# International Data Centre on the Hydrology of Lakes and Reservoirs (HYDROLARE)

First steps

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# Some peculiarities

**The total number of world lakes can be calculated only approximately. According to up-to-date research there are about 4,000,000 lakes on the Earth. The data are available only for the largest natural lakes in all regions of the world. But in some countries the data on water resources even for the largest lakes are very approximate.**

**The large water storage is located in artificial reservoirs. The total storage of water in 10,000 operating reservoirs of the world is equal to 5,000 km3. Large reservoirs change a seasonal distribution of runoff but leads to the considerable changes of thermal, ice, dynamic, chemical and biological characteristics of water bodies.**

**Lakes and reservoirs are widely spread on all continents. In some countries lakes cover vast part of area (for example, in Canada 7.9% of area is covered by lakes, in north-western regions of Russia –10% and in Finland –12 %).**
**Catchments of the largest water bodies and vast lake districts (with natural origin) as a rule are located within the limits of several countries;**

**Permanent observations on hydrological characteristics of some water bodies count several centuries or decades (for example, Lake Siva –Japan observations on ice-on date are from 15-th century; observations on lake level and outflow from Lake Ladoga began in 1859 and for Lakes Saimaa and Baikal accordingly from 1867 and 1887);**

# The Need for Global Data on Lakes and Reservoirs

**Lakes of the world are the important source of water used in industry, agriculture and domestic water - supply recreation, fishery, hydro - electric power generation and transport Water resources of lakes and reservoirs are the most stable and readily available source of fresh water on our planet.**

**According to UNEP/ILEC the most serious global problems of inland water bodies are decrease of water storage (the Aral Sea, Lake Chad), contamination with toxic chemicals, eutrophication, acidification, accelerated siltation and extinction of indigenous ecosystem and biota;**

**Having certain inertness lakes receive, transform and intensify climatic signal. And the hydrologic characteristics of lakes most adequately reflect changes of climate. So analysis of temporal and spatial variability of lakes' dynamics should contribute essentially to global research of climate change;**

**The long-term data of observations on constructed reservoirs play an important role in planning new reservoirs and predicting the reservoirs' influence on environment;**

**The lack of long-term information for the large number of lakes and lake districts (morphometry, hydrological and hydrochemical regimes) does not permit to plan and carry out measures for conservation of water bodies and sustainable development of area.**

**On a global scale existing lakes and reservoirs monitoring systems are inadequate and thus datasets from different part of world cannot be compared. There are regions with lack of permanent information on the main hydrological elements. An international cooperation will be useful for development of lakes monitoring in those countries where such observations are absent.**

**Hence, there is an imperative need for the establishment of international database uniting long-term data of observations on hydrological regime of inland water bodies as well as the development of the world lakes and reservoirs monitoring system.**

# Main steps

- **First discussions between the State Hydrological Institute (SHI) and WMO on the establishment of an International Centre of Data on the Hydrology of Lakes and reservoirs were held in early 2001 and a first proposal had been developed in April 2001.**

- **At the 54th session of the WMO Executive Council (EC) in June 2002, the representative of ROSHYDROMET proposed to establish an "International Data Centre on the Hydrology of Lakes and Reservoirs (HYDROLARE)" at the State Hydrological Institute (SHI) in St Petersburg. The EC noted an urgent need in hydrological data on lakes and reservoirs on the global scale for the assessment of water resources and climate research, appreciated the efforts of the Russian Federation on the creation of the International Centre of Data on Hydrology of Lakes and Reservoirs.**

- **The WMO Commission for Hydrology (CHy) further supported the proposal at its 12th session in November 2005.**

- **The necessity to establish an International "Data Centre on the Hydrology of Lakes and Reservoirs" was also discussed at the Second session of the Project "Global Terrestrial Network - Hydrology" (GTN-H), held in July 2005.**

- **The Implementation Plan of the Global Climate Observing System (GCOS) in support of the UNFCCC also contains proposed actions towards the establishment and operation of such a Centre.**

- **Planning meeting on the establishment of an International Data Centre on the Hydrology of Lakes and Reservoirs (HYDROLARE), State Hydrological Institute, St Petersburg, Russia, 1 November 2006**

- **First meeting of the Steering Committee for the International Data Centre on the Hydrology of Lake and Reservoirs, State Hydrological Institute, St Petersburg, Russia, 14-15 June 2007**

The objective of the HYDROLARE is:

the establishment, development and regular update of international database on 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.

## Principal expected outputs :

- Basic data on permanently studied lakes and reservoirs of the world collected and processed, including physiographic and morphometric characteristics of water bodies and their catchments.

- Inventory of existing monitoring systems on lakes and reservoirs on a global scale.

- Inventory of existing data of permanent hydrological observations on lakes and reservoirs on a global scale.

- Database on long-term time series of lakes and reservoirs having permanent hydrological observations on a global scale.

- Preparation of basic processing and presentation tools for lakes and reservoirs data and distributed to member countries.

- Analysis and assessment of spatial and temporal tendencies of lakes and reservoirs hydrological elements

## Why the State Hydrological Institute in Russia?

1. Up-to-date hydrological network on lakes and reservoirs of Russia consists of 377 gauges located on 71 reservoir and 160 lakes
2. The information about hydrological regime of lakes and reservoirs consists of 3 parts: passport data of lakes and reservoirs; annual data of observations from 1989, and long-term time series from the beginning of the instrumental period till 1988-2000.
3. The long – term time series are partly kept in the PC Data Base as well as 80% of annual information, which comes from the hydrological network.

Lake Bol'shoye

- In 1986 in the State Hydrological Institute (SHI) the specialized data bank of the State Water Cadastre “Lakes and Reservoirs” has been put into the operation used for the automatic treatment of the hydrometeorological observation data on lakes and reservoirs.
- The bank keeps the following information:
- passport data on water bodies;
- passport data on gauges on lakes and reservoirs;
- annually replenished data of hydrometeorological observations near shore and/or at water bodies’ water surface;
- data of annual generalization in the form of hydrological annuals.


Lake Onega


Lake Ladoga

## The data bank is destined for solving several problems:

- · archiving and keeping of inquiry data and data of annual generalization;
- · renewal and addition of the passport data on water bodies and gauging sites on them;
- · input and control of data of current observations in the regime of dialogue and their load into the data base;
- · management of the data base;
- · treatment of the observation data with the output of the results in the form of tables of hydrological annual and annual generalization for the fulfillment of the long term time series in the automatic regime and the regime of dialogue;
- · issue of data due to requirements;
- · water balance calculations.

Lake Ladoga

# Main products of the Russian data base

- ***Hydrological annuals containing following data:***
- *list of gauges ;*
- · daily level at gauges and mean monthly level for lakes and reservoirs;
- · ten days surface water temperature near shore and at lake's surface area;
- · water temperature at different depths;
- · ice cover duration at gauging site;
- · ice thickness and snow depth on ice near shores and at ice profiles;
- · water balance;

- ***Annual publication "Water resources of surface and ground waters, their using and quality"***
- containing information on storage and level changes of the 26 largest lakes and reservoirs of Russia
- ***"Long-term characteristics of hydrological regime of lakes and reservoirs "*** – each five years, containing information on mean and extremal level, monthly inflow, mean and extremal water temperature, mean and extremal dates of ice events, ice thickness, mean water balance characteristics, data on currents, waves, damage of shores and siltation, evaporation from water by evaporation pans
- ***"Long-term characteristics of inflow and ice conditions on largest lakes and reservoirs of Russia"*** (including probability values) – each decade
- ***Monographs*** on hydrometeorological regime of individual lakes and reservoirs summarizing information for the whole period of observations (11 books for 22 lakes and reservoirs), 1 international monograph on Lake Peipsi (Estonia-Russia)

# The following information on lakes and reservoirs is presented in the hydrological annuals:

- · list of gauges on lakes and reservoirs information on which are placed in an annual;
- · water level at gauges and mean lake level for lakes and reservoirs;
- · surface water temperature near shore and at the lakes surface area;
- · water temperature at different depths;
- · heat content of water storage;
- · ice cover duration at gauging site;
- · ice thickness and snow depth on ice near shores and on ice profiles;
- · recurrence of different wind speeds and wind directions;
- · water balance;
- · waves;
- · currents.

# Examples of publications summarizing information on the hydrological regime of lakes and reservoirs

ФЕДЕРАЛЬНАЯ СЛУЖБА РОССИИ
ПО ГИДРОМЕТЕОРОЛОГИИ И МОНИТОРИНГУ ОКРУЖАЮЩЕЙ СРЕДЫ

МИНИСТЕРСТВО ПРИРОДНЫХ РЕСУРСОВ
РОССИЙСКОЙ ФЕДЕРАЦИИ

ГОСУДАРСТВЕННЫЙ
ВОДНЫЙ КАДАСТР

РЕСУРСЫ
ПОВЕРХНОСТНЫХ И ПОДЗЕМНЫХ ВОД,
ИХ ИСПОЛЬЗОВАНИЕ И КАЧЕСТВО

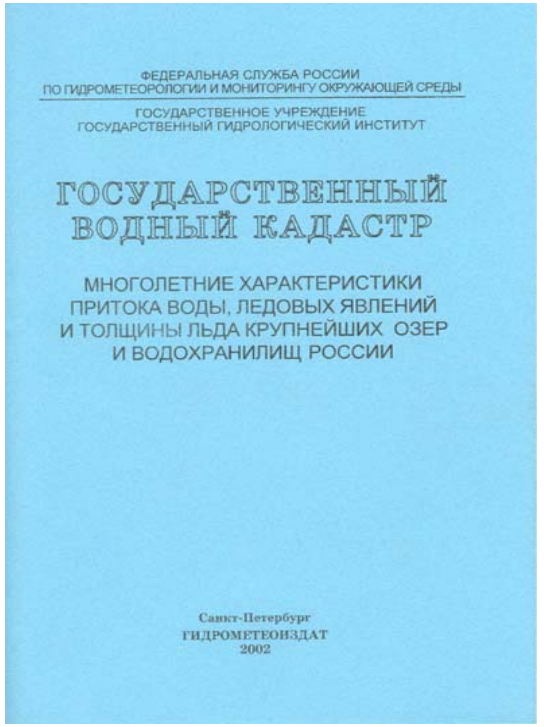
*ЕЖЕГОДНОЕ ИЗДАНИЕ*

2002 год

Санкт-Петербург
ГИДРОМЕТЕОИЗДАТ
2003

Bratskoye Res.

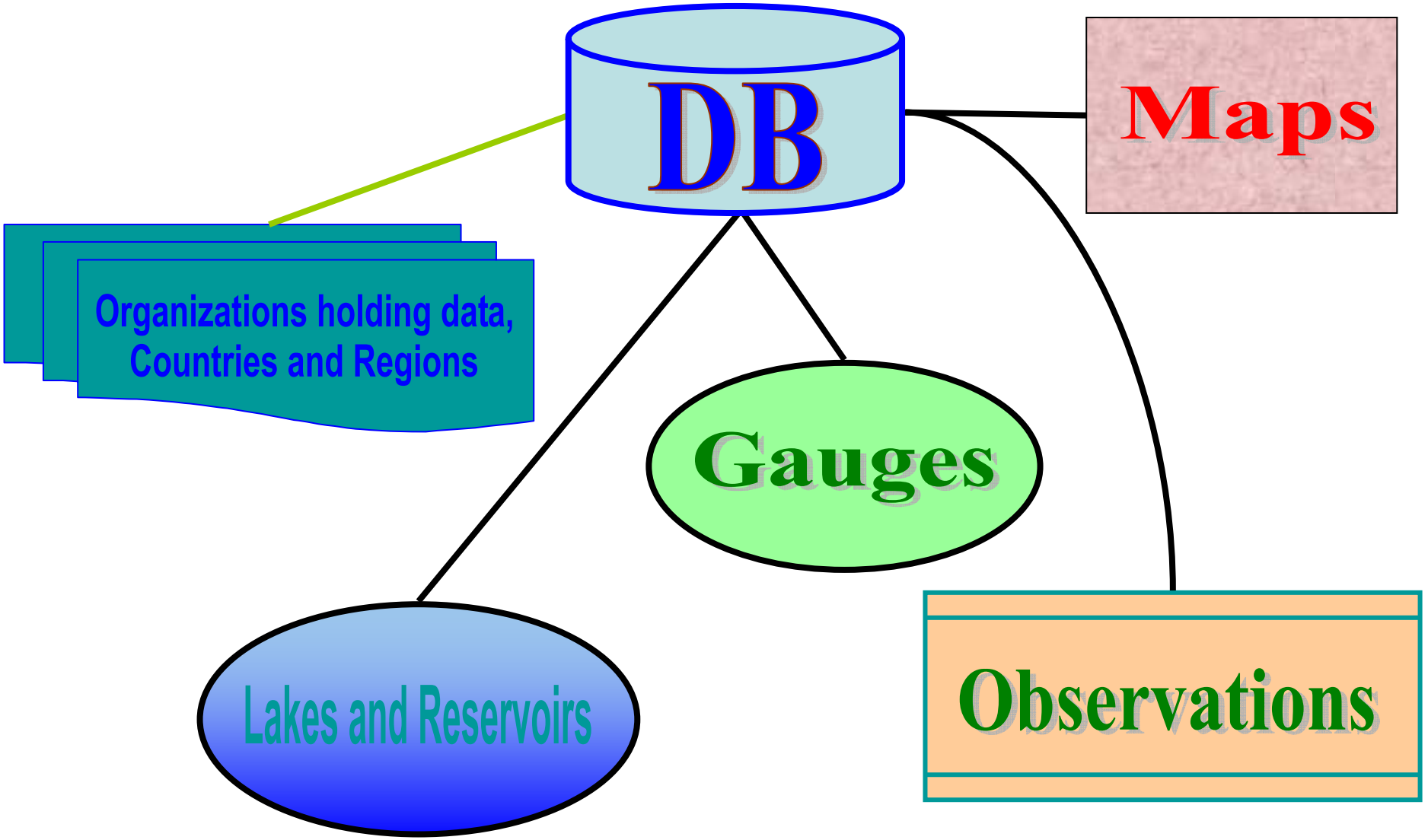
Ust-Ilimskoye Res.

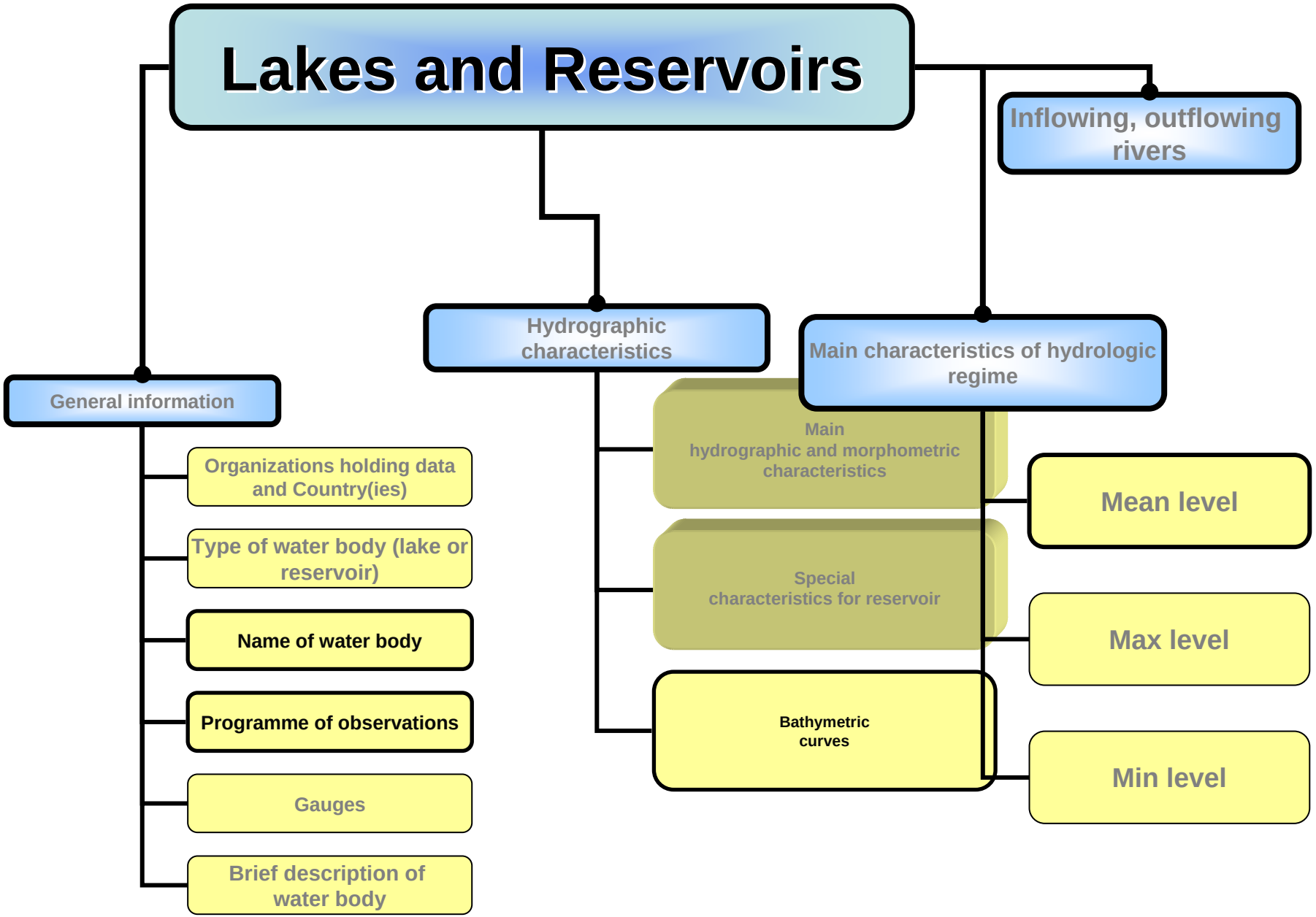


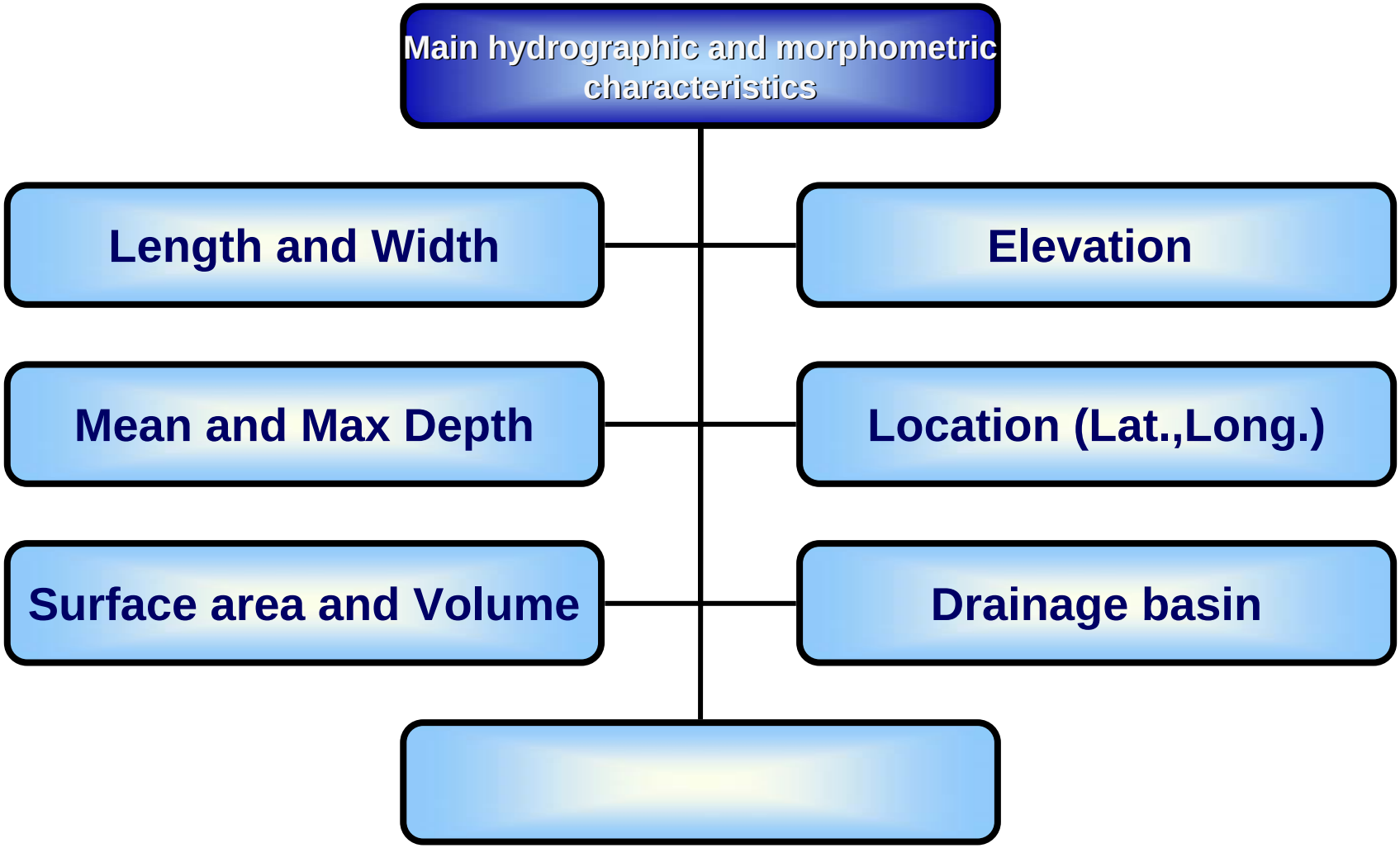
# Water storage and water level changes of the largest lakes and reservoirs

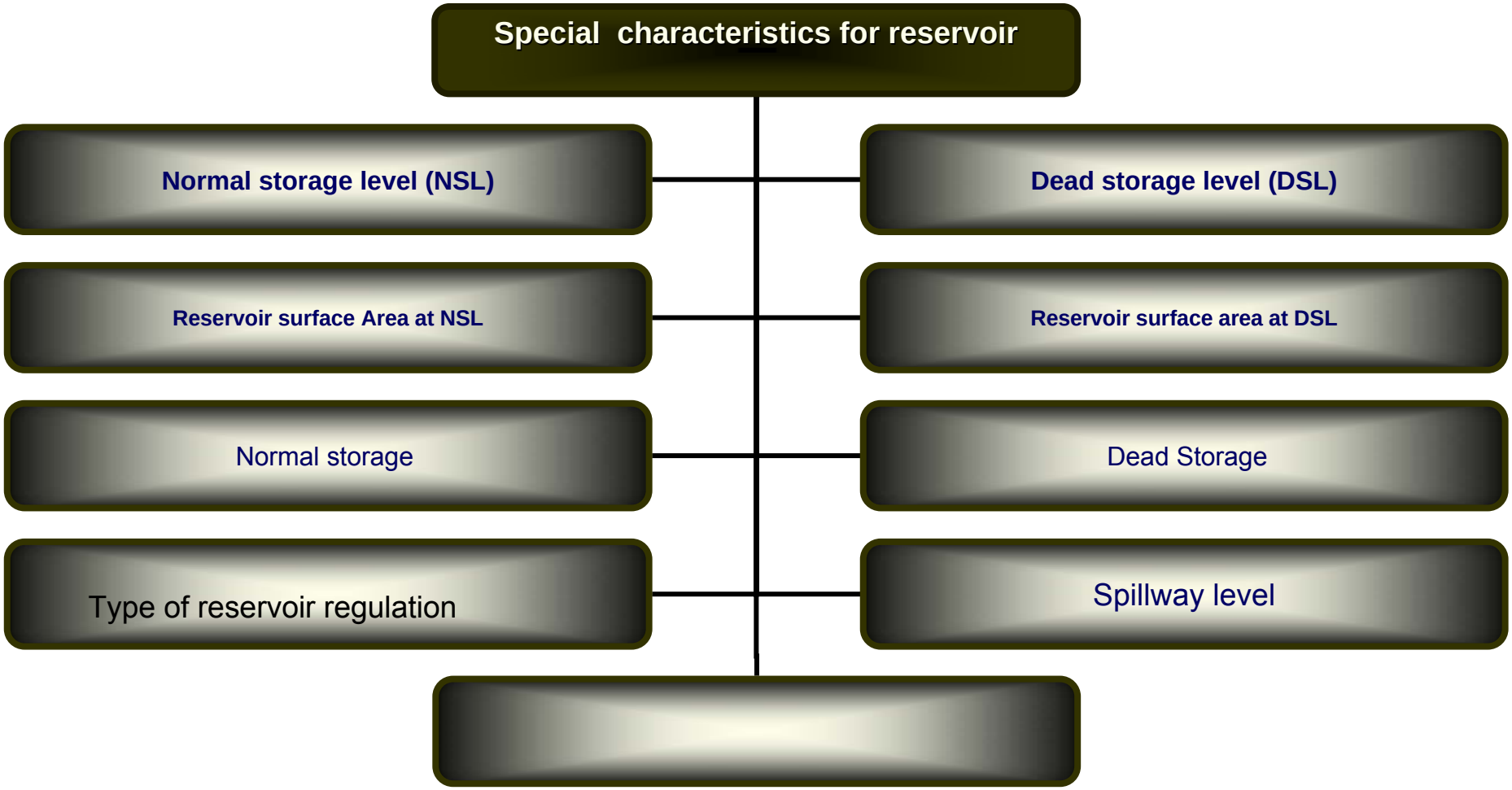
| Lake or reservoir name | Mean long-term water storage, $km^3$ | Long-term mean annual lake level, m above msl | Water storage, $km^3$ | | | Lake level, m above msl | | |
|---|---|---|---|---|---|---|---|---|
| | | | January 1, 2002 | January 1, 2003 | Storage change for 2002 | January 1, 2002 | January 1, 2003 | Change for 2002 |
| Ladoga | 911.00 | 5.10 | 894.80 | 885.10 | – 9.70 | 4.19 | 3.61 | – 0.5 |
| Onega | 292.00 | 33.00 | 289.90 | 288.60 | – 1.30 | 32.79 | 32.66 | – 0.1 |
| Ilmen | 2.92 | 18.00 | 2.36 | 1.59 | – 0.77 | 17.46 | 16.62 | – 0.8 |
| Baikal | 23000.00 | 455.00 | | | – 4.72 | 455.97 | 455.82 | – 0.1 |
| Khanka | 18.30 | 68.90 | 16.34 | 18.98 | 2.64 | 68.41 | 69.07 | 0.6 |
| Ivan'kovskoye | 1.12 | 123.89 | 0.87 | 0.87 | 0.00 | 123.04 | 123.04 | 0.0 |
| Uglichskoye | 1.25 | 112.82 | 1.21 | 1.23 | 0.02 | 112.68 | 112.75 | 0.0 |
| Rybinskoye | 26.34 | 102.00 | 16.64 | 13.72 | – 2.92 | 99.60 | 98.72 | – 0.8 |
| Gorkovskoye | 8.81 | 84.00 | 8.80 | 7.83 | – 0.97 | 83.99 | 83.34 | – 0.6 |
| Tcheboksarskoye | 12.80 | 68.00 | 5.16 | 5.05 | – 0.10 | 63.47 | 63.38 | – 0.0 |
| Kuibyshevskoye | 57.99 | 53.00 | 46.26 | 50.22 | 3.96 | 51.02 | 51.72 | 0.7 |
| Saratovskoye | 12.87 | 28.00 | 12.95 | 12.95 | 0.00 | 28.04 | 28.04 | 0.0 |
| Volgogradskoye | 31.45 | 15.00 | 32.23 | 31.74 | – 0.49 | 15.24 | 15.09 | – 0.1 |
| Iriklinskoye | 3.26 | 245.00 | 2.72 | 2.81 | 0.10 | 242.82 | 243.22 | 0.4 |
| Tsymlyanskoye | 23.74 | 36.00 | 18.06 | 16.70 | – 1.36 | 33.76 | 33.16 | – 0.6 |
| Krasnodarskoye | 2.40 | 33.65 | 1.88 | 0.35 | – 1.53 | 32.32 | 26.64 | – 5.6 |
| Kamskoye | 12.20 | 108.50 | 9.87 | 10.43 | 0.56 | 107.19 | 107.52 | 0.3 |
| Votkinskoye | 9.37 | 89.00 | 7.80 | 9.20 | 1.40 | 87.46 | 88.84 | 1.3 |
| Novosibirskoye | 8.87 | 113.50 | 7.96 | 8.10 | 0.14 | 112.62 | 112.76 | 0.1 |
| Sayano-Shushenskoye | 31.34 | 540.00 | 26.53 | 25.75 | – 0.78 | 531.29 | 529.83 | – 1.4 |
| Krasnoyarskoye | 73.30 | 243.00 | 60.11 | 51.90 | – 8.22 | 235.93 | 230.95 | – 4.9 |
| Irkutskoye | 2.12 | 456.59 | 1.92 | 1.94 | 0.01 | 455.39 | 455.48 | 0.0 |
| Bratskoye | 170.00 | 401.65 | 154.92 | 139.08 | – 15.84 | 399.82 | 396.36 | – 3.4 |
| Ust-Ilimskoye | 58.90 | 296.00 | 58.44 | 58.66 | 0.22 | 295.72 | 295.84 | 0.1 |
| Zeyskoye | 68.40 | 315.00 | 56.64 | 53.93 | – 2.71 | 309.82 | 308.48 | – 1.3 |
| Caspian | 77965.80 | – 28.30 | 78535.48 | 78543.24 | 7.77 | – 27.29 | – 27.27 | 0.0 |

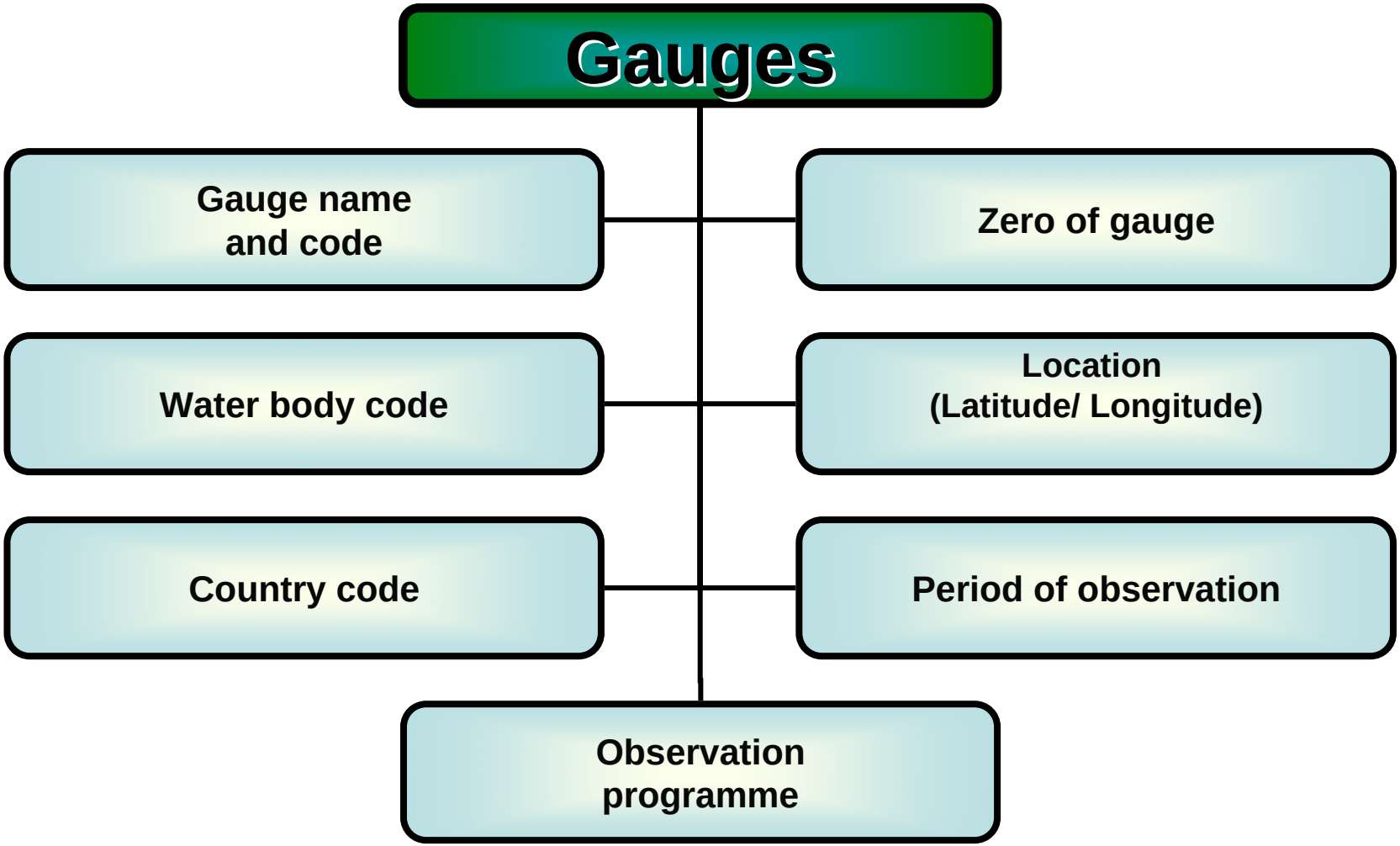
# The Data Base Structure

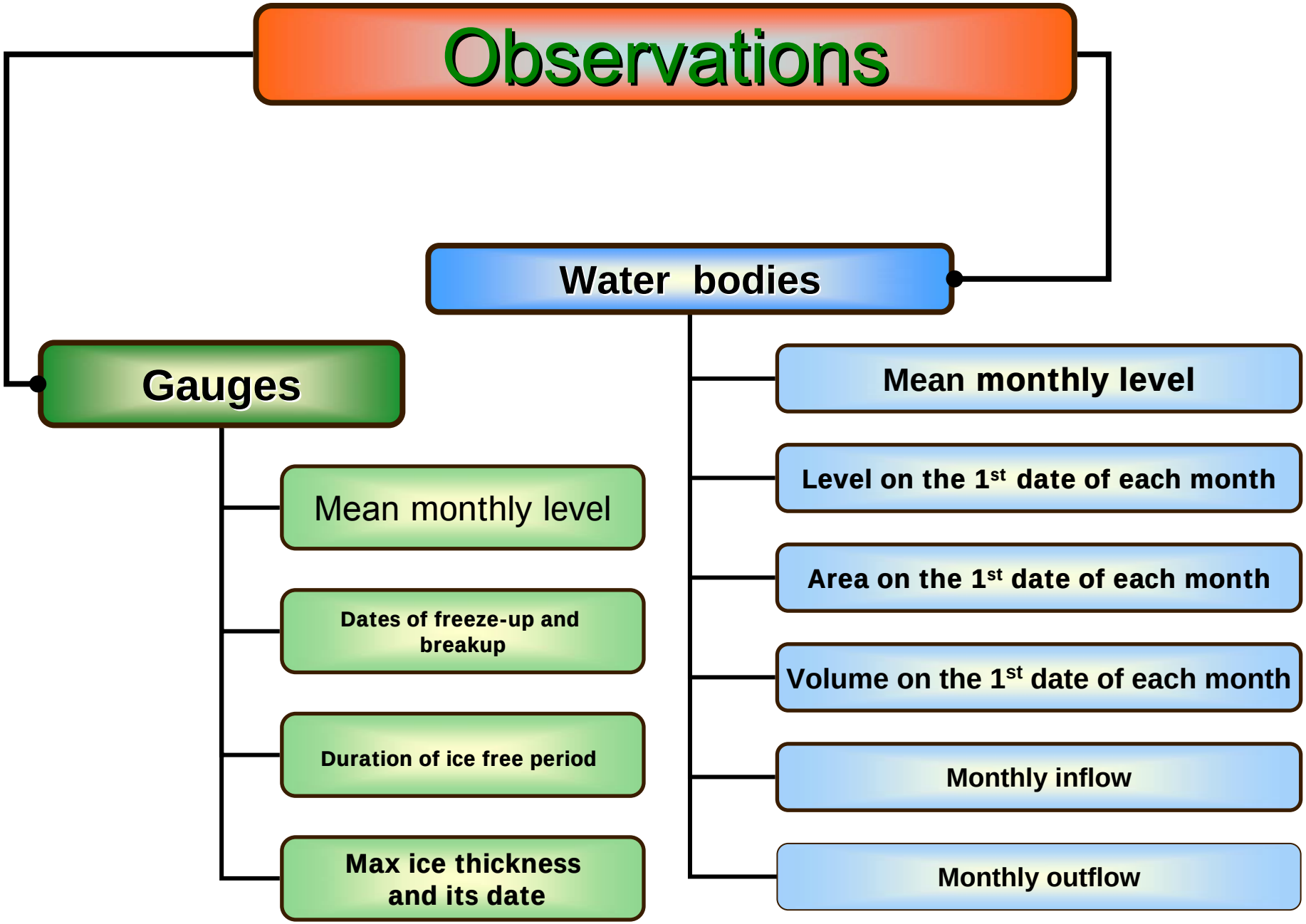


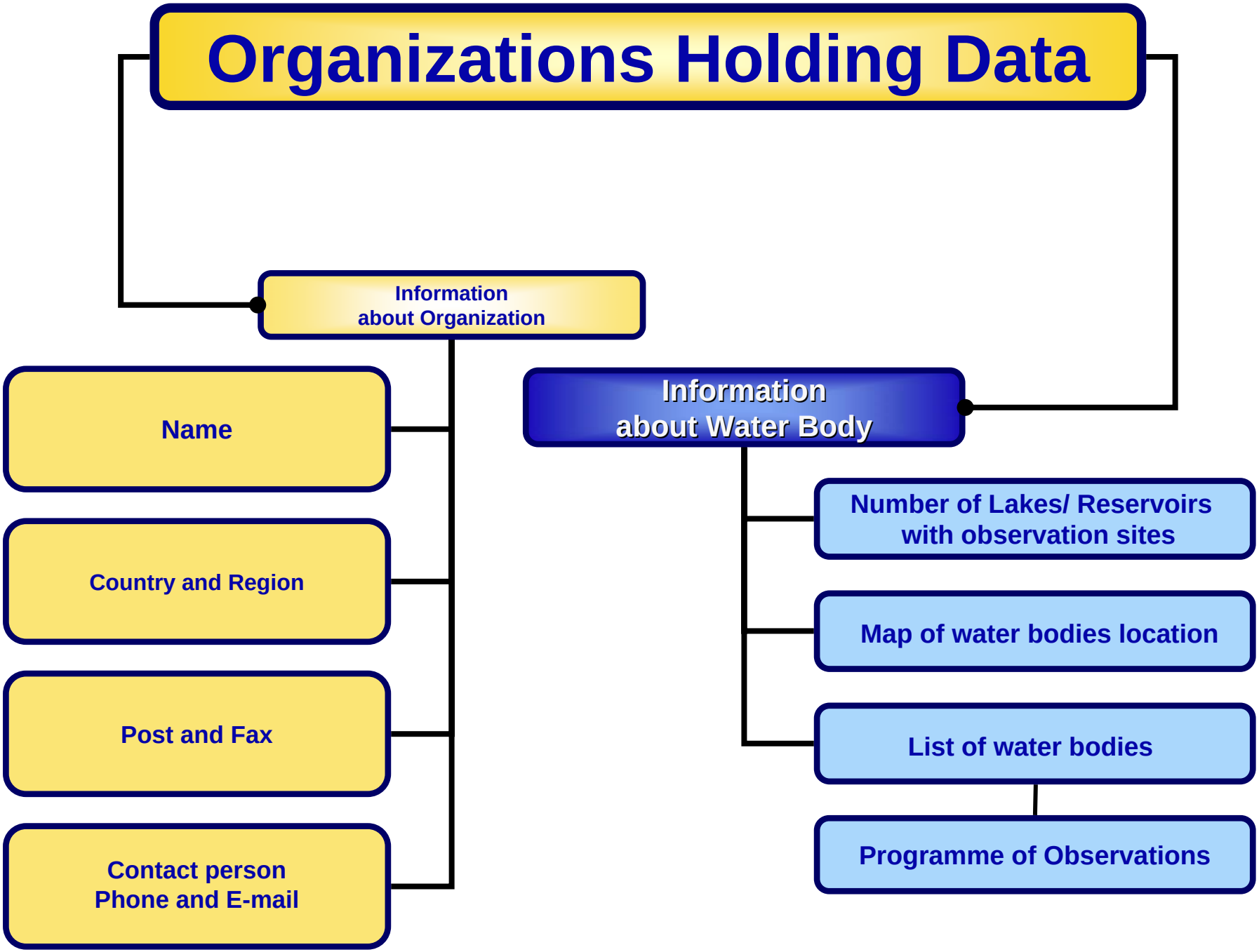

Lakes and Reservoirs
Inflowing, outflowing rivers
Hydrographic characteristics
Main characteristics of hydrologic regime
General information
Main hydrographic and morphometric characteristics
Special characteristics for reservoir
Bathymetric curves
Mean level
Max level
Min level
Organizations holding data and Country(ies)
Type of water body (lake or reservoir)
Name of water body
Programme of observations
Gauges
Brief description of water body

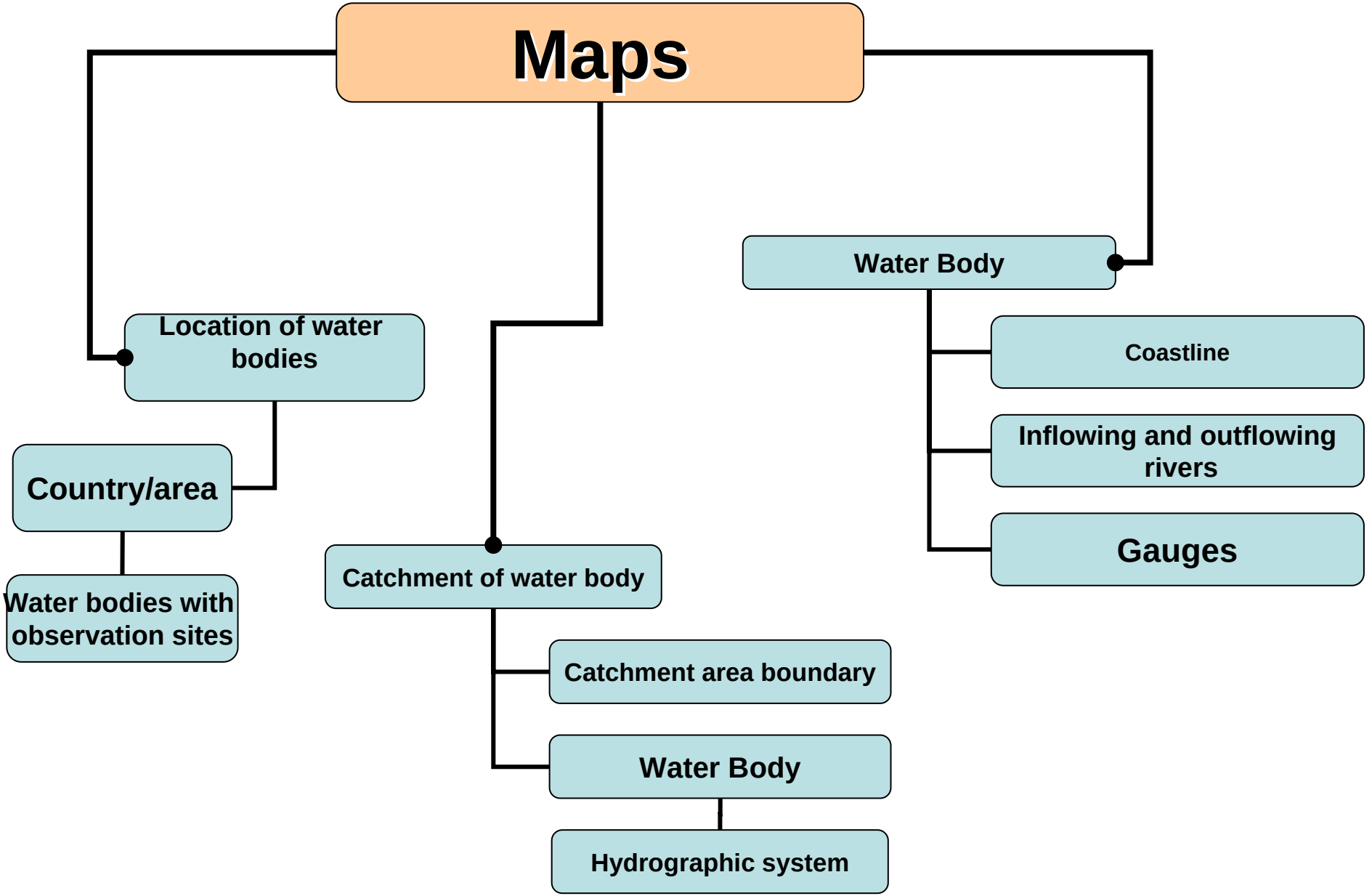

Main hydrographic and morphometric characteristics
Length and Width
Elevation
Mean and Max Depth
Location (Lat.,Long.)
Surface area and Volume
Drainage basin


Special characteristics for reservoir
Normal storage level (NSL)
Dead storage level (DSL)
Reservoir surface Area at NSL
Reservoir surface area at DSL
Normal storage
Dead Storage
Type of reservoir regulation
Spillway level


Gauges
Gauge name and code
Zero of gauge
Water body code
Location (Latitude/ Longitude)
Country code
Period of observation
Observation programme


Observations
Water bodies
Gauges
Mean monthly level
Dates of freeze-up and breakup
Duration of ice free period
Max ice thickness and its date
Mean monthly level
Level on the 1st date of each month
Area on the 1st date of each month
Volume on the 1st date of each month
Monthly inflow
Monthly outflow


Organizations Holding Data
Information about Organization
Name
Country and Region
Post and Fax
Contact person Phone and E-mail
Information about Water Body
Number of Lakes/ Reservoirs with observation sites
Map of water bodies location
List of water bodies
Programme of Observations


Maps
Location of water bodies
Country/area
Water bodies with observation sites
Catchment of water body
Catchment area boundary
Water Body
Hydrographic system
Water Body
Coastline
Inflowing and outflowing rivers
Gauges

# Main projecting products of HYDROLARE

- ***Questionnaire***

- ***Summary of Questionnaire and analysis of Intenet information and publications in the form of***
  - Catalogue of organizations holding data and information on hydrology of lakes and reservoirs;
  - Catalogue of water bodies and observational sites on them

- ***Website***

- ***Digital bases of metedata and time series of hydrological data***

- ***Periodical publication in the form of NewsLetter***

- ***Annual reports on development and state of data base***

- ***Periodic scientific reports on level and storage change in water bodies by countries and continents***
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- ***Periodic scientific reports on water temperature and ice thickness tendencies on water bodies by countries and continents***
- ***Long-term characteristics of time series of hydrologic characteristic containing in the data base***
- ***Reports at the international conferences, symposiums and workshops***
- ***Scientific and popular publications in journals and magazines***
- 

# Promotion of HYDROLARE

- **Development of Hydrolare website including educational information about lakes and reservoirs and observations on them for children**
- **Introduction of the information concerning Hydrolare on the international websites of institutions specialized in research, management, protection, use and developing projects on lakes and reservoirs (ILEC, ICOLD, LakeNet, FAO and so on)**
- **Preparation and publication of summaries about Hydrolare in Newsletters and Bulletin of International environmental organizations (UNEP, WMO, ICOLD, IAHS, IAEL and so on)**

- **Preparation of publications on Hydrolare for scientific journals devoted to the problems of hydrology, hydrobiology, hydrochemistry, environment, water resources management, monitoring,remote sensing and etc.**

- **Preparation reports on Hydrolare activity and results of data set analysis at international conferences**

- **Publications on Hydrolare in popular international geographical journals**

- **Interview in mass media, concerning Hydrolare**

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

**St. Petersburg, Russian Federation, 14-15 June 2007**

**FINAL REPORT**

**July 2007**

The Steering Committee should consist of representatives from the following organizations and institutions:

State Hydrological Institute (2: one member being the Chairperson, the other the Head of HYDROLARE);
WMO (1);
UNEP (1, representing the UNEP GEMS/Water Collaborative Centre on Water Quality);
UNESCO-IHP (1);
GRDC (1);
GCOS (1);
ILEC (1).

# Milestones until December 2008

| WMO | Milestone | Deadline |
|---|---|---|
| 1 | Preparation of questionnaire for data collection, in collaboration with WMO | September 2007 |
| 2 | Development of encoding system for database, taking into account WMO requirements | September 2007 |
| 3 | Development of encoding system for data base, take into account WMO requirements | September 2007 |
| 4 | Preparation of metadata for lakes and reservoirs of Russia and other former USSR countries, for loading into the prototype data base | December 2007 |
| 5 | Preparation of requests for historical observational data from foreign countries, and distribution of these requests and the questionnaire via WMO | December 2007 |
| 6 | Loading of available metadata for lakes and reservoirs of Russia and other former USSR countries into the database | since January 2008 |
| 7 | Preparation of historical observational data for lakes and reservoirs of Russia, for loading into prototype data base | January 2008 |
| 8 | Selection of the HYDROLARE database software, and design and development of the database to a prototype level | February 2008 |
| 9 | Loading of historical observational data for lakes and reservoirs of Russia into the prototype database | since February 2008 |
| 10 | First test operation of HYDROLARE | March 2008 |
| 11 | Preparation of historical observational data for lakes and reservoirs of former USSR countries, for loading into the data base | June 2008 |
| 12 | First review of HYDROLARE functions and activities | June 2008 |
| 13 | Loading of historical observational data for lakes and reservoirs of former USSR countries into the database | since July 2008 |
| 14 | Loading of available metadata for lakes and reservoirs of foreign countries into the database | since July 2008 |
| 15 | Loading of historical observational data for lakes and reservoirs of foreign countries into the data base | since October 2008 |
| 16 | Second meeting of HYDROLARE Steering Committee | November 2008 |



Thank you!