydrology theme is the continued implementation of the project to assess the performance of flow measurement instruments and techniques (Project X). In the period since CHy-14, five teleconferences and one face-to-face meeting have been held. A workplan has been developed and has been finalized and is ready for consideration by the Advisory Working Group. The workplan, which is a living document, is available at: http://www.wmo.int/pages/prog/hwrp/Flow/flow_tech/workplan.php. A community of practice has been launched for the project management committee to facilitate sharing of documents and communications among participants.

A second element within this theme involves the preparation of background material for NHSs explaining why they should use standard methods in their data collection. A WMO QMF website has been launched (<http://www.wmo.int/pages/prog/hwrp/qmf-h/index.php>) and contains a number of relevant documents.

A third QMF-Hydrology element aims to facilitate the development of policies, frameworks and information sources for promoting standardization/guidance of the most suitable equipment and technologies in order to achieve high levels of reliability, user knowledge training

effectiveness and other economies of scale. The Project X management committee reviewed a proposal for a Hydrometric Technology Verification Program (HTVP). The management committee concluded that such an activity would be advantageous and would add value to currently on-going verification efforts undertaken by NHSs. The management committee has included in its workplan additional consideration of the HTVP, which will likely be referred to as an Independent Verification Proposal. If approved, it will be presented to the CHy Advisory Working Group for its consideration.

A critical quality management element involves coordinating a review of ISO and other standards, and to specify what joint ISO/WMO standards will be and how they will be established. There have been three meetings involving ISO staff, WMO staff, and the AWG member to discuss the process and how NHSs might be able to access ISO publications and use them in the development of Standard Operating Procedures (SOPs) of various NHSs and avoiding potential lawsuits for use of copyrighted material. In a recent meeting, a potential approach to joint standards was proposed whereby WMO, as a liaison to an ISO Technical Committee, could submit a document for consideration under the various categories of ISO publications (i.e., technical document, technical specification, standard). The review process was also discussed. It became apparent that very few documents produced by the WMO Hydrology and Water Resources Programme (HWRP) would likely be submitted through the joint WMO/ISO standard process, while more might be considered through the liaison role. There were two possible advantages that were evident from discussions for having HWRP documents available on the ISO website. One was that having WMO HWRP documents within the ISO system would increase awareness and possible availability, although acquisition through the ISO is at a cost to the requester. The second is that within the ISO process, AFNOR (France's national standards organization) may decide to translate the document into French, with the translation being made available to WMO, which could then make it available to NHSs.

Discussions were also held on how WMO and NHSs might be able to access on-line ISO standards. The AWG member is preparing a preliminary list of ISO documents that would be of most interest to NHSs (e.g., mentioned in Technical Regulations Volume III – Hydrology and in our manuals). ISO is assisting in this activity as are the Project X experts and management committee. Currently, we are guardedly optimistic that progress is being made toward an agreement whereby at least some ISO documents will be made available to NHSs worldwide.

An ongoing aspect of QMF-Hydrology is the review of material for the Technical Regulations (Volume III – Hydrology). A thorough review and revision of the material represents a daunting undertaking, both in terms of magnitude and structure of effort. The existing workplan calls for the formation of an editorial board to oversee and drive the review, but this has not yet happened. The responsible AWG member has suggested the need for appointing an expert who can be tasked with undertaking this review. That suggestion is currently under discussion between the president of CHy and Secretariat staff.

A separate review effort is also underway that is looking at the potential need to revise relevant HWRP documents from a QMF perspective. Recommendations have been made to review and update the *Guidelines on the Role, Operation and Management of National Hydrological Services*, and the *Manual on Low-flow Estimation and Prediction* so that these documents can be given a QMF-H designation, indicating that their contents are consistent with desired QMF practices. To date, an expert has been selected to update the "*Guidelines*" document with a timetable for completing the update by the end of 2015.

The AWG member responsible for QMF-H has been representing CHy on the WIGOS Task Team on WIGOS Regulatory Material (TT-WRM). Drafts of the WIGOS Manual and the WIGOS Technical Regulations have been prepared and are ready for review. Our AWG member has been an active participant in this process to ensure that the many differences between CHy

procedures and those of the rest of WMO are fully understood and accommodated. This has been a very laborious and difficult task, and our representative has served our interests exceedingly well.

Data Operations and Management (Tony Boston)

As requested by CHy-14, a community of practice on database management systems has been established, based on the open source MCH (Meteorology, Climatology and Hydrology) system. MCH, originally developed in Spanish and installed in several Latin-American countries, has been translated into English and French and installed in Ghana, Belize, Curacao, Albania, Bosnia Herzegovina, with several other countries to be added in the next few months. In all cases, NHS staff has been trained in the operation and management of the system.

A significant amount of progress has been made in the development and application of WaterML 2.0. Much of this effort involves close coordination between CHy and the WMO/Open Geospatial Consortium (OGC) Hydrology Domain Working Group (HDWG), on which our AWG member is a co-chairperson. In particular, current HDWG activities include the development of a candidate standard WaterML 2.0, Part 2, on Ratings, Gaugings and Sections. This candidate standard will be tested in the coming months through an interoperability experiment in Australia, the USA, and the UK. There has also been a release of a Sensor Observation Service (SOS) profile for hydrology that defines how WaterML 2.0 should be made available using the OGC web service.

Another aspect of this theme area involves monitoring and reporting on new developments dealing with data management issues, such as observations, data exchange and protocols, data transfer formats, data information, as well as the WMO Information System (WIS) and WIGOS. An awareness-raising article has been prepared and submitted to the WMO Bulletin entitled *Global Initiatives in Hydrological Data Sharing*. An update to the Global Runoff Data Center's (GRDC) Hydrological Metadata profile of ISO 19115 has also been released. Our AWG member responsible for this theme is currently investigating the possibility of publishing a list of commercial and open source water data management systems on the WMO website that support OGC services for hydrological data exchange, along with guidelines on their implementation and use. He is also investigating the use of the WMO Information System (WIS) for registering hydrological data services.

With respect to reviewing progress on the exchange of hydrological data and products, as well as protocols for providing information on data use, a survey was released in September 2013 on the exchange of hydrological data. Initial results were presented to the WMO/OGC HDWG at that time. A list of commercial and open source software systems supporting OGC services for hydrological data exchange have also been identified. It was noted in the results that better engagement with developing countries through WMO Regional Associations is essential to broaden understanding of the value of, and to encourage the use of, WaterML 2.0.

Finally, in terms of testing and applying WaterML 2.0 in pilot projects aimed at demonstrating the value and utility of WaterML 2.0 and providing a basis for it to become a WMO information exchange standard, a project has been implemented by the Italian National Hydrology Survey (ISPRA). ISPRA has built a national hydrologic information system for Italy's federated hydrologic data services from observation sites managed separately in 21 geographic regions across the country. There is a HydroCatalog in Rome that compiles the data from HydroServers in each of the 21 regions. Italy has also developed documentation that supports the exchange of hydrological data using WaterML 2.0. The plan is to host this software (open source) on the WMO website. This website could potentially list Hydrological Information Systems that support OGC web services and WaterML 2.0, and other resources of relevance to National Hydrological

Services. The site will also include updates of progress in this area, focusing on the current state of standards along with examples of software that supports the standard, with an invitation for other compliant software to be listed on request.

Water Resources Assessment (Antonio Cardoso-Neto and Sung Kim)

There had been plans to hold both a regional and a global Workshop on Water Resources Assessment in late 2013, but due to an already busy schedule and other delays, these meetings did not proceed. Planning is now underway to hold these meetings later this year and early in 2015. In the interim, some discussions have been held with experts to determine what type of manual could be prepared and if so what process would be most suitable for its preparation, given the difficulties that we have faced in the past.

Hydrological forecasting and prediction (Yuri Simonov and Johnson Maina)

The members for hydrological forecasting and prediction have had a very busy year, being involved as the focal points from CHy for Disaster Risk Reduction and also representing CHy on the Flood Forecasting Initiative Advisory Group. For the Disaster Risk Reduction (DRR) meeting, a mapping of the CHy activities in support of DRR was undertaken and reported on to the meeting. The CHy representatives were able to demonstrate the importance of end-to-end systems for the delivery of effective flood forecasting and warning systems.

Work has continued in the Secretariat in terms of improvements to the Zambezi River Basin Flood Forecasting and Early Warning System Strategy, supported by the United States Agency for International Development (USAID). Also supported by USAID, work has continued on the development of regional applications of the Flash Flood Guidance System developed by the Hydrological Research Centre in the USA. APFM, in partnership with GWP, continues to compile and produce guidance documents and tools in support of Integrated Flood Management (IFM). Four new tools have been published in 2013, and seven more are being developed. The most recent tools are on Floodplain Mapping, flood forecasting and early warning, transboundary aspects of flood management and coastal flood management. Training activities in support of countries wishing to adopt Integrated Flood Management Strategies are continuing, with three workshops organized in 2013 (for Mexico, Vietnam, the Balkans and Turkey) and five regional workshops being planned for 2014. Moreover, the HelpDesk on IFM has reached a peak in terms of requests received during the same period, either for rapid guidance or for the development and support of pilot projects. APFM is also supporting the EC-funded project PEARL (Preparing for extreme and rare events in coastal regions) in the Seventh Framework Programme (FP-7), as well as the Instrument for Pre-Accession Assistance (IPA) “Building resilience to disasters in Western Balkans and Turkey”. The Integrated Drought Management Programme (IDMP), also in partnership with GWP, is now operational with a Technical Support Unit in the WMO Secretariat, to which contributes also GWP through a seconded expert working in WMO. A number of country and regional workshops have been held over the last few months, also in close linkage with GWP initiatives.

You will recall that at CHy-14, Italy offered to make the DEWETRA platform freely available to members of CHy. The DEWETRA platform is a real-time integrated system for hydrometeorological and wildfire risk forecasting, monitoring and prevention. It has the capability to ingest data from different sources and produce several types of integrated maps, useful for risk-management decision-makers. As a follow-up to the offer above, WMO organized a workshop in Rome in October 2013, where representatives of 15 countries, from all RAs, were introduced to the system, and the procedures to be followed in case they were interested in requesting it for their country were explained. A Cooperation Agreement between WMO and the Italian Department of

Civil Protection (the “owner” of the software) was signed and the first installation mission was undertaken in May 2014 in the Philippines, with the next scheduled for August 2014 in Ecuador.

Water, Climate and Risk Management (Jan Danhelka)

The member responsible for water, climate and risk management has made progress on a number of elements in his workplan, including extended hydrological prediction and downscaling. He attended the AGU Chapman Conference on Seasonal to Inter-annual Hydrological Prediction in Portland, Oregon in July 2013. He presented the CHy activities in the field of extended hydrological prediction (EHP), including the template for case studies and the proposal for the EHP definition. Jan assisted in the development of the Water exemplar for GFCS and represented CHy at the IBCS-1 (July 2013) as a delegate of the president of the CHy. He also represented CHy at the 2nd meeting of Joint Commission for Climatology/Commission for Agriculture Meteorology/CHy Expert Group on Climate, Food and Water and the 5th International Symposium on Climate, Food and Water on Jeju Island in November 2013. The proposed meeting on downscaling will take place in mid-2014.

Chair of the Intergovernmental Council of the International Hydrological Programme of UNESCO (Johannes Cullman, ex-officio member)

Johannes Cullman has continued to provide excellent coordination between CHy and the IHP of UNESCO and contributed significantly to activities associated with hydrological forecasting and prediction. In particular, he has finalized a report on the intercomparison of flood forecasting models and is in the process of preparing for a meeting on extended hydrological prediction in association with Jan Danhelka.

In late 2013, WMO (Secretary-General) and UNESCO (Director-General) signed a new set of working arrangements between the two agencies.

Yours sincerely,

(original signed)

(Harry Lins)
President
Commission for Hydrology

