The 2011 Drought: Swiss Rivers’ Sensitivity

K. Stahl, M. Weiler, A. Gundel

The year 2011 experienced two dry weather periods: in spring from mid-April to mid-May, and in autumn, from October to late November.

Streamflow in many Swiss rivers fell below the national minimum flow requirement (Q347) during one or both of these drought periods. Overall, spring low flows were lower relative to the seasonal norm, autumn low flows were lower in absolute terms.

How severe was the 2011 streamflow drought?

Ranks within the common available reference period 1991-2010:

<table>
<thead>
<tr>
<th>Rank</th>
<th>Days below seasonal Q347 (%)</th>
<th>Days below seasonal Q35 (10% quantile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Rank number 1 indicates the largest number of drought days (upper) or longest drought spell (lower) below the seasonal threshold (10% moving Q35 i.e. the 10% quantile of the seasonal distribution).

The 2011 streamflow drought was:
- The most severe drought or at par with the 2003 event in one third of the catchments, when compared to the last 20 years
- More severe in the north and west of Switzerland

Relief from a wet summer with many rain events differed among catchments: no lasting increase in baseflow in Ergolz, Langeten, Mentue, Sense.

Ranks of impact among catchments

Weak relations between streamflow drought days and catchment characteristics: area and elevation

Apparent relation with area due to the two largest catchments Ergolz and Sense.

Apparent relation with elevation due to alpine catchments in the East, where winter snow conditions were different.

Relation of impact to catchment storage characteristics

Mean catchment storage-outflow behaviour (from average annual master recession below Q50)

Can it explain the streamflow drought behaviour in 2011?

Full explanation requires the determination of total and dynamical water storage in the catchment and the geographic variation of meteorological drought conditions, which were less severe in the Eastern part of Switzerland in 2011.

Wortpackage 3: Analysis of critical low-flow conditions and storage characteristics of Swiss catchments