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Geostatistical methods for hydrological extremes assessment in ungauged river basins

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Low flows and peak discharges knowledge is fundamental to characterize the associated droughts and floods and to determine all the processes related to the flow discharges and to the river ecosystems. Low flow characteristics and peak discharges are usually estimated from stream gauging stations. However hydrological data are not always available at the site of interest. Regional frequency analysis is commonly used for the estimation of flow characteristics at sites where little or no data exists. Once that homogeneous regions are determined, specific investigations tools are needed to estimate low and high flows. Spatial interpolation is used to regionalize the desired streamflow index (e.g., low-flow index, flood quantile, peak discharges, etc.), by applying Top-kriging over a geographical space. Top-kriging is chosen because it is intimately connected to the stream network structure and geometric layout. The analysis is carried out on the discharge data of 65 consistent hydrometric stations in Tuscany region, in Central Italy with data from 1949 to 2008. The results are validated using the jack-knife method. Different interpolation techniques geostatistic as well as deterministic (Inverse Distance, Ordinary kriging, Physiographical Spaced Based Interpolation PSBI) and multivariate regression methods are carried out. Different error measurement (mean square error, mean relative error, etc.) are also assessed to compare the results, to quantify the accuracy of the different techniques and to define the most suitable procedure for extremes flow regionalization.