



МЕЖДУНАРОДНЫЙ ЦЕНТР ДАННЫХ
ПО ГИДРОЛОГИИ ОЗЁР И ВОДОХРАНИЛИЩ
INTERNATIONAL DATA CENTRE
ON HYDROLOGY OF LAKES AND RESERVOIRS

ANNUAL NEWSLETTER

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Dear Reader,

I am pleased to introduce you to the seventh newsletter of the International Data Centre on Hydrology of Lakes and Reservoirs (HYDROLARE).

Here you will find traditional information about the updates of HYDROLARE database and development of the IT infrastructure in 2016. I would like to point out in particular that technological advancements made in 2016 provided an opportunity for upload of a new type of data (maximum ice depth) to our database. Information about availability of ice thickness data in the database is displayed on the website of the centre.

Active collaboration continued with the Laboratory for Studies in Geophysics and Spatial Oceanography (LEGOS) at the French National Centre for Space Studies (CNES). Information about advancements of the Hydroweb web service and current activities to extend the content and increase reliability of satellite data is given in the article by Jean-Francois Crétaux (LEGOS). It is also important to note that 60 lakes in the Hydroweb database are monitored in a near real time processing, and this database is fully accessible and free of charge. The article also tells about two very promising evolving international initiatives – the CCI+ project by ESA and the SWOT mission by NASA and CNES. Both projects seek to provide new ECVs for lakes from space.

A significant event for HYDROLARE in 2017 will be the sixth meeting of its Steering Committee to be held from 18 to 20 July 2017 in St. Petersburg.

In conclusion, on behalf of the staff of our centre, may I thank all of you who contribute to the development of the HYDROLARE database. We continue to seek support from WMO Members and welcome any initiatives and submissions in this regard.

Prof. Valery Vuglinsky
Director of HYDROLARE



Rvs. Evretou (Cyprus)

DEVELOPMENT OF HYDROLARE IT-INFRASTRUCTURE

L. Barinova, G. Barinova, E. Kuprienok, HYDROLARE, Russia

In 2016, the IT-infrastructure of the centre has continued to evolve.

The database has been updated with lake levels of Mongolia and data on the Caspian Sea water levels for 23 stations in the Caspian Sea countries, namely Azerbaijan, Iran, Kazakhstan, Russia and Turkmenistan.

Collaboration continued with the Laboratory for Studies in Geophysics and Spatial Oceanography

(LEGOS) at the French National Centre for Space Studies (CNES). Another portion of water level satellite altimetry data was provided by LEGOS to HYDROLARE. Today, the HYDROLARE database contains such data for 58 lakes in 32 countries. For 36 out of these 58 lakes *in-situ* data are not available.

Currently the HYDROLARE database holds water level data of 1183 world's lakes and reservoirs and 1420 stations (Fig. 1).

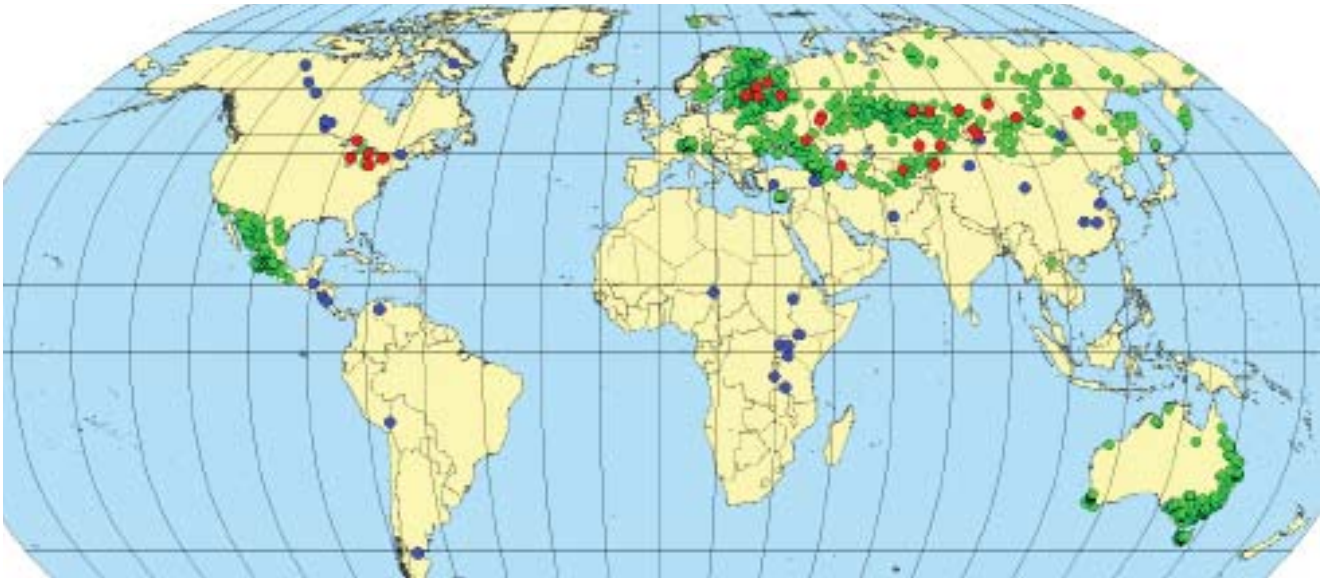


Fig. 1. Lakes and reservoirs in the HYDROLARE database.

In-situ observations are highlighted in green, satellite observations in blue and both types of observations – in red.

Furthermore, in 2016, maximum and mean monthly water temperatures for lake stations in Finland, Moldova, Mongolia and Russia have been uploaded to the database.

The IT-infrastructure has been further developed to include new type of information – maximum ice thickness – to the database.

Therefore, technological opportunities have been created to upload all three types of information (water level, water temperature and ice thickness) envisaged by the initial concept of the centre. Information about availability of these types of data in the database is available on the web-site of the centre.

It was recommended by the International Scientific Steering Committee for HYDROLARE to improve search and explore tool by adding a function to display not only lake gages but also stations on rivers inflowing to and outflowing from these lakes. It was suggested to implement such function for Russian river stations available in the database of the Global Runoff Data Centre (GRDC), Koblenz, Germany.

To this end, necessary metadata describing hydrographic connection between lakes and rivers were

uploaded to the database, river stations in GRDC were identified and the technological infrastructure of the centre was accordingly improved.

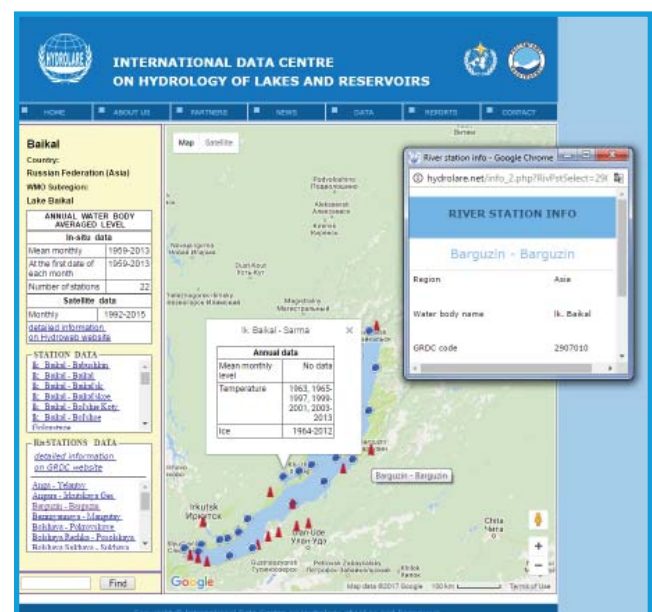


Fig. 2. Stations on inflowing and outflowing rivers on the HYDROLARE website (highlighted in red).

As a result, it has become possible to deliver inflow and outflow data from 166 GRDC stations for 70 lakes of Russia. For these stations, links were

set up on the HYDROLARE web-site that enable to obtain runoff data on the GRDC web-site (Fig. 2).

DEVELOPMENT OF HYDROWEB WEB SERVICE AND CURRENT ACTIVITIES OF LEGOS

J-F Cretaux, LEGOS/CNES, France

In January 2016, the new Hydroweb database has opened with much new functionality. This database is implemented on the THEIA platform under funding of the French Investment Program in the framework of the preparation of the wide-swath altimeters SWOT (Surface Water and Ocean Topography) mission.

Hydroweb delivers satellite altimetry products on lakes, rivers and floodplains. Currently Hydroweb produces water level variations of 160 lakes worldwide. Among them, the surface extent and the volume variations of about 100 lakes are also measured using satellite imagery. For 60 lakes monitoring and processing is performed in near real time and these data are fully opened to the scientific community without any restrictions and free of charge. See Cretaux et al., 2016 for details on the data processing developed in Hydroweb. It is believed that that this database should be in close interaction with space communities in a future with large constellation of satellites allowing the monitoring of several ECVs for lakes.

An example of information product – long-term water level changes in Lake Baikal (Russia) by satellite altimetry (Topex/Poseidon, Jason-1, Jason-2, Jason-3) is illustrated in the Fig. 3.

LEGOS is the official partner of HYDROLARE for the delivery of lake level from satellite altimetry. Several studies for validation of satellite products using Hydrolare *in-situ* database have been performed in the framework of mutual cooperation. The role of our cooperation is also to link activities of space agencies in term of development and maintenance of spacecraft dedicated to the water cycle in general and lakes in particular, the hydrologists who are using Hydroweb and HYDROLARE databases, and the national hydrological institutes and agencies maintaining *in-situ* networks.

LEGOS is now preparing a joint proposal to the CCI+ (Climate Change Initiative) of ESA (European Space Agency) call for new ECV (Essential Climate Variables) that include, inter alia, important climate indicators (Williamson, 2009; Schindler, 2009) such as water extent, water color, ice cover duration and depth.

A consortium with France, UK, Canada, Switzerland, Norway, and Russia will be setup to submit a proposal for monitoring these ECVs for lakes. The purpose is to develop benchmarking in order to se-

lect satellite missions and methodologies to provide the ECVs from space data. The results of the project will enable to obtain data on new climate indicators for lakes with required precision using satellite altimetry in collaboration with ESA and GCOS. HYDROLARE is proposed to participate in the project as an international data centre responsible for delivery of data on ECV-Lakes under GCOS project.

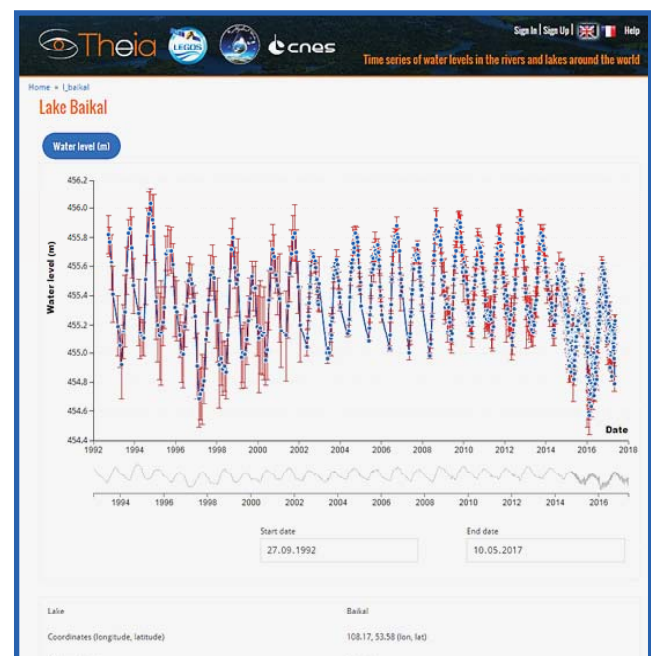


Fig. 3. Long-term water level changes in Lake Baikal (Russia) by satellite altimetry (Topex/Poseidon, Jason-1, Jason-2, Jason-3): <http://hydroweb.theia-land.fr>

In June 2017, a workshop on lakes, climate and satellites will be held in Toulouse, France. It is organized by Legos in the framework of the SWOT project. This is a new NASA project aimed at launching a new satellite mission with wide-swath altimeters. A panel of ~20 international specialists in lake morphometry, hydrology, remote sensing, and climate modeling has been invited to participate. The program of this workshop will address many different topics related to lakes: not only the survey of current ECVs from satellite but also mechanism of linkage between lakes and climate, role of lakes as carbon and methane emitters, lake ice as proxy of climate change in Arctic regions, linkage between lakes and permafrost, etc. In 2021, when SWOT will be in orbit, many other spacecrafts will carry instruments allowing also the

study of the hydrosphere properties. One of the goals of this workshop will be to propose new sensor concepts that space agencies can develop in the coming years and that would improve our ability to understand changing lake environments. Another goal is to produce a white paper (which we will also seek to publish in a widely-read peer-reviewed journal) laying out a pathway for global-scale research on lake processes from space in a changing climate. Linkage between global databases (Hydroweb, Globolake, HYDROLARE) and their respective objectives, portfolio of data productions and their interaction with space agencies operating large satellite constellations in order to improve monitoring of different climate indicators are going to be examined and discussed during this workshop.

ASSESSMENT OF THE WMO GLOBAL DATA CENTRES OPERATIONS

V. Vuglinsky, HYDROLARE, Russia

The WMO Commission for Hydrology (CHy) at its fifteenth session (Rome, Italy, 7 – 13 December 2016) discussed the role of global data centres under the Agenda item 4.1.3 – Data operations, management and exchange among other issues related to the activities carried out during the intersessional period (2012 – 2016) and the future programme of work. Based on the discussion and decisions on this Agenda item, the following was included in the general summary of the session (slightly abridged):

4.1.3.16 The Commission expressed its gratitude to Germany, the Netherlands and the Russian Federation for hosting the four global data centers under the auspices of WMO:

a) The Global Runoff Data Centre (GRDC), hosted in the Federal Institute of Hydrology, Koblenz, Germany;

b) The International Groundwater Resources Assessment Centre (IGRAC), hosted in UNESCO-IHE, Delft, the Netherlands;

c) The International Data Centre on Hydrology of Lakes and Reservoirs (HYDROLARE), hosted in the State Hydrological Institute, St Petersburg, Russian Federation;

d) The Global Precipitation Climatology Centre (GPCC), hosted by the German Weather Service, Offenbach am Main, Germany.

References:

Cretaux J-F., Abarca Del Rio R., Berge-Nguyen M., Arsen A., Drolon V., Clos G., Maisongrande P., Lake volume monitoring from Space, *Survey in geophysics*, 37: 269 - 305, doi 10.1007/s10712-016-9362-6, 2016.

Schindler, D. W. 2009, Lakes as sentinels and integrators for the effects of climate change on watersheds, air sheds, and landscapes. *Limnology and Oceanography* 54 (6): 2349 - 2358.

Williamson C. E., Saros J. E., Vincent W. F., Smol J. P., 2009. Lakes and reservoirs as sentinels, integrators, and regulators of climate change. *Limnology and Oceanography*, 54(6), 2273.

4.1.3.17 The Commission noted that a task team should be established to prepare a response to the request by Cg-17 to report to the Executive Council with regard to the evolving role of these data centers and their contribution to CHy initiatives. Given below is the abridged text of the Resolution 4.1(3)/1 related to the global data centers role and operations.

The commission for hydrology,

Recognizing:

– The importance of including reliable hydrological observations and data in the WMO Integrated Global Observing System (WIGOS) and the WMO Information System (WIS),

– That new and increased demands are now being put on the global data centers, in particular in support of the global assessment and management of the world's water resources,

Requests the president of CHy:

– To form a small task team in charge of preparing a report to the Executive Council with regard to the evolving role of the GRDC, IGRAC and HYDROLARE.

– Invites Members to contribute to global data centers in accordance with the recommendation of the report to the Executive Council mentioned above, to ensure hydrological data and related information that is critical for WMO-supported programmes is available and accessible.

The sixth meeting of the International Scientific Steering Committee for the International Data Centre on Hydrology of Lakes and Reservoirs (HYDROLARE) will be held from 18 to 20 July 2017 at the State Hydrological Institute (2nd Line, 23, St. Petersburg, Russia).