



Hydrometric Networks – Catchments and Data Series

Abstract

Switzerland's hydrometric networks include water level and discharge gauging stations run by various operators. This interactive map shows the development of Swiss hydrometric networks since 1856, and provides information about gauging stations, their catchments, and digitally available data series.

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1 Introduction

Historical and current hydrometric data on water levels and discharge are important for many areas of human activity. Sustainable water management and adequate sizing of flood control infrastructure, for example, would be impossible without suitable data series covering multiple years. Today, many gauging stations are technically capable of sending their data to a central database shortly after measurements are made. These real-time data support the detection and assessment of flood risks and thereby help to prevent damage.

Switzerland's hydrometric networks include water level and discharge gauging stations run by various operators. The federal measuring network consists of around 260 active stations and is today run by the Hydrology Division of the Federal Office for the Environment FOEN. In addition to the federal government, numerous cantonal governments, research institutions, and operators of hydropower plants run their own measuring networks.

The Hydrological Atlas of Switzerland shows gauging stations whose data are available in digital form and accessible to third parties. This is why the present edition of the data set on gauging stations contains fewer stations run by "private" operators than the last printed atlas plate on this topic, Plat 5.1² [1].

2 Data and methods

The metadata on hydrometric stations were taken from [1] where possible, and subsequently checked and completed. Each station record includes its location, information about the corresponding catchment, and selected metadata on digitally available data series. Major data sources are listed in Table 1.

A new numbering system ensures unequivocal identification of all stations in the Hydrological Atlas. Numbers of national stations consist of the two-digit ISO country code, a hyphen, and a four-digit number. For cantonal stations, the country code is followed by the ISO canton code, a hyphen, and a three-digit number. All stations run by other institutions are numbered according to the system for cantonal stations, but with the canton code replaced by an X and an additional letter signifying the operating institution. To facilitate

communication with station operators, each record also includes the operator's specific identification code for the given station. This code needs to be used when ordering data from an operator, for example.

The catchments of the monitoring sites were generally combined from the data set on the catchment classification of Switzerland (EZGG-2015 [2]) and corrected in the area of the catchment outlet to ensure that the catchment boundary more or less runs through the measuring site. The catchment areas of the currently active measuring stations of the FOEN and those of the Canton of Geneva were taken from existing geo-spatial data sets [3], [4]. All catchments of measuring stations were derived from topography, without considering hydrogeological phenomena (underground watersheds, karst, etc.) or technical infrastructure (diversions, urban drainage, etc.). Therefore, the real catchment boundaries may differ from the ones shown in the Hydrological Atlas.

The metadata on data series indicate which parameters a station measured over which period, and in which temporal resolution data are available. Information about the beginning and the end of measuring periods were recorded in terms of the exact dates whenever the data source provided this information. The data set includes information about relocations, changes of name, and changes of operator, so that each measuring site record shows the entire period for which digital data series are available, including from earlier stations nearby. However, users should assess in each individual case whether it is possible to extend a given data series with data from a previous station.

3 Results

The present data set currently contains a total of 985 hydrometric stations, of which around two-thirds are in operation. Figure 1 shows the development of hydrometric networks since 1863, the year in which the Swiss Hydrometric Committee was founded. The creation of this committee of the Swiss Academy of Science (Schweizerische Naturforschende Gesellschaft) laid the foundations for systematic monitoring of water levels on Swiss lakes and rivers [5]. At this time, a small number of water level gauges already existed along lakes and large rivers [6]. Later on, especially from the beginning of the 20th century onwards, more



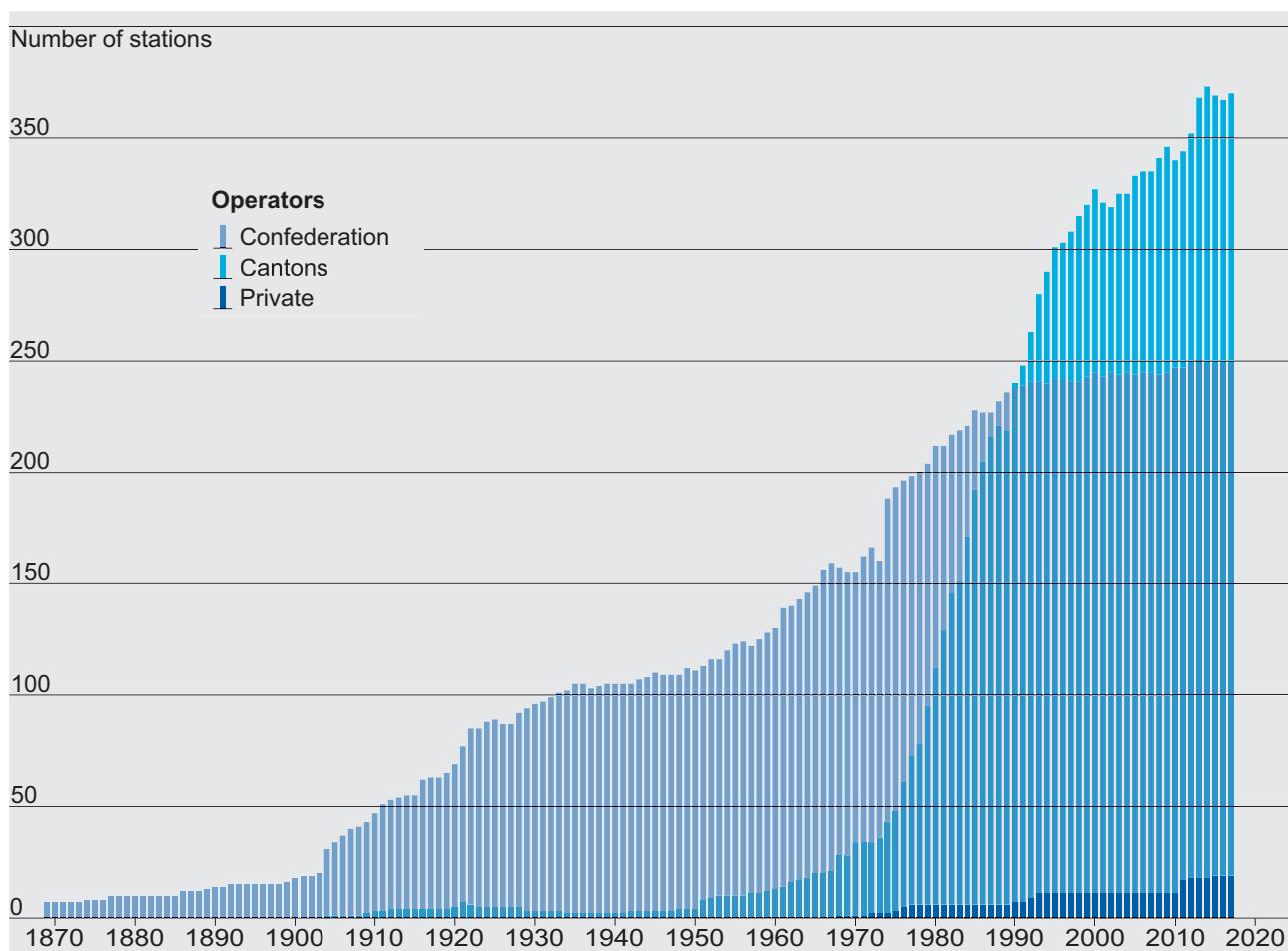


Figure 1. Development of hydrometric networks since 1869

and more stations began to also measure discharge. Today, very nearly all stations on rivers or streams measure more than just the water level. Moreover, all stations were gradually equipped with limnigraphs, which record the water level continuously. In older data series the daily mean discharge values are often based on as little as one to three daily readings of the water level. From the middle of the 20th century onwards, the federal hydrometric network was complemented with others. Cantons increasingly installed their own networks. While the first cantonal measuring stations concentrated on the Swiss Plateau and north-western Switzerland, more recently measuring networks in the Alps have been expanded as well. Cantonal measuring networks focus mainly on small rivers and streams, a fact that clearly shows in the cantonal measuring stations' median catchment area. Considering all cantonal stations currently in operation, this value amounts to 26 km² – compared to 210 km² for federal measuring stations.

4 Uses / Examples

Clicking on one of the monitoring stations will show this station's metadata, its data series, and the catchment polygon. All of these can be downloaded. In addition, the filter function enables the creation of customised lists of measuring stations, which are downloadable as well. Selection of a specific monitoring period shows

all measuring stations that offer data for at least 95% of that period.

Several sites have data series of multiple stations for successive periods owing to the relocation or renaming of stations or changes in their operators. In many cases it is possible to combine the discharge data series of two or more such monitoring stations into one long data series. This is the case, for example, on the Rhine in Basel. Taken together, the earlier stations Rhein–Basel, Schiffflände and Rhein–Basel, St. Alban; as well as the station Rhein–Basel, Rheinhalle, which has been in operation since 1995; cover the entire period from 1869 to the present. For the station Rhein–Basel, Rheinhalle mean discharge data series are shown not only for the monitoring period of this station, but for the two defunct stations as well. Discharge data for the Rhine in Basel were in fact even reconstructed back to 1807 based on gauge readings [7]. However, the Hydrological Atlas does not show this reconstructed data series because it is not available in digital form.

Table 1. Sources of data and information included in metadata on hydrometric stations

Station code	Agency/Source of data and information
CH-	Bundesamt für Umwelt BAFU, Abteilung Hydrologie
CHAG-	Kanton Aarau, Departement Bau, Verkehr und Umwelt, Abteilung Landschaft und Gewässer
CHAR-	Kanton Appenzell Ausserrhoden, Departement Bau und Volkswirtschaft, Tiefbauamt
CHBE-	Kanton Bern, Bau-, Verkehrs- und Energiedirektion, Amt für Wasser und Abfall
CHBL-	Kanton Basel-Landschaft, Tiefbauamt bzw. Amt für Umweltschutz und Energie
CHFR-	Staat Freiburg, Amt für Umwelt AfU
CHGE-	République et canton de Genève, Direction générale de l'eau
CHGL-	Kanton Glarus, Departement Bau und Umwelt
CHGR-	Kanton Graubünden, Amt für Natur und Umwelt
CHLU-	Kanton Luzern, Bau-, Umwelt- und Wirtschaftsdepartement, Umwelt und Energie
CHNE-	République et canton de Neuchâtel, Département du développement territorial et de l'environnement
CHSG-	Kanton St. Gallen, Amt für Wasser und Energie
CHSH-	Kanton Schaffhausen, Baudepartement, Tiefbau
CHSO-	Kanton Solothurn, Bau- und Justizdepartement, Amt für Umwelt
CHTG-	Kanton Thurgau, Departement für Bau und Umwelt, Amt für Umwelt
CTI-	Repubblica e Cantone Ticino, Ufficio dei corsi d'acqua
CHVD-	Canton de Vaud, Direction générale de l'environnement
CHVS-	Canton du Valais, Service des forêts des cours d'eau et du paysage
CHZG-	Kanton Zug, Baudirektion, Amt für Umweltschutz
CHZH-	Kanton Zürich, Baudirektion, Amt für Abfall, Wasser, Energie und Luft
CHXA-	EPFL Lausanne, Institut d'ingénierie de l'environnement
CHXB-	Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft WSL, Birmensdorf
CHXC-	Centre de recherche sur l'environnement alpin, Sion
CHXD-	ETH Zürich, Institute for Atmospheric and Climate Science, Land-Climate Dynamics
CHXE-	Geographisches Institut der Universität Zürich, Hydrologie und Klima
CHXF-	AXPO Power AG, Baden

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