МЕЖДУНАРОДНЫЙ ЦЕНТР ДАННЫХ
ПО ГИДРОЛОГИИ ОЗЁР И ВОДОХРАНИЛИЩ

INTERNATIONAL DATA CENTRE
ON HYDROLOGY OF LAKES AND RESERVOIRS

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Dear reader! You are getting acquainted with the next, twelfth issue of the newsletter for 2022. It traditionally provides information about the replenishment of the Center's database and the development of its IT-ifrastructure. Currently, the HYDROLARE database contains observation data on 1069 water bodies in 47 countries of the world. In 2022, the design of the Center's website was significantly updated, the structure of the website and its content were improved, as well as the user interface, which you can read about on the newsletter pages.

In a joint article by J.-F. Crétaux (LEGOS Laboratory, France) and V. S. Vuglinsky (SHI, Russia) contain information on the development of the project for the study of lakes using satellites (the project "Lakes"), which is being implemented within the framework of the international program "Climate Change Initiative" (CCI). An important milestone in the implementation of this project was the creation of the first stage of a global database on several characteristics of the water regime of 250 lakes of the planet.

An important event in 2023 will be the next HYDROLARE Steering Committee meeting, which is scheduled in St. Petersburg in November.

In conclusion, as always, I express my sincere gratitude to the representatives of the countries participating in the replenishment of the database and cooperation with the Center.

Prof. Valery Vuglinsky
Director of HYDROLARE

Lake Labynkyr (Russia)

WWW.HYDROLARE.NET

DEVELOPMENT OF THE INFORMATION TECHNOLOGY COMPLEX OF THE CENTER

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

In 2022, work continued on the collection, analysis and preparation of data, as well as on their transformation to a single form for uploading to the HYDROLARE database. As before, work was carried out on the search, recognition and selection of data on the water levels and temperature of water bodies presented on the websites of the relevant services of Slovenia, the USA and Sweden. In addition to the previously received data, daton various elements of the regime of lakes and reservoirs of Belarus for 2020 were received. The database has been updated with information on water levels at the stations of Belarus (10), Slovenia (2), Sweden (6), the USA (43), Russia (223), as well as on the water levels averaged over the lakes of Russia (15) and the Great Lakes of Canada and the USA (5). Prepared and uploaded data on the average monthly and maximum water temperature for the stations of Belarus (10), Slovenia (2), Russia (147).

In total, the Center's database contains observational data on 1069 reservoirs in 47 countries.

The development of the technological complex of the Center in 2022 was aimed at improving the site. The website design has been updated, the structure and user interface have been improved, the texts have been edited. The content of the site has been expanded due to the inclusion of new types of information in the Center's database. The updated main page of the site is shown in Figure 1.

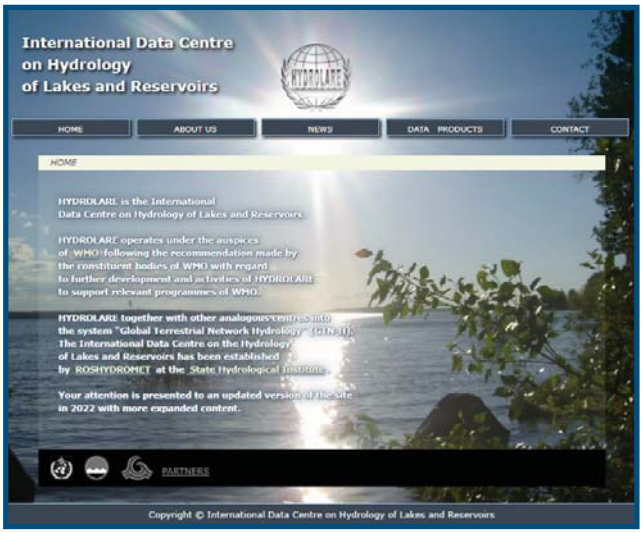

Figure 1. The main page of the site www.hydrolare.net

The main partners of the Center are presented on the main page of the website. Their composition has expanded - logos of new partners have been added, which appeared as a result of the development of international relations of the Center in the last 10 years.

Two new subsections have been created in the ABOUT US section of the main menu. The Basic documents subsection includes the Agreement between Roshydromet and WMO and the order of Roshydromet on the establishment of an International Data Center for the Hydrology of Lakes and Reservoirs (HYDROLARE) in the State Hydrological Institute (SHI), as well as WMO resolutions on data policy and on the exchange of hydrological data. The subsection Cooperation with LEGOS contains information about the cooperation of the Center with the Laboratory of Space Research in the Field of Geophysics and Oceanography (LEGOS) of the National Center for Space Research of France (CNES) on the problems of developing a methodology for correcting satellite data on the water level of lakes and reservoirs based on the results of ground observations.

Taking into account the appearance of scientific publications on the subject of the Center, a new subsection Articles in the NEWS section has been added for them.

The HYDROLARE database description subsection in the DATA PRODUCTS sections is aligned with the updated contents of the database. It provides information about the main data sources. For each type of data contained in the database, an automatic change of the statistical indicators indicated on the website is provided with a quantitative change in the data of each type. The Data availability in the HYDROLARE database section has been significantly redesigned, taking into account its special significance for users interested in a simple and visual presentation of information about data that can be obtained on request. The pages with maps showing water bodies for which information is available in the Center's database have become more informative. The procedure for presenting information about the availability of different types of data has been changed: first, the most popular information about the availability of data on stations on the lake follows, and then information about the availability of data related to the lake as whole, including satellite data. The list of stations on rivers associat-ed with the water body is issued last. Information about the number of stations on the water body has been moved to the headings

of the station lists (Lake stations list and River stations list) and is given in parentheses. In the absence of any kind of information in the database, there is also no corresponding window.

The presentation of information on the availability of data on transboundary water bodies has been changed. Previously, this information was provided regardless of the countries in whose territories they are located. Now the water body page contains information only for the country for which the water body was selected, namely, the name of the country, the names and the number of stations. In this case, markers of stations belonging only to the selected country are placed on the map (Figure 2).

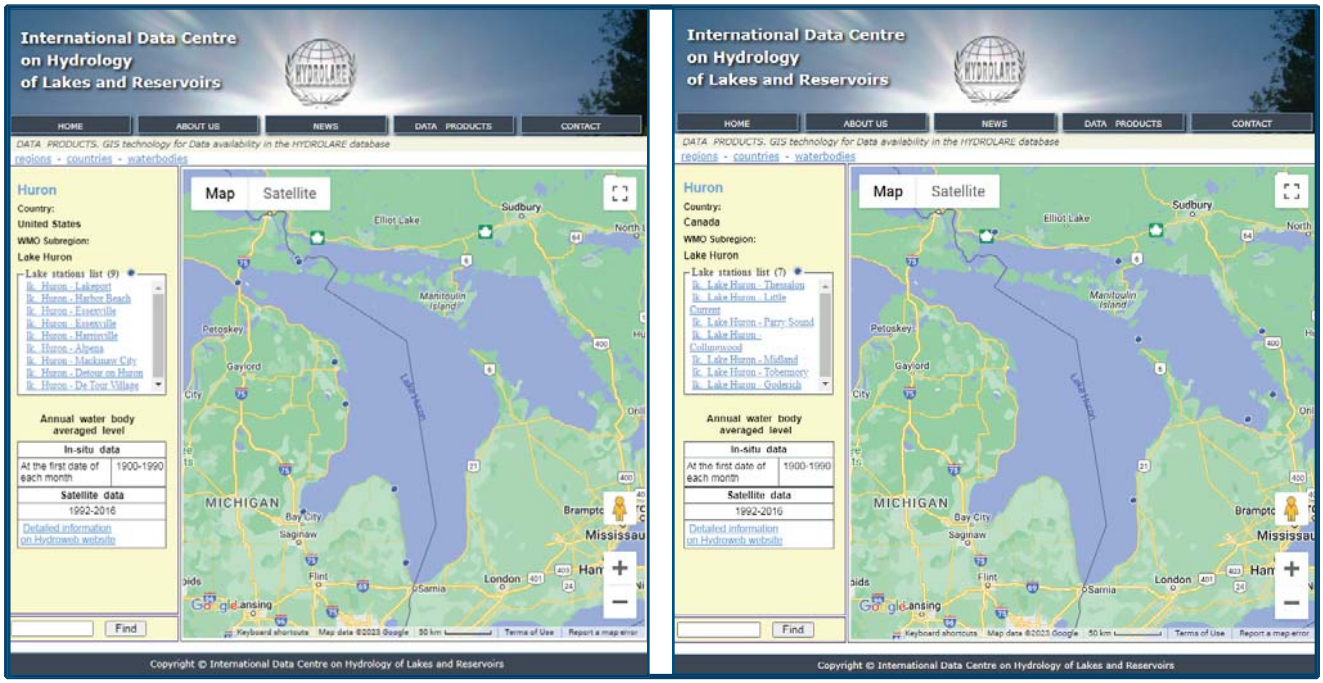

Figure 2. Stations of the USA and Canada on the transboundary lake Huron

STATUS AND PROSPECTS FOR THE IMPLEMENTATIONOF THE INTERNATIONAL PROJECT ON MONITORING LAKES USING SATELLITES

J.-F. Crétaux, (LEGOS/CNES, France), Valery Vuglinsky (HYDROLARE, Russia)

The LEGOS Laboratory and the State Hydrological Institute (SHI) are jointly participating in the implementation of the European Space Agency's satellite-based lake monitoring project as part of the international Climate Change Initiative - CCI program, which has already been reported in newsletters for 2020 and 2021. As is known, lakes influence both regional and global climate, and many characteristics of their regime can be used as indicators of climate change (Essential Climate Variables – ECV). This project is aimed at preparing homogeneous, continuous and long-term high quality satellite datasets on various characteristics of the lake regime - indicators of climate change. During the implementation of the first phase of the project (from 2019 to 2022), the first phase of the global database was prepared for several of the following characteristics:

– lake water level (LWL): a variable reflecting the ratio between input and output components of the lake's water balance;

– lake water volume (LWE): a variable that affects the local climate through the cooling effect of the lake's water mass;

– lake surface water temperature (LSWT): a variable correlated with air temperature that characterizes the thermal regime of lake waters and the associated biogeochemical cycle;

– lake ice cover (LIC): a variable that characterizes the timing of lake freezing in autumn and ice cover breaking in spring, which determines the period of ice cover.

This first phase of the database has been developed with customer requirements in mind and is called the Climate Research Data Package (CRDP, version V2.0), containing daily data with a spatial resolution of 1 km on 250 lakes. For some variables, the data covered the

time period 1992-2020, for others – 2000-2020. The database can be found at: https://catalogue.ceda.ac.uk/.

The second three-year phase of the project, which started in July 2022, will continue to produce multi-year time series of the above variables for a much larger number of lakes. In addition, data will be produced on a new variable, Lake Ice Thickness (LIT). It is an important indicator of climate change resulting from changes in air temperature and snow thickness on ice. The inclusion of this new variable is due to significant progress in the development of algorithms for determining the lake ice thickness using passive microwave radiation (AMSR-E/2) and thermal infrared radiation (Aqua/Terra MODIS). Today, the Cryosat-2 satellite has the potential to estimate ice thickness on large lakes in boreal climate regions such as northern Canada, Alaska, Scandinavia, Greenland or Northern regions of Russia. To develop a methodology for calculating lake ice thickness from satellite data, two approaches will be applied. The first one is based on the synergistic use of radar backscatter and brightness temperature (TB) data. The second approach is based on the conversion of radar altimeter signals. Priority will be given to data obtained from altimeters installed on satellites of the European Space Agency.

As a result of the work of the second stage, it is planned to gradually update the first stage of the database (version V2.0) and prepare its extended version (version V2.1) with the following distinctive features:

– data for 2021 will be added;

– data quality will be improved;

– the number of lakes with data on the water level and the volume of water in the lake will be increased (400 additional lakes are expected to be included);

– long-term ice thickness records will be included.

The figure 3 shows a map of the distribution of lakes on the continents and islands of the globe, satellite data for which will be included in the extended version of the database (version V2.1)

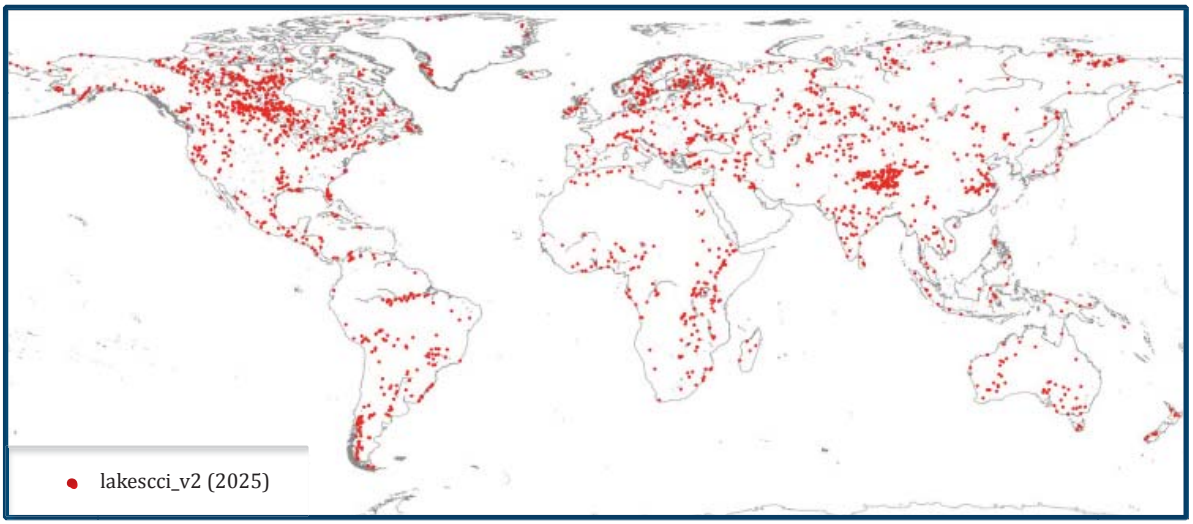

Figure 3. Map of the distribution of lakes on the continents and islands of the globe, satellite data for which will be included in the extended version of the database (version V2.1)

At the second stage of the project, in addition to preparing an extended version of the database, a methodological document on processing satellite data will be developed, based on the results of scientific and methodological research during the implementation of the project. This document (CRDP V3.0) will describe the main steps in satellite data processing, including:

– description of processing algorithms;

– validation of ice thickness data;

– methodology for processing data on the level and volume of water in the lake.

This document will be prepared taking into account the results of the scientific workshop on the project, which will take place in 2023.

During the second phase of the project, a major effort will also be made to verify the accuracy of the variables under consideration by comparing satellite data with ground-based observations. With regard to water level data, this work will be a continuation of the previous joint work of the Legos laboratory and SHI on the intercomparison of satellit and ground data on the example of Russian lakes using the HYDROLARE database. In 2023, such work will be carried out on the example of a number of lakes located in the northern regions of Russia.