



The relative influence of climate and catchment properties on hydrological drought

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Studying hydrological drought (a below-normal water availability in groundwater, lakes and streams) is important to society and the ecosystem, but can also reveal interesting information about catchment functioning. This information can later be used for predicting drought in ungauged basins and to inform water management decisions.

In this study, we used an extensive Austrian dataset of discharge measurements in clusters of catchments and combine this dataset with thematic information on climate and catchment properties. Our aim was to study the relative effects of climate and catchment characteristics on drought duration and deficit and on hydrological drought typology. Because the climate of the region is roughly uniform, our hypothesis was that the effect of differences of catchment properties would stand out.

From time series of precipitation and discharge we identified droughts with the widely-used threshold level approach, defining a drought when a variable falls below a pre-defined threshold representing the regime. Drought characteristics that were analysed are drought duration and deficit. We also applied the typology of Van Loon & Van Lanen (2012). To explain differences in drought characteristics between catchments we did a correlation analysis with climate and catchment characteristics, based on Pearson correlation.

We found very interesting patterns in the correlations of drought characteristics with climate and catchment properties:

- 1) Droughts with long duration (mean and maximum) and composite droughts are related to catchments with a high BFI (high baseflow) and a high percentage of shallow groundwater tables.
- 2) The deficit (mean and maximum) of both meteorological droughts and hydrological droughts is strongly related to catchment humidity, in this case quantified by average annual precipitation.
- 3) The hydrological drought types that are related to snow, i.e. cold snow season drought and snow melt drought, occur in catchments that have a high elevation, steep slopes, a high percentage of crystalline rock, bare rock and glacier.

The conclusion of our research is that it is not straightforward to separate the effects of climate and catchment properties on drought, since they are interrelated. This is especially true for mountainous regions where temperature and precipitation are strongly dependent on altitude. We did however see that the duration of drought is more related to catchment storage (catchment properties) and the severity of drought (represented by the drought deficit) is more related to catchment wetness (climate).

Van Loon, A.F., and Van Lanen, H.A.J.: A process-based typology of hydrological drought, *Hydrology and Earth System Science*, 16, p. 1915–1946, doi: 10.5194/hess-16-1915-2012, 2012