

Long term statistics (1845-2014) of daily runoff maxima, monthly rainfall and runoff in the Adda basin (Italian Alps) under natural and anthropogenic changes.

Roberto Ranzi (1), Federica Goatelli (1), Camilla Castioni (1), Massimo Tomirotti (1), Alice Crespi (2), Enrico Mattea (2), Michele Brunetti (3), and Maurizio Maugeri (2)

(1) Università degli Studi di Brescia, DICATAM-Dipartimento di Ingegneria Civile, Architettura, Territorio, Ambiente e di Matematica, Brescia, Italy (ranzi@ing.unibs.it), (2) Università degli Studi di Milano, DF-Dipartimento di Fisica, (3) ISAC-CNR, Bologna

A new time series of daily runoff reconstructed at the inflow in the Como Lake in the Italian Alps is presented. The time series covers a 170 years time period and includes the two largest floods ever recorded for the region: the 1868 and 1987 ones. Statistics of annual maxima show a decrease which is not statistically significant and a decrease of annual runoff which is statistically significant, instead. To investigate the possible reasons of such changes monthly temperature and precipitation are analysed. Decrease of runoff peaks can be justified by the increase of reservoir storage volumes. Evapotranspiration indexes based on monthly temperature indicate an increase of evapotranspiration losses as a possible cause of runoff decrease.

Secular precipitation series for the Adda basin are then computed by a methodology projecting observational data onto a high-resolution grid (30-arc-second, DEM GTOPO30). It is based on the assumption that the spatio-temporal behaviour of a meteorological variable over a given area can be described by superimposing two fields: the climatological normals over a reference period, i.e. the climatologies, and the departure from them, i.e. the anomalies. The two fields can be reconstructed independently and are based on different datasets. To compute the precipitation climatologies all the available stations within the Adda basin are considered while, for the anomalies, only the longest and the most homogeneous records are selected. To this aim, a great effort was made to extend these series to the past as much as possible, also by digitising the historical records available from the hardcopy archives. The 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, the secular precipitation records at each DEM cell of the Adda basin are computed by multiplying the local estimated anomalies for the corresponding climatological values. A statistically significant decreasing trend of precipitation results from the Man Kendall and Sen-Theil tests.