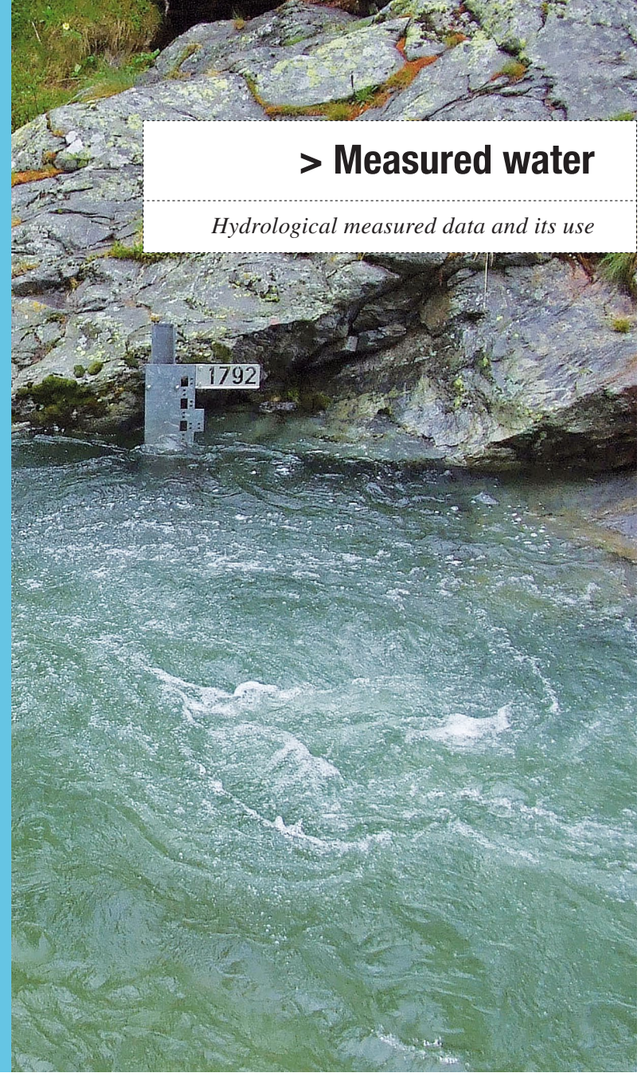

> Measured water

Hydrological measured data and its use

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Office for the Environment FOEN

> Monitored riches

The rain and snow falling annually in Switzerland totals around 60 billion cubic metres of water, which is equivalent to a column of water some 1.5 metres high for every square metre of land. Around a third of the precipitation evaporates and the rest remains in the form of snow and glacier ice, runs off the surface through streams, lakes and rivers or seeps into the groundwater.

A valuable resource but a potential hazard

As the “reservoir of Europe”, Switzerland is gifted with a valuable resource: Water is used for drinking, irrigation, electricity production and as a waterway and creates attractive landscapes and natural habitats. But the dynamics of water also present dangers: In periods of high precipitation or snow melt there is a threat of damage from avalanches, flash floods and flooding, whereas shortages and conflicts of use can occur in times of drought.

Intensive monitoring

The Federal Office for the Environment (FOEN) monitors the quantity and quality (chemical and physical characteristics) of surface waters and groundwater through a dense network of monitoring stations. Rising water levels, pollution and other problematic changes can be detected in good time and appropriate countermeasures can be taken. Data capture and transmission are largely automatic, but local manual measurements by specialists continue to be essential. By evaluating and analysing the measured data it is possible to predict the flow rate expected in the days ahead, give warnings of extreme events and allow sustainable management of water resources (see overleaf).

Measurement on the surface

The FOEN determines the water level of the lakes and the flow rate (discharge) of streams and rivers at around 260 monitoring stations. Physical and chemical parameters are also recorded at many stations. The data is sent automatically to the FOEN’s head office where it is available in real time. Uninterrupted operation of the stations is ensured by weekly inspections carried out by local station observers and by regular maintenance. Specific monitoring campaigns targeting current problems are carried out alongside the long-term measurements. The first systematic national data records date back to 1863.

Measurement underground

In collaboration with the cantons, the confederation examines the quantity and quality of groundwater at over 600 sites. The monitoring sites are representative of the different regions, aquifer types and land uses. They determine the groundwater level and spring discharge (output volume) along with the groundwater quality. This is affected by natural and synthetic substances in the water such as nitrate, plant protection products and chlorinated hydrocarbons.

> Service

The following FOEN services can be found at *www.hydrodaten.admin.ch:*

Data service

The data from approximately 260 monitoring stations on lakes and watercourses and approximately 100 groundwater monitoring sites can be accessed online and downloaded.

SMS service

The latest FOEN hydrological data can be requested by SMS.

Hydrological bulletin

The FOEN issues a hydrological bulletin twice a week. If there is a threat of flooding, the FOEN publishes regular situation assessments.

The federal government warns of threats of natural hazards at *www.naturgefahren.ch*

Flood warnings

The federal government publishes nationally relevant warnings of floods and other natural hazards. These warnings are also broadcast on radio and television.

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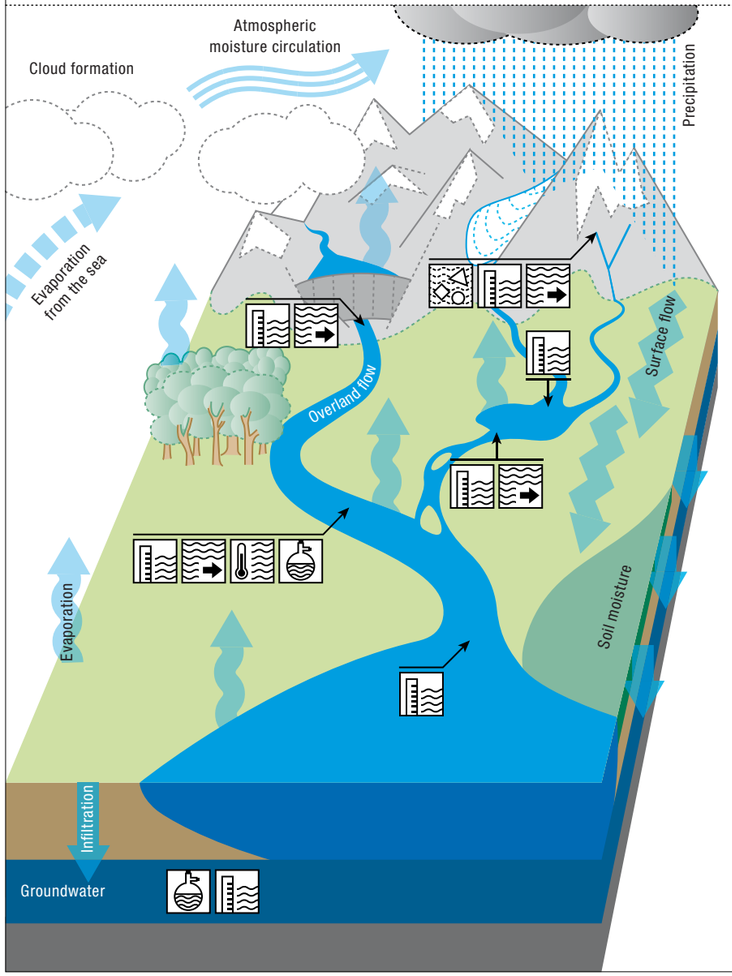
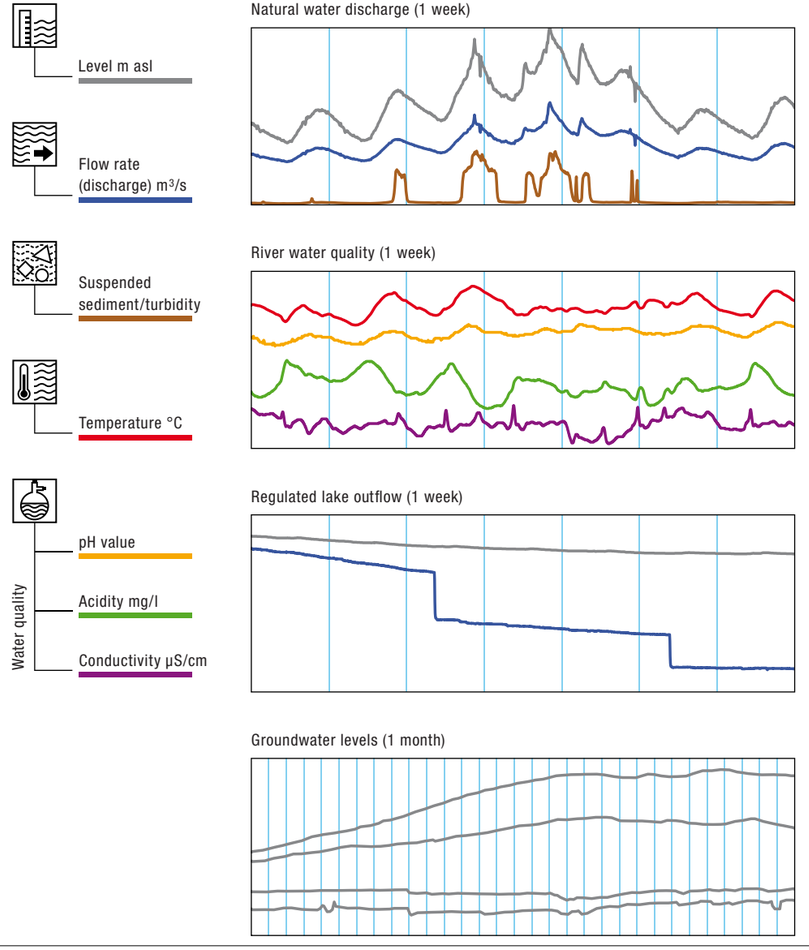
> Hydrology: From measurement to application – some examples

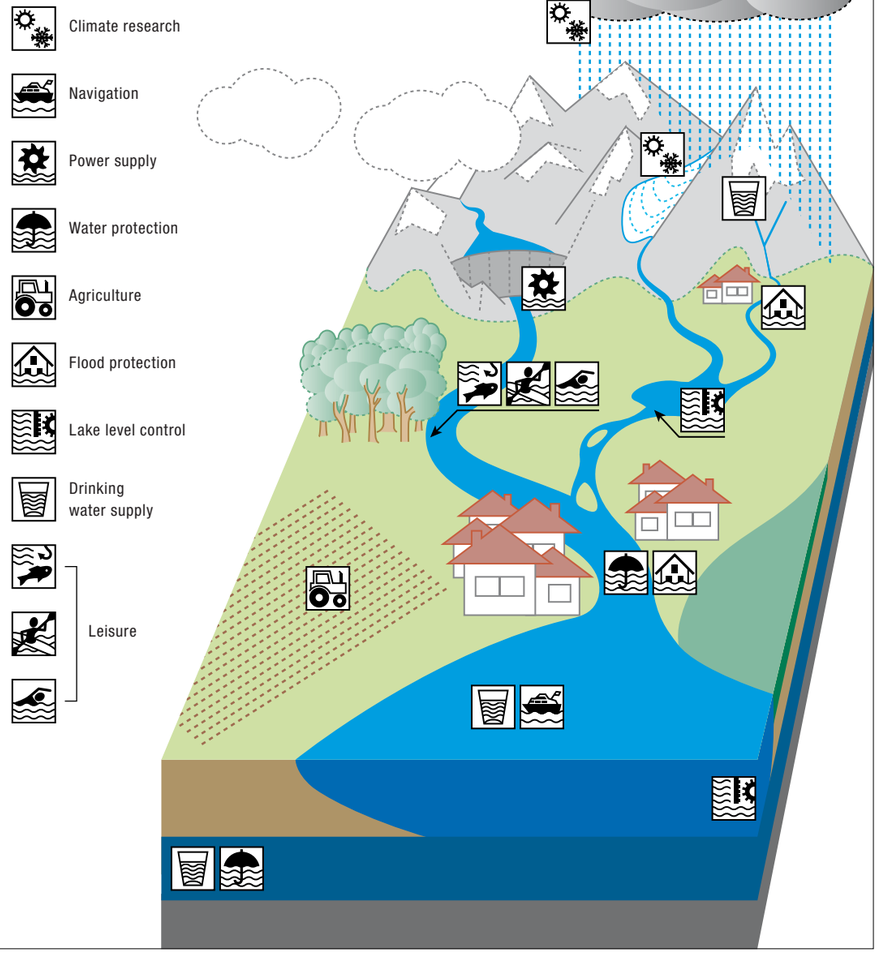
Measurements in the hydrological cycle →



Data processed and visualised →



Applications



> Demand for data and analyses

Predicting and controlling natural hazards

Damage can only be prevented and flood events controlled with the help of reliable data. Measurement series of sufficient length indicate the peak floods that can occur on a specific stretch of water and can also be used to calculate how often these events can be expected. Hydrological measurements are an essential basis for effective structural flood protection and suitable precautions to reduce damage.

In situations of acute flooding, the FOEN's hydrological data is used in combination with weather forecasts and measurements to generate predictions for the hours and days ahead and if necessary to warn the authorities and the population affected.

Protection of natural resources

Systematic measurements of water quantity are essential for sustainable resource management. The data collected gives the federal and cantonal authorities a reliable basis on which to evaluate diverse claims, such as power generation, conservation, irrigation and tourism. These interests are assessed in the course of environmental impact assessments, the awarding of licences, residual flow reviews etc.

The flooded Krummbach in the Simplon region. Photo: Eugène Lehmann

By conducting regular, long-term, nationally representative surveys of water quality, it is possible to detect discharges of pollutants from industry, transport, agriculture and inhabited areas in good time and initiate targeted countermeasures. Groundwater monitoring helps to protect this primary source of drinking water supplies. People are protected from the effects of harmful organisms (e.g. pathogens) and substances harmful to health.

Water management

Information on the current status and trends in water levels and flow rates is needed so that economic activities such as waterway navigation and hydropower generation can be planned and carried out as well as to control water levels in the lakes. The FOEN makes this data available continuously and with the necessary spatial and temporal resolution.

Science and research

Scientists and researchers rely on long-standing, high quality measurement series from a range of hydrological situations. Due to the diverse topography and the associated wide climatic differences in the alpine regions, the measured data for one catchment cannot be used to determine the status of another; a dense monitoring network is therefore required. A broadly based system helps to improve understanding of the hydrological cycle (precipitation – evaporation – discharge). Scientific calculation models provide information on the hydrological conditions in a changing climate and supply answers to the question of how much water Switzerland will have in future.

The Spöl below the Punt dal Gall dam with residual flow regulation. Photo: Andrea Crose

Leisure and recreation

The FOEN's hydrological data can also be of everyday use to the public. The temperature readings for rivers and lakes can be helpful in planning summer swimming trips.

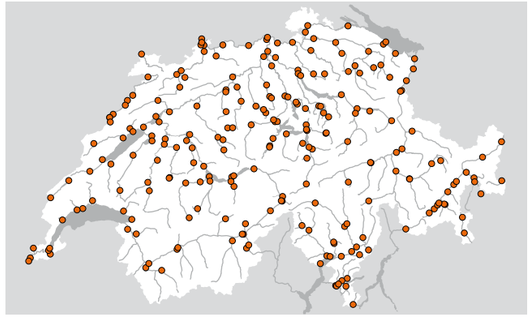
Acoustic Doppler current profiler on a trimaran. Photo: Beat Sigrist

Federal government monitoring networks on rivers and lakes

> *Surface waters:* Some 260 stations with water level and flow rate.
> *Temperature measurement network:* Some 70 stations with water temperature on watercourses.
> *National long-term testing of watercourses (NADUF):* Some 20 stations with flow rate and chemical parameters.
> *Hydrological testing regions of Switzerland (HUG):* 40 catchments with flow rate, precipitation, evaporation, geology etc.
> *Sediment transport in watercourses:* Transport of sediment (suspended matter, sand, gravel, pebbles).

Federal measurements in groundwater

> *National groundwater monitoring (NAQUA):* Some 600 monitoring points with groundwater level, spring discharge, nutrients, plant protection products and other organic trace substances.



Monitoring stations on rivers and lakes. Source: www.hydrodaten.admin.ch