Second Meeting of the Steering Committee for the International Data Centre on the Hydrology of Lakes and Reservoirs (HYDROLARE)

St. Petersburg, Russian Federation, 15-17 July 2009

FINAL REPORT

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Second Meeting of the Steering Committee for the International Data Centre on the Hydrology of Lakes and Reservoirs (HYDROLARE)

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The second meeting of the Steering Committee (SC-II) of the International Centre on the Hydrology of Lakes and Reservoirs (HYDROLARE) took place at ROSHYDROMET's State Hydrological Institute (SHI) in St. Petersburg, Russian Federation, on 15-17 July 2009. Main goals of the session were to assess progress against the milestones agreed at the first meeting in 2007, to address issues related to implementation, and to bring relevant international partners of SHI into the picture.

1. Opening and Objectives of the Meeting

The meeting was opened by the Director of SHI, Dr Shiklomanov, who stressed the importance of the goals and objectives of HYDROLARE for the international community and wished the group success in its deliberations. After a tour-de-table of participants (Annex 1), the proposed agenda was adopted with the proviso that a site visit be added on Thursday afternoon, at the request of SC members (Annex 2). Dr Vuglinsky, Head of HYDROLARE, was accepted as Chair of the session. In his opening remarks, he recalled that the principal objectives of HYDROLARE were to establish, develop and regularly update the international database on the hydrological regime of lakes and reservoirs in order to:

- stimulate the development of the global monitoring system on lakes and reservoirs for rational use, preservation and management of their water resources;
- improve the knowledge of lateral fluxes transformation within lakes and reservoirs;
- supply data for scientific and educational purposes, modelling, development of different global and regional projects/programmes.

(cf. Annex 4.1/4.2 for Agreement between WMO and ROSHYDROMET on HYDROLARE)

He outlined as the main objectives of the meeting to
- review progress against activities agreed at SC-I in 2007;
- strengthen collaboration between HYDROLARE and its international partners;
- discuss plans to integrate data on lakes and reservoirs from both in-situ and space-based observing systems, and to generate demonstration products;
- agree on a work plan for 2009-2010.

Mr Blinov addressed the Committee on behalf of the Head of ROSHYDROMET, Mr Bedritsky. He explained the importance of the issues HYDROLARE was going to address related to water resource management, in support of climate change research for the planned IPCC Fifth Assessment Report, and relevant to the assessment of and adaptation to climate change impacts. Information on lakes and reservoirs was highly relevant as an integrator subjected to climatic as well as water management effects on water bodies. Mr Blinov confirmed the commitment by ROSHYDROMET to facilitate in every possible way the activities of the Centre and expressed his strong expectation that the Centre would meet all its internationally-agreed objectives and apply due diligence to the accomplishment of the milestones and actions recommended by the International HYDROLARE Steering Committee.

2. Status Report of HYDROLARE

2.1. Progress Report June 2007 - July 2009

Dr Vuglinsky presented a report on HYDROLARE activities in the period since SC-I in June 2007, focusing on organizational as well as technical progress. On the technical side, a prototype database application has been developed, tested during 2008 and completed in early 2009.

It allows storage and retrieval of data and metadata on lakes and reservoirs. The relational database model foresees metadata on location and type of measurement gauges (using, *inter alia*, the WMO Regional Associations geographical structure) as well as hydrographical and morphometric information on the water body in question. Further, the database has placeholders for mean monthly water levels and levels on the first date of each month, surface water temperature (mean monthly and maximum), and maximum ice cover thickness. Metadata on all lakes in Russia and the Commonwealth of Independent States (CIS, former Soviet Union) have been entered into the database, along with historical observational data for 697 lakes in Russia and other CIS countries. Test operations of the HYDROLARE data management system were undertaken during 2008, and completed in early 2009 (for more detail, see section 2.2).

In an attempt to make worldwide data on lakes and reservoirs available through HYDROLARE, in November 2008, WMO on behalf of HYDROLARE distributed a questionnaire to all its Member countries, soliciting information on the availability of data on lakes and reservoirs and the willingness and ability to submit these data to HYDROLARE. Until March 2009, responses have been received from 46 Member countries which are indicative of: number of gauge stations, different types of available hydrological data, archive types (paper, digital), and availability of historical vs operational data. 32 Members agreed to share their data holdings with HYDROLARE (see Annex 5), and follow-up is now needed.

As for organizational matters, HYDROLARE has been formally established through an Agreement between ROSHYDROMET and WMO which was signed on 5 May 2009, with the exchange of documents celebrated during the 61st session of WMO Executive Council in June 2008 (see Annex 4.1/4.2). A HYDROLARE logo was created and a website (http://www.hydrolare.ru) established.

The Committee commended Dr Vuglinsky and his colleagues for progress made in the implementation of HYDROLARE and decided to defer the discussion on the future work plan to the last day of the session. It stressed that a functional web-accessible HYDROLARE database was a prerequisite for meeting the expectations of the international community of simple access to data on lakes and reservoirs.

Further, it welcomed the positive response by WMO Members to the HYDROLARE call for information but stressed that in many countries, institutions responsible for routine observations of lakes and reservoirs were different from those represented by the Hydrological Advisors to WMO Permanent Representatives (to which letters from WMO Secretariat are always addressed). The Committee therefore requested HYDROLARE to directly contact national and international institutions known for archiving and distributing data and derived products as soon as possible (see Annex 3). It also added that appropriate follow-up was needed with those Member countries that had indicated their willingness to collaborate. HYDROLARE should also explore the reasons for which 14 Members declined sharing their data.

2.2. Status of HYDROLARE Database Application and Data Content

Dr Gusev presented the status of development of the HYDROLARE database, currently consisting of a subset of the full SHI data holdings. The HYDROLARE database contains a range of metadata (“passport data”) for 697 lakes in Russia and former Soviet Union states. For those lakes and reservoirs, observations of hydrological parameters from near shore and on open water are available, partly consisting of long time series in digital form. A focus in the HYDROLARE data model, according to a recommendation by SC-I, has been on,
For individual gauge stations:

- mean monthly water level,
- mean monthly water temperature,
- highest water temperature per year (including date),
- maximal ice thickness per year (including date),
- Freeze and break-up dates (or modifications thereof, e.g. period of full ice coverage, ice-free period).

For averages for water bodies (observed by more than one gauge station):
- mean monthly water level,
- water level at the first date of each month.

Many datasets before 1989 are still available on paper only, and steps need to be taken to digitize them systematically. Priorities for digitizing such records, perhaps with support by WMO and GCOS, should be made as soon as a complete inventory of existing data records is available. The list of GTN-L lakes could serve as a starting point in this prioritization.

Dr Gusev also reported on the status of the database application system, currently based on MS Access, to be migrated to the relational database management system Firebird. Database report generators have been developed, and a SHI-internal graphic user interface to search and view data has been demonstrated. A metadata coding system has been developed, with identifiers for all water bodies (TRSSNNN: Type, WMO Region, WMO Subregion, Number of station).

The Committee thanked Dr Gusev for his presentation. It recommended that SHI prepare two documents that describe in detail, respectively, (1) the current status of the HYDROLARE database application, and (2) the current data available in the HYDROLARE database, and availability of (digital/paper) metadata and data records on lakes and reservoirs in preparation for HYDROLARE, from all sources (Russian Federation, former Soviet Union, foreign countries) and detailed by hydrological parameters. The Committee also suggested the possibility of English language training for technical staff of HYDROLARE to facilitate their collaboration with partner institutions.

The Committee further emphasized the following points related to data on lakes and reservoirs in HYDROLARE:

For each time series:
- Start and end points in time need to be known;
- For each altitude (water level) datum, the reference geoid needs to be known;
- For each parameter, expected accuracy should be stated;
- If they cannot be physically incorporated into the HYDROLARE database, hyperlinks or contacts to sources should be established;
- A unified, web-based view on metadata should be achieved; consistent, internationally-accepted terminology should be used (e.g., for names of lakes).

2.3. Observations of lakes and reservoirs in the Russian Federation

The system of nation-wide observations of hydrological components was introduced by Dr Vuglinsky, consisting of networks on lakes and reservoirs, networks on swamps, networks on evaporation, water balance, and rivers and channels. During the last ten years, the Russian Federation maintained around 350 gauges (1986: 514; 2007: 354), located at 160 lakes and 71 reservoirs. Metadata and data for all these gauges are available at SHI. Many small water bodies are not being monitored, and Dr Vuglinsky expressed his hope that space-based observations may help monitoring these smaller lakes and reservoirs in the near future. In addition to the different parameters observed at such gauges (e.g., lake level, water surface temperature), open water measurements are also being carried out routinely, such as of ice thickness, currents and water profile temperature.

The Russian National Water Cadastre consists of six sub-databases in which data for different user communities (federal, regional, local level) are being archived. In maintaining the cadastre, basic data processing and analysis steps are being made, resulting in a range of regular publications, such as the yearbook of water resources for each region in Russia. Dr Vuglinsky also informed the Committee about the establishment of an Automated Informational System for enhanced collection, quality control and processing of observational data within Russia. He mentioned the introduction of a new water code at ROSHYDROMET which is aimed at facilitating the exchange of data on lakes and reservoirs on a national level.

2.4. Role of Lakes and Reservoirs in the Global Hydrological Cycle

Dr Lemeshko described the role of lake water abundance within in the global hydrological cycle, e.g. average residence times of water in different water bodies (17 years on average for lakes, compared to 16 days in rivers), and stressed their importance as a freshwater resource for human activities. Russia has about 2.76m lakes, of which over 35,000 with a surface area above 1km².

Furthermore, Ms Lemeshko elaborated on artificial lakes, also called reservoirs, which have always been constructed by mankind primarily for addressing problems of water supply, or alternatively for providing flood or drought protection. In modern times, they also were used for such purposes as hydropower generation, sports and commercial fisheries and water-based recreation. Nearly all the world's major river systems have reservoirs in their drainage basins, and 800,000 reservoirs are now in operation worldwide. Approximately 1,700 large reservoirs are currently under construction, particularly in developing countries. SHI assessed the total reservoirs volume in the world to 6370 km³, 14.9% of the world's renewable water resources.

Ms Lemeshko illustrated the different factors contributing to the water balance of lakes and reservoirs and mentioned the influence of lakes on regional climate conditions due to the effect of evaporation on local convection systems. In conclusion, she suggested participation of HYDROLARE in the ILEC-UNEP-Japan-sponsored initiative "World Lake Vision : A Call to Action".

The Committee expressed its appreciation for Ms Lemeshko's overview presentation and requested its publications on the HYDROLARE website.

3. Data Integration and Product Generation

3.1. Space-based observations for monitoring lakes and reservoirs

Dr Cretaux introduced the principles of satellite altimetry (laser and radar) utilized to monitor water levels of lakes and man-made reservoirs, major river basins, floodplains and temporary lakes. Altimetry contributes to many hydrological application areas, such as surveys of water-level variation used in global and local-scale water budgets, charting of floodplain dynamics, hydrodynamic modelling, and input to global databases such as HYDROLARE. Space-based observations complement in-situ gauge data, and provide a tool for continuous monitoring of lakes and reservoirs where no gauge data are available.

Dr Cretaux stressed that although current satellite altimeters were built for the purpose of ocean sea-level observations rather than monitoring land-based water bodies, many water level time series in the database routinely maintained by LEGOS (Hydroweb[1], currently featuring 150 lakes) were demonstrated to meet GCOS accuracy requirements (10cm). The accuracy of water level (validated with in-situ gauge data) is mainly dependent on the water bodies' size, shape (i.e. intersections of surface area with the satellite ground track) and surrounding topography. Along with multispectral optical and IR imagery, space-based water level information can be used to derive time series of water volume variation. Using the example of the Aral Sea, Dr Cretaux demonstrated very good agreement of these time series with volume estimates derived from in-situ data.

LEGOS was addressing two out of three satellite-based products identified in GCOS-107 (T.1.1, T.1.2) as being a priority for climate-related studies:

- Gridded geo-referenced maps of 250 m spatial resolution on a monthly basis for 20 lakes, along with hypsometry curves
- Radar altimetry over 150 lakes with 5 to 50 cm accuracy depending on size of the lake including ~40 lakes of the GTN-L

[1] http://www.legos.obs-mip.fr/en/soa/hydrologie/hydroweb

Plans foresee extension of Hydroweb to include all (currently) 156 lakes in the GTN-L. In conclusion, he emphasized the interest by LEGOS to contribute its current (space-based) Hydroweb database on lakes and reservoirs to HYDROLARE, given the mutual benefits of in-situ, mostly gauge-based data on lakes and reservoirs, and satellite-derived information.

The Committee warmly welcomed Dr Cretaux's presentation and recommended continuing close collaboration between HYDROLARE and LEGOS on organizational as well as technical levels. It also noted the potential benefits associated with using the SRTM-derived water basin map HydroSHEDS.

3.2. Observing the GCOS Essential Climate Variable Lakes

On behalf of the Global Climate Observing System (GCOS) Secretariat, Dr Bojinski introduced the main principles for observing systems and datasets to meet the needs of climate scientists. In general, an optimal balance of satellite and *in-situ* systems and adherence to the 20 GCOS Climate Monitoring Principles were necessary to ensure that climate data users had datasets of well-known accuracy and high stability of time series at their disposal.

Lake levels are one of the currently 44 Essential Climate Variables identified by GCOS in the GCOS Implementation Plan[2]. More detailed user requirements specifically for satellite-derived observations of lake area, lake level and lake temperature are given in GCOS-107[3]. For systematic global monitoring, 156 lakes in the Global Terrestrial Network – Lakes (GTN-L) have been proposed as a priority (see Annex 8 of SC-I Report), focussing on the largest lakes worldwide, primarily closed-basin lakes that include major ephemeral lakes, and a selection of the largest open lakes.

Dr Bojinski stressed that, in order to support climate change research in view of the IPCC Fifth Assessment Report, HYDROLARE should focus on providing comprehensive time series for all lakes in the GTN-L. For this purpose, national hydrological services and other relevant national institutions should eventually agree to submit weekly/monthly lake level/area data for GTN-L lakes to the HYDROLARE; complemented by the submission of weekly/monthly altimeter-derived lake levels by space agencies. Further, historical data on those parameters for all GTN-L lakes should also be made available. Finally, surface and sub-surface water temperature of lakes and reservoirs, and their date of freeze-up and date of break-up are of interest to the climate community.

In response to Dr Bojinski's talk, Dr Blinov confirmed the commitment by the Russian Federation to fully contribute its data on freeze-up and break-up of lakes and reservoirs to the international community through HYDROLARE.

The Committee welcomed the setting of priorities in the selection of lakes and reservoirs encompassed by HYDROLARE and recommended, on the grounds of a few omissions of major lakes in the current GTN-L, to review the list by November 2009.

3.3. Development of a HYDROLARE Science and Applications Plan

HYDROLARE requires close links to the scientific and operational user communities in the fields of hydrology and climate. The development of HYDROLARE should be guided by a Science and Applications Plan, which would ensure that the needs of these communities for data will be met. This Plan should contain a review of relevant scientific literature, describe the state-of-the-art and demonstrate the areas where HYDROLARE will be beneficial to the users. It should encompass a 5-10 year time horizon, not exceed 20 pages in length. Similar documents from GRDC and GEMS/Water can be used as examples.

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[2] *Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC* (GCOS-92, October 2004); http://www.wmo.int/pages/prog/gcos/Publications/gcos-92_GIP.pdf (currently under review)

[3] *Systematic Observation Requirements for Satellite-based Products for Climate – Supplemental Details to the GCOS Implementation Plan* (GCOS-107, September 2006); http://www.wmo.int/pages/prog/gcos/Publications/gcos-107.pdf

3.4. HYDROLARE Product Generation

Apart from becoming fully operational in technical terms, HYDROLARE should focus on the following aspects of product generation (see Action list in Annex 6):

In the short-term (until the end of 2009):

Develop full search & explore functionality of database; using simple statistical tools (e.g., GEMStat);

Mid-term (until end of 2010):

Carry out demonstration project showcasing integration of in-situ and satellite-based data;

Long-term: (< 3 years):

Time series of volume changes of lakes in GTN-L on a monthly basis.

4. Collaboration with Partner Institutions

4.1. Global Runoff Data Centre

In his overview of activities at the Global Runoff Data Centre (GRDC) hosted by the German Federal Institute of Hydrology (BfG) and supported by the German Government, Mr Looser elaborated on the status of the Global Runoff Data Base, the dissemination of products, data policy issues and the reporting framework.

The runoff database currently has data from more than 7300 river gauge stations worldwide, 4900 thereof with daily data. Since the early 2000s, there has been a strong increase in user demand for data, especially from operational hydrology and climate research communities. Based on the European Terrestrial Network for River Discharge (ETN-R), a service has been built to support the European Flood Alert System (EFAS) by the regular provision of river gauging data in near real-time. It uses a software system for the automated collection, harmonisation, processing and re-distribution of real-time water level and discharge data, along with mapping tools of stations in Google Earth used for process monitoring. This infrastructure serves as the basis for monitoring the Global Terrestrial Network River Discharge (GTN-R), designed to provide a global runoff dataset to assess freshwater fluxes into the world's oceans.

GRDC data acquisition is governed by WMO Resolution 25 (Cg-XIII-1999) on free and unrestricted exchange of hydro-meteorological data, and largely opportunity-driven through individual contacts within National Hydrological Services and other institutions. Only for a limited number of countries, automated internet data downloads are performed routinely. In most cases, cooperation between GRDC and data providers relies on voluntary cooperation and goodwill. Different data formats and standards used by providers pose a constant challenge to data quality.

GRDC performs plausibility checks on all received discharge data and metadata, and potential questionable data are referred back to providers for correction. Once data have passed quality checks, they are archived in the Global Runoff Data Base. Ownership of the data remains with the original data provider, GRDC merely serves as the data custodian, but not as the owner.

Data are available in principle in a free and unrestricted way, and made available to users upon (written) request.

The Committee recommended that GRDC data policy and data dissemination practices serve as a model for HYDROLARE. It also strongly encouraged HYDROLARE technical staff to visit GRDC to share experiences in designing the database application, including user interfaces.

4.2. International Lake Environment Committee (ILEC)

Dr Aladin briefly outlined the latest developments on the part of ILEC. In a recent decision, the committee decided to cease supporting activities related to the lake database (LakeNet).

He informed the Committee that the National Geographic Society had plans to set up a world lake database, and appropriate contact should be established to HYDROLARE. Dr Aladin stressed that in the future, HYDROLARE would owe much of its credibility with users to its support by governments, to its responsiveness to user needs, and to visibility of its activities in the peer-reviewed literature.

4.3. UN Global Environmental Monitoring System for Water (GEMS/Water)

Dr Robarts provided an overview of the GEMS/Water database capabilities, which are all accessible online. GEMS/Water provides value to national-level data by integrating it with data from other countries so that it can be used in large geographic scale analyses. He presented the various ways of packaging and displaying water quality data for countries, regions, and continents and informed the Committee that this functionality would be fully web-interactive as of next year. The GEMS/Water system architecture, displayed in Fig. 1, allows for a range of web-based services to users, including the application of basic statistical analyses using GEMStat. The development of environmental indicators was current work in progress, and new approaches for water quality monitoring were currently explored.

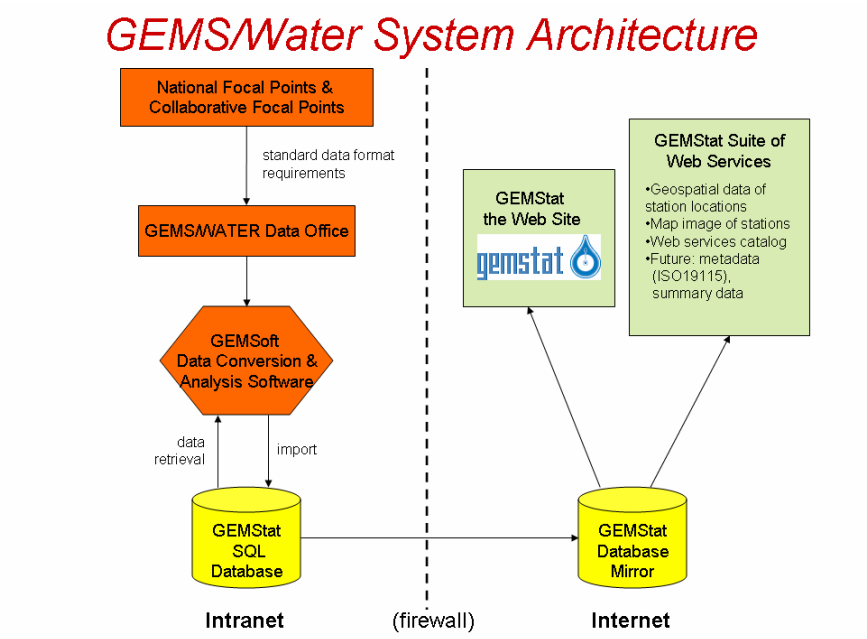

Figure 1: System Architecture of GEMS/Water database and application

The Committee encouraged HYDROLARE technical staff to closely collaborate with GEMS/Water in the further development of the HYDROLARE database, including user interfaces.

4.4. Russian Academy of Sciences, Institute of Limnology

Dr Moiseenkov presented the databases maintained by the Institute of Limnology, Russian Academy of Sciences, St. Petersburg, Russia. The Institute holds data from over 32 000 lakes in 150 countries, and from 4500 reservoirs in 132 countries. A significant body of expertise exists in processing and visualizing information, including metadata, using GIS-based tools. Since the early 2000s, the “Lakes of the Earth” database has been developed, holding detailed limnological information on the largest and best-studied lakes on Earth. To date, physical and chemical characteristics are archived and can be interactively retrieved using search and explore tools. A web-version, possibly using GoogleMaps, in under development. In early 2008, data from 965 lakes (mean values, no time series) worldwide were available in the “Lakes of the Earth” database.

The Committee appreciated the presentation by Dr Moiseenkov and noted great potential for synergy between the work undertaken at the Russian Academy of Sciences and HYDROLARE. It stressed that the two institutions should enter into close collaboration.

5. Public Relations and Outreach

For better visibility in the hydrological community and broadening the user base, the Committee recommended a range of public relations measures.

Outreach Material:
HYDROLARE should create a flyer briefly explaining objectives, goals and concept to the educated public.

Conferences:
HYDROLARE should present its activities at:

- the 2nd Meeting of the CIS Council of Hydrometeorological Centres in Minsk, Belarus, in October 2009;
- the International ILEC Conference in Wuhan in November 2009.

6. New HYDROLARE Work Plan

The Committee agreed on a set of milestones (actions) until December 2010, as well as a set of recommendations, to implement HYDROLARE, given in Annex 6 and 7 respectively. It finally agreed to hold the third Steering Committee session in the second half of 2010.

7. Adjourn

The Committee thanked all SHI staff for their hospitality in hosting the meeting. The meeting closed on 17 July at 15.00 p.m.

Annex 1

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Annex 2

Final Agenda

Wednesday, 15 July

11.00 – 11.15 Welcome
11.15 – 11.30 Introduction and adoption of the agenda

11.30 – 12.00 Status report of HYDROLARE – summary of activities and milestones (SHI, Russia)

12.00 – 12.30 Coffee Break

12.30 – 13.00 Invited lecture: Role of lakes and reservoirs in the global hydrological cycle (SHI, Russia)

13.00 – 14.00 Lunch

14.00 – 14.30 Invited lecture from host institution – The system of observations on lakes and reservoirs in the Russian Federation (SHI, Russia)

14.30 – 15.00 Space-based observation systems for the monitoring of lakes and reservoirs (Jean-Francois Cretaux, France)

15.00 – 15.30 Observing the Essential Climate Variable: Lakes (GCOS)

15.30 – 16.00 Coffee Break

16.00 – 17.00 Presentations by collaborating partners (GRDC, ILEC)

17.00 – 17.30 Experience of the development an Internet - reference book "Lakes of the Earth" with electronic database (Institute of Limnology, RAS, Russia)

18.30 Reception

Thursday, 16 July

10.00 – 11.00 Liaison with national and international providers of data and information (SHI and partners)

11.00 – 11.30 Data acquisition and database formation – activities and strategies: An outlook (SHI and partners)

11.30 – 12.00 Coffee Break

12.00 – 13.00 Development of a Science and Applications Plan for HYDROLARE 2010-2015 (All participants)

13.00 – 14.00 Lunch

14.00 – 14.45 HYDROLARE Site Visit

14.45 – 15.30 Integration of terrestrial and space-based observations (All participants)

15.30 – 16.00 Generation of data products and reports (SHI, All participants)

16.00 – 16.30 Coffee Break

16.30 – 17.00 HYDROLARE Web-site

Friday, 17 July (morning session only)

10.00 – 10.30 Summary of agreed actions (WMO)

10.30 – 11.00 Work plan and milestones 2009-2010 (All participants). Adoption of work plan, recommendations and conclusions (All participants)

11.00 – 11.30 Coffee Break

11.30 – 12.00 Any other business (All participants)

12.00 – 12.10 Closure of the meeting (SHI and partners)

12.30 – 13.30 Lunch

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Annex 3

Existing and Potential Partners for HYDROLARE

International Joint Commission (USA & Canada): http://www.ijc.org/en/home/main_accueil.htm
Royal Geographical Society: http://www.rgs.org/HomePage.htm
National Geographic Society: www.nationalgeographic.com

LEGOS/CNES Hydroweb : http://www.legos.obs-mip.fr/en/soa/hydrologie/hydroweb/
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Dr Ian Boomer (School of Geography, Earth & Environmental Sciences, The University of Birmingham), Edgbaston, Birmingham B15 2TT, Location: GES 408, Tel: +44 (0)121 41 45536 (office) / -42866 (lab), Fax: -45528, i.boomer@bham.ac.uk

Global Runoff Data Centre http://grdc.bafg.de
Ulrich Looser (GRDC, Germany): Tel: +49 (0)261 1306 5224, Fax: -5722, looser@bafg.de

Finland's environmental administration: http://www.environment.fi/
Food and Agriculture Organisation: http://www.fao.org/nr/water/aquastat/main/index.stm
LakeNet: www.worldlakes.org
International Commission on Large Dams (ICOLD): http://www.icold-cigb.net/
International Lake Environment Commitee (ILEC): http://www.ilec.or.jp/eg/index.html
International Association for Environmental Hydrology (IAEH): http://hydroweb.com/
International Association of Hydrological Sciences (IAHS): http://www.cig.ensmp.fr/~iahs/
International Geographical Union: (IGU): http://www.igu-net.org/uk/igu.html
US Army Corps of Engineers (USACE):

- Hydraulics and Hydrology:
  - http://www.lre.usace.army.mil/greatlakes/hh/
  - http://www.lre.usace.army.mil/greatlakes/hh/contacts/
- Great Lake Water Levels: http://www.lre.usace.army.mil/greatlakes/hh/greatlakeswaterlevels/
- Historic Great Lake Water Levels: http://www.lre.usace.army.mil/greatlakes/hh/greatlakeswaterlevels/historicdata/greatlakeshydrographs/

US Department of Agriculture, Foreign Agricultural Service: Global Reservoir and Lake Monitor (TOPEX/POSEIDON and Jason-1 Altimetry)
http://www.pecad.fas.usda.gov/cropexplorer/global_reservoir/
Charon Birkett (NASA Goddard Space Flight Centre, USA); Mailcode 923 Greenbelt, MD 20771, USA Tel: +1 301 614-6643; cmb@nemo.gsfc.nasa.gov

Northern Eurasian Earth Science Partnership Initiative (NEESPI) (http://neespi.org/)
Science Plan Overview http://neespi.org/science/ExecutiveSummary19W.pdf

Annex 4.1

AGREEMENT

between

THE FEDERAL SERVICE FOR HYDROMETEOROLOGY AND ENVIRONMENTAL MONITORING, THE RUSSIAN FEDERATION

and

THE WORLD METEOROLOGICAL ORGANIZATION

on

Establishment of the International Data Centre on Hydrology of Lakes and Reservoirs – HYDROLARE

Whereas this Agreement between World Meteorological Organization (hereinafter referred to as WMO) and the Federal Service for Hydrometeorology and Environmental Monitoring (hereinafter referred to as ROSHYDROMET) on the Establishment of the International Data Centre on Hydrology of Lakes and Reservoirs – HYDROLARE (hereinafter referred to as Agreement) pertains to the Convention of the World Meteorological Organization of 1947 and the Russian Federation's rights and duties as a member-state of the WMO;

Whereas WMO and ROSHYDROMET (further named as "the Parties" collectively, or "Party" individually) want to enhance fruitful co-operation between the Parties and also to reach targets that are of common interest;

Whereas WMO co-ordinates and promotes global operational and scientific activities to allow increasingly prompt and accurate information services concerning weather, climate and water resources for public, private and commercial use, and in particular, that activities of WMO in hydrology and water resources are designed, among others, to monitor and assess water resources in support of integrated water resources management, to support global and regional water cycle assessments and climate monitoring, and to prevent hydrological disasters;

Whereas ROSHYDROMET bears the duties on national level to collect, analyze, interpret and disseminate all data and information on the hydrology of surface water bodies of the Russian Federation, including the hydrology of lakes and reservoirs;

Whereas the WMO Executive Council recognised at its 54th session in June 2002 the urgent need for hydrological data on lakes and reservoirs on a global scale for water resources assessment and climate research;

Whereas the Russian Federation at the 56th session of the WMO Executive Council (Geneva, June 2004) proposed to establish a Global Data Centre on Hydrology of Lakes and Reservoirs to be based at the the State Hydrological Institute in St. Petersburg (Russian Federation), and further the recommendation of the 2nd session of the Global Terrestrial Network – Hydrology (GTN-H) coordination panel meeting (Koblenz, July 2005) as well as the recommendation of the GCOS/GTOS Terrestrial Observation Panel for Climate (TOPC) related to the establishment of an international data centre for lake and reservoir data;

The Parties concur as follows:

Article I

PURPOSE

1. ROSHYDROMET establishes the International Data Centre on the Hydrology of Lakes and Reservoirs (hereinafter referred to as HYDROLARE) at the State Hydrological Institute in St. Petersburg which has a track record on international co-operation projects and activities related to the hydrology of lakes and reservoirs.

2. HYDROLARE operates under the auspices of WMO following the recommendations made by the constituent bodies of WMO with regard to further development and activities of HYDROLARE to support relevant programmes of WMO.

Article II

SCOPE AND RESPONSIBILITIES

1. HYDROLARE's principal objectives are to establish, develop and regularly update the international database on the hydrological regimes of lakes and reservoirs in order to:

- stimulate the development of the global monitoring system of lakes and reservoirs for rational use, preservation and management of their water resources;
- improve the knowledge of lateral fluxes transformation within lakes and reservoirs;
- supply data for scientific and educational purposes, modelling, development of different global and regional projects/programmes.

2. HYDROLARE operates under the administration of the State Hydrological Institute and ROSHYDROMET, which provides funds and facilities for HYDROLARE functioning under the guidance of the International Steering Committee for HYDROLARE.

3. HYDROLARE consults regularly with WMO with regard to matters of common interest so as to ensure an operational and research work in the field of assessment and management of water resources in lakes and reservoirs, as well as weather and climate-related aspects, including climate-related variability of the regime of lakes and reservoirs, and issues related to the water cycle. HYDROLARE and WMO inform each other of their relevant programmes of work and projected activities which might be of mutual interest, and exchange of documentation and publications concerning these and related fields.

4. The Parties co-ordinate its activity related to HYDROLARE development and operation. Specific activities are carried out according to the evolving needs that to be defined by the Parties and in compliance with recommendations and decisions adopted by the International Steering Committee for HYDROLARE.

5. HYDROLARE cooperates with national and international partner institutions on the advice of WMO and/or the International Steering Committee for HYDROLARE.

6. HYDROLARE provides both the WMO and the International Steering Committee for HYDROLARE with information regarding its work and progress in achieving the set targets and tasks on regular basis.

7. The WMO may provide financial support for HYDROLARE, within its budgetary and resources limitations, which is consistent with the resolutions and decisions of WMO Congress , the WMO

Executive Council and financial regulations of WMO with the understanding that no financial support can be claimed by HYDROLARE from WMO.

8. WMO may decide to withdraw its recognition of HYDROLARE as operating under the auspices of WMO upon non-fulfilment by ROSHYDROMET of the functions of HYDROLARE set by the Parties, or upon its non-observance of the basic conditions and obligations contained in this Agreement after duly conducted consultations between the Parties.

Article III

INTELLECTUAL PROPERTY RIGHTS

The data and information provided to HYDROLARE by WMO members-states continues to belong to the providers of such data and information. In the event that HYDROLARE ceases its operation or its cooperation with WMO, ROSHYDROMET makes adequate provisions to transfer all information held by HYDROLARE - most notably electronic information archives and data holdings - to a successor institution.

Article IV

SETTLEMENT OF DISPUTES

Any disputes between the Parties concerning interpretation or implementation of this agreement shall be resolved through discussions by the Parties.

Article V

TERMS AND CONDITIONS

1. The Agreement comes into effect on the day of signing and will remain in effect for a period of five years. The Agreement will be renewed automatically for additional five-year periods upon expiration, unless either Party gives notice of termination in writing to the other Party at least six months prior to the expiration of the first or any subsequent five-year period.

2. This Agreement may be amended at any time with the written consent of the Parties.

3. Termination of this Agreement will not affect implementation of any activity undertaken under this Agreement which is already in progress and not completed by the time of termination unless otherwise concurred by the Parties.

DONE at _____, this_____ day of _____, _____, in duplicate in English and Russian languages, both texts are equally authentic.

For The World Meteorological Organization	For ROSHYDROMET
M. Jarraud Secretary-General	A. Bedritsky Head of Roshydromet

Annex 4.2

СОГЛАШЕНИЕ
между
Федеральной службой по гидрометеорологии и мониторингу
окружающей среды, Российская Федерация
и
Всемирной Метеорологической Организацией
о создании
Международного центра данных по гидрологии
озер и водохранилищ

Принимая во внимание то, что настоящее Соглашение между Федеральной службой по гидрометеорологии и мониторингу окружающей среды (далее Росгидромет) и Всемирной метеорологической организацией (далее ВМО) о создании Международного центра данных по гидрологии озер и водохранилищ (далее Соглашение) соответствует положениям Конвенции ВМО от 1947 г. и правам и обязанностям Российской Федерации как страны-члена ВМО;

Учитывая то, что Росгидромет и ВМО (далее «Стороны», если упоминаются вместе, или «Сторона», если по отдельности) желают развивать плодотворное сотрудничество между Сторонами, а также решать задачи, представляющие общий интерес;

Принимая во внимание то, что ВМО координирует и обеспечивает глобальную оперативную и научную деятельность, позволяющую постоянно улучшать и совершенствовать информационные услуги, касающиеся погоды, климата и водных ресурсов для общественного, частного и коммерческого использования, и, в частности, поскольку такая деятельность ВМО развивается в отношении гидрологии и водных ресурсов для мониторинга и оценки водных ресурсов в целях поддержания интегрированного управления водными ресурсами, для содействия в получении оценок глобального и регионального водного цикла и климатического мониторинга и предотвращения гидрологических бедствий;

Принимая во внимание тот факт, что Росгидромет несет ответственность на национальном уровне за сбор, анализ, обобщение и распространение данных и информации по гидрологии поверхностных водных объектов на территории Российской Федерации, включая информацию по гидрологии озер и водохранилищ;

Принимая во внимание позицию Исполнительного Совета ВМО, высказанную на его 54-ой сессии (Женева, июнь 2002г.), об острой потребности в данных по гидрологии озер и водохранилищ на глобальном уровне для оценки водных ресурсов и климатических исследований;

Принимая во внимание предложение Российской Федерации в адрес 56-й сессии Исполнительного совета ВМО (Женева, июнь 2004г.) об учреждении Глобального центра данных по озерам и водохранилищам в Государственном гидрологическом институте (ГГИ) в Санкт-Петербурге (Российская Федерация), а также последовавшую за этим рекомендацию 2-ой сессии по проекту «Глобальная наземная сеть – Гидрология» (Кобленц, июнь 2005 г.), также как и рекомендацию Группы по наземным наблюдениям за климатом ГСНК/ГСНС в отношении учреждения международного центра данных по гидрологии озер и водохранилищ;

Стороны договорились о нижеследующем:

СТАТЬЯ I

ЦЕЛЬ

1. Росгидромет учреждает Международный центр данных по гидрологии озер и водохранилищ (далее МЦД ГОВР) на базе своего института – Государственного гидрологического института (ГГИ) в Санкт-Петербурге, который имеет опыт в осуществлении

международных совместных проектов, в том числе деятельности, относящейся к гидрологии озер и водохранилищ;

2. МЦД ГОВР функционирует под эгидой ВМО, следуя рекомендациям, выработанным уполномоченными органами ВМО в отношении развития и функционирования МЦД ГОВРа в поддержку соответствующих программ ВМО.

СТАТЬЯ II

СФЕРА ДЕЯТЕЛЬНОСТИ И ОТВЕТСТВЕННОСТЬ

1. Основными задачами МЦД ГОВРа являются создание, развитие и регулярное обновление международной базы данных по гидрологическому режиму озер и водохранилищ для того, чтобы:

- Стимулировать развитие глобальной системы мониторинга на озерах и водохранилищах с целью рационального использования, сохранения и управления их водными ресурсами.

- Улучшать знания о внутриводоёмных процессах в озерах и водохранилищах.

- Накапливать данные для научных и образовательных целей, для моделирования и развития различных глобальных и региональных проектов/программ.

2. МЦД ГОВР работает под административным управлением Государственного гидрологического института и Росгидромета, которые предоставляют финансирование, помещения и оборудование для функционирования МЦД ГОВРа под управлением Международного координационного комитета по МЦД ГОВР.

3. МЦД ГОВР проводит регулярные консультации с ВМО в целях соблюдения общих интересов, таких как проведение оперативных и исследовательских работ в области оценки и управления водными ресурсами озер и водохранилищ в отношении соответствующих аспектов погоды и климата, включая изменчивость режима озер и водохранилищ, связанную с климатом, и вопросов, имеющих отношение к водному циклу. МЦД ГОВР и ВМО информируют друг друга о своих соответствующих программах работ и предполагаемых действиях, которые могут представлять взаимный интерес, и обмениваются документами и публикациями, относящимися к этим и другим смежным областям деятельности.

4. Стороны координируют свою деятельность по вопросам развития и функционирования МЦД ГОВР. Специальные виды деятельности осуществляются в соответствии с возникающими потребностями, которые определяются Сторонами во исполнение рекомендаций и решений Международного координационного комитета по МЦД ГОВР.

5. МЦД ГОВР обеспечивает сотрудничество с национальными и международными организациями-партнерами в соответствии с рекомендациями ВМО и/или Международного координационного комитета по МЦД ГОВР.

6. МЦД ГОВР обеспечивает на регулярной основе как ВМО, так и Международный координационный комитет по МЦД ГОВР информацией о своей работе и достигнутых успехах в достижении поставленных целей и задач.

7. ВМО может осуществлять финансовую поддержку МЦД ГОВР в рамках существующих ограничений в отношении своих ресурсов и бюджета и в соответствии с резолюциями и решениями конгресса ВМО, Исполнительного Совета ВМО, Финансовым Уставом ВМО при понимании того, что МЦД ГОВР не может требовать финансовой поддержки со стороны ВМО.

8. ВМО может принять решение об отмене своего признания МЦД ГОВР в качестве Международного центра данных, действующего под эгидой ВМО, в случае не обеспечения Росгидрометом выполнения МЦД ГОВРом функций, согласованных Сторонами, или из-за

несоблюдения основных условий и обязательств, содержащихся в настоящем Соглашении, после проведения соответствующих консультаций между Сторонами.

СТАТЬЯ III

ПРАВА НА ИНТЕЛЛЕКТУАЛЬНУЮ СОБСТВЕННОСТЬ

Данные и информация, предоставленные странами-членами ВМО в распоряжение МЦД ГОВРа, продолжают принадлежать поставщикам таких данных и информации. В случае если МЦД ГОВР прекратит свою деятельность или свое сотрудничество с ВМО, Росгидромет обеспечит адекватную передачу всех видов продукции МЦД ГОВР – электронных информационных архивов и хранилищ данных – соответствующей организации-приемнику.

СТАТЬЯ IV

УРЕГУЛИРОВАНИЕ СПОРОВ

Любые споры между Сторонами, касающиеся толкования и ли выполнения настоящего Соглашения, решаются путем переговоров между Сторонами.

СТАТЬЯ V

ЗАКЛЮЧИТЕЛЬНЫЕ ПОЛОЖЕНИЯ

1. Настоящее Соглашение вступает в силу со дня его подписания и остается в силе в течение пяти лет. В дальнейшем действие настоящего Соглашения продлевается автоматически на последующие пятилетние периоды до тех пор, пока любая из Сторон не уведомит в письменной форме другую Сторону о намерении прекратить его действие, по крайней мере, за шесть месяцев до истечения первого или любого последующего пятилетнего периода.

2. В настоящее Соглашение могут вноситься поправки в любое время только с письменного согласия Сторон.

3. Прекращение действия настоящего Соглашения не затрагивает осуществление любой деятельности в рамках настоящего Соглашения, начатой в период его действия и не завершенной к моменту прекращения действия настоящего Соглашения, если Стороны не договорятся об ином.

Совершено в городе_____, день _____, месяц _____, год _____ в двух экземплярах, каждый на русском и английском языках, причем оба текста имеют одинаковую силу.

За Федеральную службу по гидрометеорологии и мониторингу окружающей среды

Александр Бедрицкий
Руководитель

За Всемирную метеорологическую организацию

Мишель Жарро
Генеральный секретарь

Annex 5

International Response to HYDROLARE Questionnaire (Status: 1 April 2009)

Summary from answers on Questionnaire

Date	Country	Station	Level	T_water	Ice_ regim	T_ice	Wave	Current	Archive	Type of data	Action
28.10.2008	BELARUS	14							PD	OH	yes
16.12.2008	SLOVAKIA										no
23.12.2008	SWITZERLAND	35							PD	OH	yes
26.12.2008	KAZAKHSTAN	34							P	H	no
30.12.2008	UZBEKISTAN	25							P	OH	yes
02.01.2009	FINLAND	300							D	OH	yes
07.01.2009	ESTONIA	6							PD	OH	yes
08.01.2009	HONG KONG	17							D	OH	yes
08.01.2009	KYRGYZSTAN	5							P	H	yes
09.01.2009	AUSTRIA	53							PD	OH	yes
12.01.2009	CHINA	426							PD	OH	no
14.01.2009	LAO PEOPLE'S (DR)										no
14.01.2009	MONGOLIA	16							PD	OH	yes
15.01.2009	TANZANIA, UNITED REPUBLIC OF	5							PD	OH	yes
16.01.2009	HUNGARY	20							PD	OH	yes
19.01.2009	OMAN										yes
19.01.2009	TAJIKISTAN	6							P	H	yes
20.01.2009	BELIZE	3							PD	OH	yes
20.01.2009	SPAIN	360							D	OH	yes
22.01.2009	ARMENIA (Fax)	8							PD	H	yes
22.01.2009	ROMANIA	142							P	H	yes
23.01.2009	COLOMBIA (CVC)	2							D	O	yes
23.01.2009	LATVIA (Post)	5							PD	OH	no
23.01.2009	MALI	2							PD	H	yes
26.01.2009	JAPAN	100							PD	OH	no
27.01.2009	TURKEY	134							P	H	no
28.01.2009	SLOVENIA	4							PD	OH	yes
29.01.2009	DOMINICA (BG)	1							PD	O	yes
29.01.2009	DOMINICAN REPUBLIC	22							D	O	no
29.01.2009	MOLDOVA, REPUBLIC OF	2							P	OH	yes
30.01.2009	COLOMBIA (IDEM)	5							PD	H	yes
30.01.2009	MAURITIUS	6							PD	OH	no
30.01.2009	CHILE	60							PD	H	yes
02.02.2009	GUYANA										no
02.02.2009	SWEDEN	200							PD	H	yes

Date	Country	Station	Level	T_water	Ice_ regim	T_ice	Wave	Current	Archive	Type of data	Action
03.02.2009	AUSTRALIA	200	*	*					D	OH	yes
03.02.2009	CANADA	444							PD	OH	yes
03.02.2009	POLAND	89							PD	OH	no
04.02.2009	ZAMBIA (Fax)								PD	OH	yes
05.02.2009	THAILAND										no
06.02.2009	DOMINICA (DES)								PD	OH	yes
12.02.2009	ANTIGUA AND BARBUDA								PD	O	yes
17.02.2009	INDIA (Fax)	81							P	OH	yes
23.02.2009	CYPRUS	57							PD	OH	yes
23.02.2009	TUNISIA	29							PD	OH	no
30.03.2009	MEXICO (Post)	176							PD	OH	yes
Итог		46	38	40	24	14	11	3	4		

there are other type of observations

don't mark quantum stations

Archive: P - paper records
D - digital

Type of data: O- operational
H - historical

Action: agree (yes) or disagree (not) to deliver their data to HYDROLARE

Annex 6

Milestones for HYDROLARE until December 2010

No	Action	Who (Lead)	Deadline
1	Inform WMO Commission for Hydrology on HYDROLARE	WMO	As soon as possible
2	Upgrade of website (meeting report; About Us, status of database, data submission forms, links to partner organizations)	SHI	Oct 2009; continuous
3	Preparation of document describing current status of database application software, and functionality (in-house, web-based, max. 10 pages); Include progress against Milestones 2 and 8 from SC-I: • Development of encoding system for database, taking into account WMO requirements • Selection of the HYDROLARE database software, and design and development of the database to a prototype level	SHI	Oct 2009
4	Presentation of HYDROLARE at CIS Council	SHI	Oct 2009
5	Review 156 GTN-L list, based on better geographic distribution	Vuglinsky, Cretaux, Dolman	Nov 2009 (TOPC-XII)
6	Preparation of document “Status report on the availability of data on lakes and reservoirs in HYDROLARE”, including an inventory of data collected from WMO countries	SHI	31 Dec 2009
7	Complete milestones 4,6,7,9,11,13 from SC-I: • (Preparation and) Loading of available metadata from Russia and other former USSR countries into HYDROLARE • (Preparation and) Loading of historical observational data from Russia and former USSR countries into HYDROLARE	SHI	Dec 2009
8	Prepare official report on HYDROLARE in 2009 for WMO and ROSHYDROMET	SHI	Dec 2009
9	Address milestones 14,15 from SC-I: • (Preparation and) Loading of available metadata from WMO member countries (outside former USSR) into HYDROLARE • (Preparation and) Loading of historical observational data from WMO member countries (outside former USSR) into HYDROLARE	SHI	From Jan 2010 onwards; check status in June 2010
10	Agreement on data policy, using GRDC as a template (ensure consistency with data policy of partners)	SHI, WMO	Jan 2010
11	Development of a HYDROLARE science and applications plan, including: • Literature review, Scientific state-of-the-art • Requirements of the user community • Way forward (next 5 years) • Use GRDC 1987 plan as reference	SHI, GRDC, LEGOS/CNES, TOPC	Mar 2010 (draft); End 2010 (final)
12	Feature HYDROLARE in documentation for WMO Executive Council	WMO	Apr 2010
13	Develop web-based, dynamic search and explore tool based on metadata on lakes/reservoirs (includes up-to-date statistics on archived data, including content; this tool allows monitoring of all information in HYDROLARE, including from WMO member countries)	SHI	Apr 2010

14	Develop and carry out demonstration project showcasing integration of in-situ and satellite data: Use a small number of lakes and at least one lake in Russia, including volume changes; Explore the value of lake temperature database for regional climate studies for case examples within this project	SHI, LEGOS/CNES, GEMS/Water	Jun 2010 (completion)
15	Develop a HYDROLARE newsletter (every 6 months, first issue in 2010)	SHI	Dec 2010 (first issue)
16	Prepare progress report on HYDROLARE for SC-III	SHI	2 weeks before SC-III starts
17	Third Meeting of Steering Committee, in conjunction with workshop on lakes/reservoirs	SHI	Second half of 2010
18	Prepare official report on HYDROLARE in 2010 for WMO and ROSHYDROMET	SHI	Dec 2010
19	Discuss feasibility of workshop on lakes and reservoirs in 2010/2011	SHI, WMO	Before SC-III
20	Organize telephone conference of Steering Committee every 6 months	WMO	First conference in December 2009
21	Contact all institutions holding data of lakes and reservoirs of relevance for HYDROLARE (CNES/LEGOS; University of Maryland; Russian Academy of Sciences; ILEC; Caspian Sea Environmental Programme etc; use list by WMO for guidance)	SHI	End 2009
22	Formulation of collaboration agreement between HYDROLARE and partners (e.g., CNES/LEGOS)	SHI	End 2009
23	Visit of HYDROLARE technical staff to GRDC	SHI, GRDC, WMO	During 2010
24	Ensure cross-validation of station data at lakes/reservoirs with several stations	SHI	Ongoing (recommended)
25	Preparation of journal publications on HYDROLARE, e.g. in the ILEC Science Journal	SHI and partners	Ongoing (recommended)

Annex 7

Recommendations for HYDROLARE arising from SC-II

The second session of the HYDROLARE International Steering Committee further recommended that SHI ensure in the further implementation of HYDROLARE the following:

1. Standardization of all metadata information, thereby ensure consistent geo-referencing of lake shapes (e.g., using HydroSHEDS) and station elevation (including the reference geoid model if available);

2. Transparency in the origin of data (give sources and references);

3. Enhanced cooperation between HYDROLARE and GEMS/Water for application of GEMSoft;

4. Generation for quick look of volume changes of lakes in GTN-L as well as fully Quality Controlled products;

5. Compilation of time series of volume changes of lakes in GTN-L on a monthly basis.

Annex 8

Glossary

GCOS	Global Climate Observing System
GEMS	Global Environmental Monitoring System
GEO	Group on Earth Observations
GPCC	Global Precipitation Climatology Centre
GRDC	Global Runoff Data Centre
GTN-H	Global Terrestrial Network - Hydrology
GTN-L	Global Terrestrial Network for Lakes
GTOS	Global Terrestrial Observing System
HYDROLARE	International Data Centre on the Hydrology of Lakes and Reservoirs
ICOLD	International Commission on Large Dams
IGRAC	International Groundwater Resources Assessment Centre
IHP	International Hydrological Programme
ILEC	International Lake Environment Committee Foundation
ROSHYDROMET	Federal Service of Russia for Hydrometeorology & Environmental Monitoring
SHI	State Hydrological Institute (St Petersburg, Russian Federation)
TOPC	Terrestrial Observation Panel for Climate
TOPEX/POSEIDON	Ocean Surface Topography Altimeter Experiment (NASA/CNES)
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
WMO	World Meteorological Organization

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