



1845-2016 gridded database of monthly precipitation series for Adda basin (Italy): long-term variability and trend in rainfall-runoff comparison

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A new gridded dataset of 1845-2016 secular monthly precipitation series for the Adda basin (Italy) closed at Fortilizio (close to Lecco) is presented. The considered drainage area covers about 4500 km² in Northern Italy and, to a lesser extent, in Switzerland, and it represents an important water reservoir for agriculture, energy management and economical activities.

The availability of long-term high-resolution precipitation series allows to investigate the variability and trend of the climatic signal and to assess future changes in water resources. The gridded database is constructed using more than 400 quality-controlled monthly precipitation series covering the Adda basin and part of the surrounding area. The methodology used to project observational data onto the high-resolution grid (30-arc-second Digital Elevation Model, DEM GTOPO 30) is based on the assumption that the spatio-temporal behaviour of a meteorological variable can be described by the superimposition of two fields: the climatologies for a reference period and the departures from them, i.e. the anomalies. The two fields can be reconstructed independently starting from different datasets. To compute precipitation climatologies all available stations within Adda basin are considered while, for anomalies, only the longest and the most homogeneous series are selected. The 1961-1990 climatological values at each DEM cell of the Adda basin are obtained by a local weighted linear regression of precipitation versus elevation (LWLR) taking into account the closest stations with similar geographical characteristics to those of the cell itself. The anomaly field is obtained by a weighted average of the anomalies of neighbouring stations considering both the distance and the elevation differences between the stations and the considered cell. Finally, secular precipitation series at each DEM cell of Adda basin are computed by multiplying the gridded anomalies for the corresponding climatological values. Precipitation series of Adda basin is then compared to 1845-2016 runoff series reconstructed at the inflow in the Como Lake. Mann-Kendall and Theil-Sen tests highlight a significant negative trend in the annual runoff to precipitation ratio. While precipitation series do not show a significant trend, a significant decrease in annual runoff is found. The negative trend in runoff series may be justified by higher evapotranspiration losses due to increasing temperature as well as by land-use changes occurring in mountain valleys.