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Prediction of low-flow indices in ungauged basins through physiographical space-based interpolation

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Recently, a physiographical space-based Kriging methodology for regional flood frequency estimation has been proposed in the scientific literature [Chokmani and Ouarda, WRR, 2004]. The application reported by the authors exploits a well established geostatistical technique to interpolate flood quantiles on a continuous physiographical space, whose coordinates are a suitable set of geomorphological and climatic catchment descriptors. In particular, for determining these coordinates of the physiographical space, two multivariate analysis techniques can be applied: the Canonical Correlation Analysis (CCA) and Principal Components Analysis (PCA). The original features of the proposed methodology are its suitability for ungauged sites and its capability to capture the spatial autocorrelation structure of the variables in the physiographical space. In principle, the proposed methodology is suitable for predicting the streamflow regime in ungauged basins and therefore flood quantiles, but also low-flows. The aim of this study is to investigate the applicability of physiographical space-based interpolation techniques for the prediction of low-flow indices in ungauged basins. The study area consists of 52 unregulated catchments located in central Italy, for which several geomorphological and climatic descriptors are available. The analysis focuses on the estimation of low-flow indices, such as Q_{355} (discharge associated with a duration of 355 days) and 7Q10 (7-day average low-flow with a recurrence interval of 10 years), and applies several techniques for performing the spatial interpolation of the low-flow indices of the physiographical space. These techniques are either deterministic (e.g., inverse distance, etc.) or geostatistical (e.g., Kriging). The reliability of each technique is assessed through a comprehensive cross-validation procedure

that simulates the ungauged conditions at each sites of the study area.