Submitted Abstract

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Abstract

Water scarcity and related conflicts are becoming a worrying topic in Alpine regions. Moreover, lowland regions far beyond the Alps suffer from missing water from the Alps. Thus, countries are urged to act on this topic with common strategies. To support this cause, the Interreg Alpine-Space project, Alpine Drought Observatory (ADO), aims to set up a virtual observatory for the monitoring of drought in the entire Alpine region.

Monitoring is based on a fusion of existing approaches (e.g. meteorological drought indices, hydrological drought indices), and newly available information (e.g. remote sensing of snow and soil moisture), to provide an optimized set of drought indices and a common drought classification.

In the context of the project, a database of discharge measurements with more than 1400 gauging stations on alpine rivers with, on average, 35 years of records was assembled and inserted in the ADO platform for hydrological drought indices calculation. This wealth of information constitutes an ideal source for data-driven discharge modeling with Machine Learning (ML). Discharge forecasting is relevant for many sectors related to the water cycle, such as agriculture and energy production. Moreover, appropriate river low streamflow prediction can improve preparedness for drought-related risks.

The ML algorithm predictor variables are total precipitation, temperature, and potential evapotranspiration based on ERA5 reanalyses, bias-corrected with quantile mapping, and down-scaled to a 5.5 km grid is the source. The last predictor is the snow water equivalent, obtained with an adaptation of the SNOWGRID model. All the predictors have a daily temporal resolution.

We evaluate the performances of the different approaches, investigate each input variable's importance for several test catchments with different hydrological regimes.

The results show the suitability of ML for discharge prediction up to one month of advance, especially for predicting low-flow conditions in snow-dominated large catchments. Moreover, we discuss the challenges in assembling alpine-wide homogenous hydrological observations datasets for algorithms validation.