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! We present to your attention the next, fifteenth issue of our bulletin, which traditionally begins with information about the replenishment of the Center's database and the state of its information technology complex. In 2025, the database was expanded with the results of in-situ observations of water levels, temperatures, and ice thickness in lakes and reservoirs in a number of countries. The Centre's database currently contains information on water levels in 1,069 lakes and reservoirs in 48 countries.

The article by A. I. Shevchenko, V. S. Vuglinsky and L. N. Barinova is devoted to the development of a web service for machine-to-machine exchange of access to the HYDROLARE center's metadata

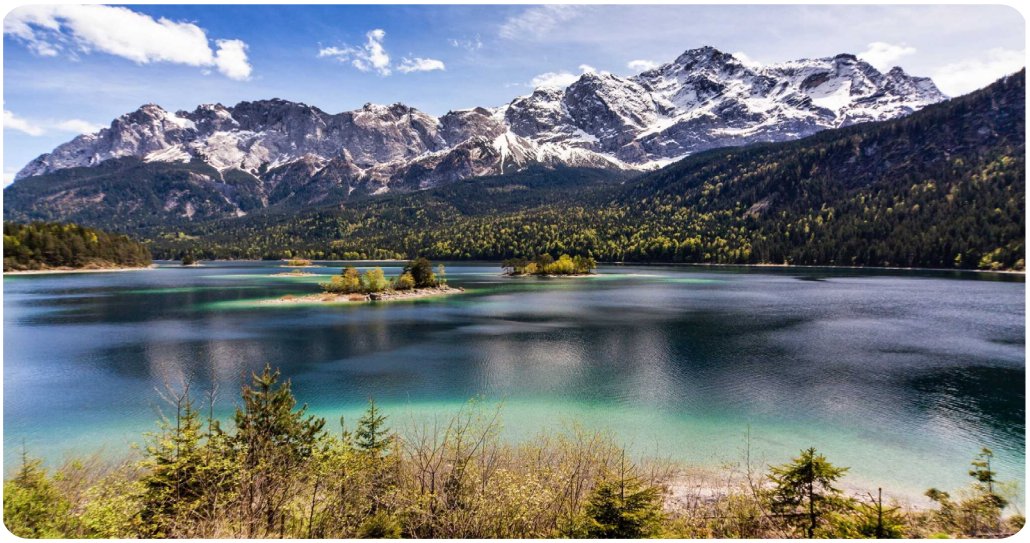
Information on the activities of the Global Climate Observing System expert group on developing requirements for global climate data repositories is presented in the material by V.S. Vuglinsky.

The Chronicle section examines two important aspects of the work of the WMO Working Group on Hydrological Data Centres.

The next ninth meeting of the International Steering Committee of the HYDROLARE is scheduled for autumn 2026 via videoconference.

In conclusion, as always, I express my sincere gratitude and appreciation to the representatives of the organizations collaborating with the Center.

Prof. Valery Vuglinsky
Director of HYDROLARE



Eibsee Lake (Germany)

WWW.HYDROLARE.NET

DEVELOPMENT OF THE IT-IFRASTRUCTURE OF THE CENTER

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

In 2025, the Center continued collecting, analyzing, and preparing data, as well as converting it into unified form for uploading to the HYDROLARE database. As before, work was carried out to search, recognize, and select data on water levels and temperatures from the websites of the relevant US and Canadian agencies . In addition to previously obtained data, data on various elements of the lake and reservoir regimes of Belarus for 2023 were obtained.

The database has been expanded to include information on water levels at stations in Belarus (10), the USA (24), and Russia (156), as well as on average water levels in lakes in Russia (10) and the Great Lakes of Canada and the USA (5).

Data on average monthly and maximum water temperatures at stations in Belarus (10) and Russia (8), as well as on maximum ice thickness at stations in Russia (4) have been prepared and uploaded.

In addition, data on Caspian Sea water temperatures measured at 19 stations in the Caspian coastal countries – Azerbaijan (5), Kazakhstan (4), Russia (5), and Turkmenistan (5) – have been updated.

As of 2025, the HYDROLARE database contained observation data for 1069 lakes and reservoirs in 48 countries and 1201 hydrological stations within them. The number of stations with available data on water levels is 1178, water temperatures - 515, and maximum ice thickness - 140. Water level data derived from satellite altimetry are available for 87 lakes and reservoirs in 34 countries.

As an additional means of providing information on the availability of observational data in the HYDROLARE database, a machine-to-machine data exchange service was developed in 2025, offering a list of metadata in WaterML 2.0 format (see separate article in the bulletin).

DEVELOPMENT OF A WEB SERVICE FOR MACHINE-TO-MACHINE ACCESS TO HYDROLARE METADATA

A. Shevchenko (RIHMI-WDC), L. Barinova (SHI), V. Vuglinsky (SHI).

The WMO Hydrological Observing System (WHOS) is designed to enhance and improve the free international exchange of hydrological data and products [1]. The main providers of hydrological data are national hydrometeorological services. Currently, the WMO Hydrological Observing System receives information from more than 30 countries. The bulk of global hydrological information is concentrated in international hydrological data centers, one of which is the WMO International Data Centre on Hydrology of Lakes and Reservoirs (HYDROLARE).

The WHOS does not store or archive data, but instead, using Discovery and Access Broker technologies, enables interoperability and exchange of data provided by original data providers through their web services [2]. The implementation of these technologies allows for consistent search and access to specific hydrological data, despite the fact that the providers of these data use different interfaces and data models.

Scheme of the WHOS "Broker" technology, which combines a data storage and management system and a data retrieval system.

The WHOS "Broker" technology uses various web technologies, such as messaging protocols, data exchange formats, server-side and interface programming languages, open standards (ISO, OGC, and W3C), and WMO Information System 2.0 (WIS 2.0) technologies.

In 2025, within the existing WHOS concept, development began on a web service for machine-to-machine access to metadata and historical observational data from the WMO International Data Centre on Hydrology of Lake and Reservoir

(HYDROLARE). The main objective of this work is to contribute to the development of WHOS and the implementation of technologies that will further enable updating the HYDROLARE database with observation data from national hydrometeorological services of WMO member countries, as well as the machine-to-machine exchange of existing data.

HYDROLARE currently holds historical data on water levels, water temperatures and ice thickness from hydrological stations. The Centre's database currently contains observation data from 1,069 lakes and reservoirs in 48 countries.

During 2025, in accordance with the architectural principles and ideology of the WHOS, a machine-to-machine exchange service for access to the Center's metadata was developed. The service is implemented as a REST API service, using standard HTTP request methods for interaction between the client and the server. When interacting with the WHOS broker, the service acts as a client. The application on which the service is deployed uses the Wildfly 34 application server. RESTful Web Services technologies were used to create REST services. The «Java API for RESTful Web Services (JAX-RS)» tool was used to create web services.

The Center's metadata required for providing information was converted from MySQL to the PostgreSQL database management system. JPA (Java Persistence API) technology was used to work with the database. The query result is generated in the WMO-recommended hydrological data exchange format WaterML 2.0 [3].

The developed web service provides the following information:
– a list of observation points on lakes and reservoirs with their coordinates and names;
– name of the water body;
– periods of availability of data on water level, temperature and ice thickness;
– country of origin and contact information of the data owner.

The service was tested on the WHOS test portal https://whos.geodab.eu/gs-service/whos-test/search.html. In 2026, the metadata provided by the service will be available on the main WHOS portal.

The developed service is available at this link: http://hydroweb.meteo.ru/hydro-service/rest/GetWHOSHydroStationsHydrolare/whos

A link to the service is also available on the HYDROLARE Center website http://hydrolare.net/link.php.

In 2026, it is planned to develop a web service for exchanging data between machines to access historical observation data stored in the Center's database.

References:

1. WMO. 2021c. “WMO Hydrological Observing System (WHOS)” WMO. https://community.wmo.int/activity-areas/wmo-hydrological-observing-system-whos.

2. Multi-scale hydrological system-of-systems realized through WHOS: the brokering framework. Enrico Boldrini, Stefano Nativi, Silvano Pecorab, Igor Chernov, Paolo Mazzetti. INTERNATIONAL JOURNAL OF DIGITAL EARTH2022, VOL. 15, NO. 1, 1259–1289 https://doi.org/10.1080/17538947.2022.2099591 https://www.tandfonline.com/doi/full/10.1080/17538947.2022.2099591#abstract

3. OGC. 2012. WaterML 2.0: Part 1- Timeseries. http://www.opengis.net/doc/IS/waterml/2.0.1

ACTIVITIES OF THE GCOS EXPERT GROUP ON THE DEVELOPMENT OF REQUIREMENTS FOR GLOBAL CLIMATE DATA REPOSITORIES

V. Vuglinsky (HYDROLARE, Russia)

In 2023, the GCOS Expert Group on Global Climate Data Repositories (GCOS Experts Group) was established to develop requirements for global climate data repositories, including hydrological data.

The requirements formulated by the international organization CoreTrustSeal (CTS), which certifies data warehouses worldwide, were adopted as a basis. The organization’s 16 requirements include: continuity of service, compliance with legal and ethical standards, data availability, use of modern operating systems and software, availability of sufficient resources and funding, and others. The above requirements were circulated among global hydrological data centers, including the Global River Runoff Data Center (GRDC), the Global Precipitation Data Center (GPCC), the International Data Center on Hydrology

of Lakes and Reservoirs (HYDROLARE), and several others, to assess their feasibility. The responses received were summarized in the GCOS 2025 Report on Global Climate Data Repositories.

The report acknowledges that not all global hydrological data centers implement the full range of CTS requirements. To accredit these centers, it was proposed to develop a criteria system that included CTS requirements. However, repositories may vary by category. For example, the highest category may meet CTS requirements, while lower categories may meet fewer, simpler criteria.

It is recommended that work in this area be continued within the iClimateAction initiative.

CHRONICLE

In 2025, the WMO Task Team on Hydrological Data Centers was formed. The first online meeting of the Task Team took place on April 4, 2025, at which representatives of various global hydrological centers (GRDC, IGRAC, HYDROLARE, GEMS, GPCC, and others) presented brief reports on the activities of the centers. At the meeting the goals and objectives of the Task Team were discussed and proposals for its activities for the coming year were considered. A total of five online meetings were held in 2025. At these meetings various issues related to the status of the data centers, coordination of their activities, interaction with other climate centers within the GCOS program, and other issues were discussed.

In particular, to facilitate the development of a unified concept for global hydrological centers, the group developed a questionnaire (Questions to facilitate Global Hydrological Data Centers Framing for INFCOM-4 Report and WIGOS/WIS/WIPPS).

The responses received from various centers to this questionnaire are being compiled and will serve as the basis for developing a classification of global hydrological centers in the WMO system in 2026.

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The WMO Task Team on Hydrological Data Centres took an active part in the discussion of the draft new edition of the Guideline to hydrological network design, which was prepared by the Network Design Subgroup of the WMO EarthHydroNet Task Team. The new version of the Guidelines covers the design, deployment and operation of precipitation observing networks, snow cover, evaporation, soil moisture, river levels and discharge, sediment runoff, reservoir and lake levels, ice cover on rivers and lakes, groundwater and water quality.

The final version of the Guidelines is scheduled for release in 2026.

The next ninth meeting of the International Steering Committee of the HYDROLARE is scheduled for November 2026 via videoconference.