Plate 5.4 Natural Runoff 1961–1980

Introduction

Since 1863, runoff has been measured systematically in Switzerland, thus laying the groundwork for an extensive data system (cf. map 5.1). By means of this data, the present map focuses on providing a comprehensive, spatially differentiated overview of the long-term average annual runoff for the period 1961–1980.

For the purpose of an easier evaluation of individual statements, a spatial reference system was established for the «Hydrological Atlas of Switzerland». It comprises three levels: the large river basins, mostly with areas of multiple 1000 km^2, form the top level (cf. map 6.1). Large river basins are then subdivided into medium scale catchments (100–150 km^2), referred to as water balance basins in this text. The latter make up the spatial starting-point for this map. On the lowest level, consisting of small catchments with areas of 30 to 50 km^2, catchment characteristics are analysed (cf. map 1.2).

Water balance basins

The following criteria are relevant for the classification of Switzerland into approximately 300 water balance basins:

(1) Selection of medium scale catchments: the average area of the water balance basins is 145 km^2, ranging from 29 to 434 km^2. 25 % of the basins are smaller than 90 km^2 and 25 % are larger than 188 km^2.

(2) Consideration of geological conditions: as a rule, the basin boundaries are identical to the above ground divides. In regions with important groundwater resources or extensive permeable rock (e.g. limestone), it was necessary to deviate from this rule. In the Jura region, the basins were defined according to a study by [2], considering as close as possible the subsoil discharge conditions. This map includes, in generalised form, the common subsoil inflows and outflows between the water balance basins, according to a reference study by [1].

(3) Assignment of basin outlets within the embouchure area to larger rivers, taking into account the position of hydrometric stations. This allows the downstream discharge of the water balance basins to be summed up continuously. In the Swiss border zone and around large lakes, hydrologically open basins developed. For them it is partly impossible to determine any basin runoff.

The water balance basins are numbered according to the hydrographic principle. The first number indicates the corresponding drainage basin (e.g. 1: Rhine, 2: Aare).

Data base

Map 5.1 depicts the federal, cantonal and private runoff gauging stations with basically accessible data. However, only stations were considered if they were operating during the 1961–1980 reference period, or if their values could be converted into this period. On the map, these initial data are compiled according to their temporal origin. The indicated runoff usually refers to the average natural discharge of the period of 1961–1980, i.e. observed runoff data, taking into account the artificial inflows and outflows (cf. map 5.3).

Determination of runoff at the basin outlets

At the basin outlets the discharge had to be determined in different ways: if the basin outlets were situated within the range of a runoff gauging station, the measured – temporally converted if necessary – discharge was taken directly; in all other cases, the discharge was spatially interpolated. In particular instances, it was not possible to determine discharge because special estimation methods, such as those described by map 5.2, for example, were not applied. The indicated discharge at the basin outlets is equal to the total amount of water runoff at the same positions.

Average specific surface discharge of the water balance basins

For the 1961–1980 period, the average annual specific surface discharge for about 85 % of the water balance basins could be calculated, based on the discharge determined at the basin outlets.

Specific surface discharge of the water balance basins fluctuate between 8 and 73 l/s*km^2, with half of all the values ranging between 21 and 42 l/s*km^2 (cf. table). The surface-weighted average specific discharge of the water balance basins amounts to approximately 32 l/s*km^2, corresponding to a depth of discharge of 1009 mm.

To consider the plausibility of these figures, the specific discharge was assessed with regard to the regional hydrology. For each basin, due consideration was given the specific surface discharge, as well as the residual element of the corrected basin precipitation (map 2.2) and the basin runoff. Subsequently, both the specific discharge and the residual element of a water balance basin were compared to the values of the other water balance basins assigned to the same hydrological region. A region includes particular levels of altitude within a river basin. For each region, a range of variation for specific discharge and the residual element was assessed. If the values of a water balance basin are within this range, the specific surface discharge can be considered to be plausible from a hydrological point of view. If a basin deviates more or less strongly, the following possible interpretations should be considered:

(1) the spatial-temporal interpolations led to inaccurate specific surface discharges;

(2) the specific surface discharges are reliable, but special hydrological conditions exist (subsoil inflows and outflows, changes in mass balances at glaciers), which led to the deviating values.

Results of these plausibility assessments are compiled in the table.

References

[1] **Buttet, P. (1990):** Ecoulements souterrains d'un bassin versant vers un autre. Rapport interne du Service hydrologique et géologique national, Berne.

[2] **Magnin, O. (1990):** Délimination de bassins versants dans la chaîne du Jura et définition d'indices hydrogéologiques. Rapport interne du Centre d'hydrogéologie, Neuchâtel.