



ARCTIC-HYCOS PLANNING AND IMPLEMENTATION MEETING

GENEVA, SWITZERLAND, 26-27 MARCH 2014

FINAL REPORT



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Introduction and Welcome

The Arctic-HYCOS planning and implementation meeting was held on 26 and 27 March 2014 in WMO Secretariat headquarters in Geneva (Switzerland). The list of participants is attached as Annex I

Mr B. Stewart, Director, Climate and Water Department, welcomed the participants on behalf of Mr M. Jarraud, WMO Secretary General. He recalled that the WHYCOS programme has been, since its inception 20 years ago, a quite successful undertaking, helping to improve hydrological data collection and management, especially in developing countries. The main challenge continues to be the long-term sustainability of project achievements, by promoting the use of collected data to produce user-oriented information. He underlined the uniqueness of Arctic-HYCOS in that it is the first HYCOS component being implemented by developed countries, which is perceived as being very positive for the long-term sustainability of the project.

Mr H. Lins, President of the WMO Commission for Hydrology (CHy), added his words of welcome and underlined that, considering the technical and scientific capabilities of participating NHSs, Arctic-HYCOS could well become a source of innovative practices and tools to be shared with other HYCOS components worldwide.

Meeting objectives

Mr A. Pietroniro recalled the outcomes of the previous meeting held in Halifax, Canada, in 2012, wherein there was agreement on developing a science-driven project, focussed on monitoring, uncertainty assessment, a pan-arctic analysis system, and agreed upon the principles of data sharing. He then reviewed some recent progress with moving towards project implementation, where a document on it had been circulated two months earlier.

He also noted that a formal letter of agreement had been signed by all participating countries; and Canada had expressed its willingness to host the regional centre. He indicated that the next steps in the project implementation are:

- Establishing a web site with data
- Publishing a peer-reviewed article on freshwater fluxes into the Arctic Ocean
- Establishing a workable mechanism to provide monthly data to users
- Assessing the contribution and influence of the ungauged basins' flows to the Arctic Ocean

He also indicated some points to be further discussed, such as the inclusion of water quality data, use of satellite observations, and the start date at which systematic (historical) records should commence and be made available as part of the exercise.

WHYCOS overview

Mr T. Abrate, from WMO Secretariat, provided a brief overview of the WHYCOS programme, the status of implementation of the various ongoing and planned HYCOS components, and the recommendations issued by the WHYCOS review carried out in 2012, which had been reviewed by WIAG and CHy. Particular emphasis was placed on the WMO oversight role, the need for formal commitment from participating countries to participate in the project and share their data and information in the spirit of WMO Resolutions 40 (Cg-XII) and 25 (Cg-XIII).

Review and approval of draft Arctic-HYCOS Implementation Plan

Mr P. Pilon, C/HFWMD, introduced to the participants the project document, reminding that purpose and objectives of the project had already been endorsed in previous meetings. Two types of station were identified: those suitable for monitoring freshwater fluxes to the Arctic Ocean (Sub-Network A) and those suitable for studying changes in the hydrological regime (Sub-network B). Daily data (especially discharge and temperature) from selected stations should be reported on a monthly basis in provisional form (with caveats on their quality when appropriate) and in quality-controlled/approved form as soon as they are available according to national practices. The need to share descriptions of the procedures adopted (e.g. under ice flow estimation) by each country in this regard was also underlined as being of importance. Various revisions to the draft project implementation plan were discussed and provided by meeting participants. The meeting also discussed and agreed on the composition of the Arctic-HYCOS Project Steering Committee (PSC). It was also mentioned that this meeting could be considered the first such meeting of the PSC. It was agreed that the suggested revisions would be incorporated in the draft plan and circulated to meeting participants for their review and approval.

Global Runoff Data Centre

Mr U. Looser from the Global Runoff Data Centre (GRDC) gave a brief overview of the operations and data holdings of the GRDC. Currently quality controlled historical discharge data are available from about 9000 gauging stations covering 158 countries. The GRDC hosts no real-time data.

GRDC data policy is strongly linked to WMO Resolution 25 (Cg XIII-1999). GRDC accepts only written data requests for scientific and research purposes and requestors have to sign a user declaration stating that they agree to Resolution 25 principles, especially refraining from commercial use and redistribution to third parties.

The GRDC data holdings of the Arctic Runoff Database, a subset of the GRDC database were presented. Currently 2412 stations from 9 countries (Canada, Denmark, Finland, Iceland, Kazakhstan, Mongolia, Norway, Russian Federation, and United States of America) are included. Updates for a large number of stations have been received recently, and the GRDC is in the process of receiving them. Exceptions are for the stations in Kazakhstan and Mongolia, where no recent data have been made available (see Annex II).

GRDC also hosts Global Terrestrial Network for River Discharge (GTN-R). The arctic stations identified for the GTN-R are more or less in line with the selection criteria for the Arctic-HYCOS Sub-Network A. GRDC also hosts the Climate Sensitive Stations Network, proposed by the CHy and whose selection criteria match the proposed Arctic-HYCOS Sub-Network B.

The GRDC offered to host the historical (quality controlled) discharge data from all identified stations and make those data available to the scientific and research communities according to its established policy and practices.

Member countries status update on providing near real-time data

Canada

Mr A. Pietroniro provided a presentation on the Water Survey of Canada (WSC), its governance structure, and its overall goals and objectives as a national hydrometric monitoring programme. Mr. Pietroniro discussed issues on cost-share agreements, transboundary waters, national administration of the programme through its partners, and the overall size and scope of the network. He mentioned the existing and beneficial close-working relationship that exists between the WSC and the United States Geological Service (USGS); and the free and consistent flow of information between the United States of America and Canada on matters related to hydrometry, training and data production. He discussed his programme's involvement with international treaties and some of the obligations therein. He also pointed out some of the existing challenges concerning under-ice measurements, network density, rising costs, and logistical issues. He also reviewed some of the motivation for existing monitoring in the north and provided some background on the northern network. He mentioned the value of the HYCOS network in furthering the resolution of these issues collectively as a community of practice.

USA

Mr J. Conaway's presentation focused on the general hydrology of Alaska and the role of the USGS stream gauging program. The U.S. Arctic is comprised of the northern portion of the Brooks Range, the Brooks Range foothills, and the Alaskan Arctic Coastal Plain. Snowmelt is the largest contributor to runoff in these areas contributing as much as 70 percent to the total runoff at the mouth of larger arctic rivers. Much of this runoff is concentrated in a period of two or less weeks during the spring breakup when discharge record is often estimated due to backwater effects of ice in the channel. The majority of freshwater inflow to the Arctic Ocean from Alaska is from rivers that are located south of the Arctic Circle. Freshwater discharge from south-central Alaska is transported via the Alaskan Coastal Current towards the Bering Sea making an unknown contribution to the Bering Strait Current that also collects discharge from the Kuskokwim and Yukon Rivers as it heads north. The freshwater flux from the Bering Strait to the Arctic Ocean averaged 2,500 cubic kilometres per year between 1990 and 2004. Seven stream gauges with a stable funding source were identified as important to the Arctic-HYCOS project. These stations are a mix of locations that are important for understanding freshwater flux to the Arctic Ocean as well characterizing arctic hydrology. Quality assured and quality controlled temperature records are collected at some of these gauge locations but were identified as a priority for all sites. Collection of these data will begin during open water in 2014.

Russian Federation

Mr. V. Vuglinsky reported on the hydrological observation system for the Russian Federation describing its structure and main components. He noted that the hydrological network within the Russian territory had decreased up to 30 % during the last three decades, including the Arctic region. At present 236 river stations and 52 stations on the lakes in the Arctic region of Russia are operating. The system of hydrological data processing (i.e., the Water Cadastre

system) was described. Mr. Vuglinsky also reported on ongoing projects for the period 2012-2020 on the modernization and optimization of the networks.

Sweden

In presenting the Swedish status, Mr D. Gustafsson highlighted that, since none of the Swedish hydrological observing stations are situated in rivers draining to the Arctic Ocean, the Swedish Meteorological and Hydrological Institute contribution to the project will be mainly represented by data from a pan-Arctic deterministic hydrological model (Arctic-HYPE). This activity will be implemented in parallel to the other Arctic-HYCOS activities, providing assessment of provisional and quality assured observational data, estimates of ungauged flow, and overall estimates of freshwater flux into the Arctic Ocean. However, it was also decided that a selection of Swedish discharge stations, which are already being provided to GRDC, will be included in the network design and analysis for Sub-network B, i.e. stations suitable for studying changes in hydrological regime of the Arctic region.

Finland

Ms J. Korhonen presented on hydrological monitoring in Finland. Finnish Environment Institute (SYKE) is responsible for the co-ordination of the hydrological monitoring network and the operation of relevant data systems. Hydrological fieldwork is done by 13 regional centres. Additionally, local observers are engaged. She also recalled that only a small amount of Finnish rivers flow into the Arctic Ocean, as most flow to the Baltic Sea

The national network consists of about 300 stations for surface water level and river discharge measurement. The automation rate of water level stations is about 80%. Most automatic stations provide data at least every hour, but only daily averages are quality controlled in the database. Discharge is mostly determined by use of rating curves, which are rather stable. Hydropower companies also provide water level and discharge data, and they are responsible for their data quality. Winter discharges are at some places biased due to the effect of ice-cover. Corrections to compensate for the effect of ice are done afterwards, not in real time. SYKE uses in-house developed software to make graphical ice corrections with the help of weather data, winter discharge measurements and modelled values. ADCP under-ice measurements were taken for test purposes during the winter of 2013-14.

SYKE has an open data policy, and automatic data transfers have been implemented (e.g. neighbouring countries, GRDS, EFAS).

SYKE has a surface water temperature network with about 30 observation sites, mostly in lakes. Measurements are done during the open water period, once a day, at a depth of 20 cm. Many of automatic water level stations also provide water temperature data at the sensor's depth, but these data are not validated.

Iceland

Ms J. Harðardóttir underlined the importance of groundwater flow in Iceland, which is approximately 10% of the total discharge, and the practical difficulties encountered in its measurement. Other difficulties faced are linked to the amount of solids transported and to

the intermittent icing of rivers during the cold season. She also reported that a 25% increase in runoff has been detected, with being attributed to the effects of climate change.

Icelandic Meteorological Office is responsible for the management of the observing network and receives support for its maintenance from hydropower companies. It is also implementing research programmes in hydrology and glaciology.

Norway

Mr M. Johnsrud reported that Norwegian Water Resources and Energy Directorate (NVE) is managing a network of about 2000 stations on different parameters, of which about a quarter are reporting in real time. NVE has approximately 60 stations in operation observing water temperature. This network is coordinated with that of the Norwegian Meteorological Institute to support the provision of avalanche and debris flow forecasts. NVE has implemented an open-data access policy applicable also for commercial purposes. Private and state owned hydropower companies in Norway are also collecting data on streamflow and some other parameters. Most of these data are openly made available for common use provided they have not been defined as being sensitive for the electrical market.

WHOS (WMO Hydrological Observing System)

Mr H. Lins (President, CHy) provided an overview of the WMO Hydrological Observing System (WHOS), as an effort to facilitate online access to near real-time and historical discharge data contained in the water information systems of countries around the world that make their data freely and openly available via the internet. WHOS is envisaged as providing the worldwide hydrological network that was planned as WHYCOS in 1993, but that never came to fruition. The original WHYCOS design was for a global network of 1,000 stations, operated in conjunction with a distributed water information system, to capture data and information on the hydrological cycle. As a result of the need to fill gaps in the spatial coverage of observing stations, particularly, in the developing world, WHYCOS shifted its emphasis to capacity building through the establishment of regional HYCOS projects. It was anticipated that, over time, these projects would collectively form the building blocks of WHYCOS. When this happened, however, all work ceased on establishing the remainder of the global network based on existing stations, and the goal of building a worldwide hydrological database has never been realized. To rectify this situation, WHOS has been proposed as a simple web-based portal to near real-time and historical hydrological data that are already freely and openly available online. As HYCOS projects mature and are able to provide data, they would be included within WHOS. In this regard, Arctic-HYCOS is viewed as a critical example of what other regional HYCOS projects can and should aspire to, because it is already capable of providing data to WHOS. Meeting participants voiced support for the WHOS concept, and for the Arctic-HYCOS component serving as a source of input to WHOS.

Discussion on next steps for Arctic-HYCOS implementation plan

The meeting agreed to focus during the initial stages of the project on collecting data on discharge and possibly sediment transport and temperature, leaving water quality data, ice thickness and dates of freeze-up and break-up of ice to a later phase. A working group, comprising representatives of Canada (Mr A. Pietroniro to identify the expert), Russian

Federation (Mr V. Vuglinsky), Sweden (Mr D. Gustafsson), and the United States of America (Mr R. Lammers) was established to define the selection criteria for the stations. WMO criteria for the identification of climate sensitive stations were cited as being potentially useful in the establishment of such criteria for Sub-network B. It was envisaged that the working group would develop in the first six months an initial list of stations for Sub-network A, with the final selection of stations being done by each participating country. The intent was to initially focus on Sub-network A, to be followed shortly thereafter by defining those stations fulfilling the criteria established for Sub-network B. In particular for freshwater flow to oceans, it was recommended to choose stations close to the mouth of rivers and another immediately inland for back-up purposes; while for studies of change in the hydrological regime, stations located in headwater and small sub-catchments, including pristine basins, should be included. It was also felt that stations outside the Arctic Ocean basin, such as at the mouth of the Yukon River, Baltic Sea and Hudson Bay, can also be considered to allow a better understanding of processes occurring in the general region.

Data collection and dissemination procedures for the project should be based on an automatic data gathering process and on a single-point data access for users. Countries shall facilitate, to the extent possible, access to their data banks, especially those that are not yet regularly publishing their data on the Internet. Discussions also focused on activities to facilitate easy access to data. Initial activities were to commence on making provisional data available on-line using automated retrieval approaches. Mr R. Lammers had agreed to develop such a pilot system with assistance of each country, as their participation was needed to develop access procedures to provisional data holdings. Mr R. Lammers also agreed to inform all participants of the specific technical problems encountered in accessing their data. At a later stage, data exchange standards, such as possibly WaterML2.0, will be implemented, when such standards become available and have been adopted for general use.

The meeting also proposed that data hosted in GRDC data base from countries that have embraced a free and unrestricted access policy, should be directly downloadable from GRDC web site. GRDC facilities shall also be used for hosting Arctic-HYCOS historical data, as a subset of its data archive. The meeting also agreed that there is need to develop operational procedures to ensure that revision and amendment to data that have been transferred to GRDC, are adequately reflected in its data base.

The meeting also agreed on the need to define a set of products, based on user community needs that can be developed with the data produced by the project, and on the need to prepare a statement on the possible future use of data and their dissemination.

From discussions, it was evident to participants that additional efforts could be undertaken on the review and development of recommended practices and procedures. Three areas where attention could be directed were identified. These included: 1) acquiring the temperature of water in rivers and lakes; 2) undertaking hydroacoustic measurements under ice conditions; and 3) how to apply corrections to compensate for the effect of ice. Participants agreed to share with each other how they currently approach each issue and would share all relevant documentation prior to the next meeting of the Project Steering Committee.

Summary and closing remarks

The participants agreed on the following actions and relevant dead lines:

List of station to be prepared by participating NHS	by March 2015
Mr R. Lammers to inform all participating NHS of the specific technical problems encountered in accessing their on-line data	

The participants were pleased to learn of and accepted the kind invitation from the representative of Iceland to host the next meeting of the Project Steering Committee of Arctic-HYCOS, with the meeting being tentatively scheduled for 24-25 March 2015.

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Annex II

GRDC arctic data holding

Country	Arctic Runoff Database	Availability
Canada	822	Up to 2013
Denmark	1	Up to 2013
Finland	3	Up to 2013
Iceland	11	Up to 2002
Kazakhstan	97	Up to 1994
Mongolia	5	Up to 1984
Norway	31	Up to 2008
Russian Federation	1405	Up to 2011
Sweden	-	Up to 2013
United States	37	Up to 2013
TOTAL	2412	