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Multidimensional context for extreme analysis of daily streamflow, rainfall and accumulated rainfall across USA

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Statistical analysis of rainfall and runoff extremes plays a crucial role in hydrological design and flood risk management. Usually this analysis is performed separately for the two processes of interest, thus ignoring their dependencies, which appear at multiple temporal scales. Actually, the generation of a flood strongly depends on soil moisture conditions, which in turn depends on past rainfall. Using daily rainfall and runoff data from about 400 catchments in USA, retrieved from the MOPEX repository, we investigate the statistical behavior of the corresponding annual rainfall and streamflow maxima, also accounting for the influence of antecedent soil moisture conditions. The latter are quantified by means of accumulated daily rainfall at various aggregation scales (i.e., from 5 up to 30 days) before each extreme rainfall and streamflow event. Analysis of maxima is employed by fitting the Generalized Extreme Value (GEV) distribution, using the L-moments method for extracting the associated parameters (shape, scale, location). Significant attention is paid for ensuring statistically consistent estimations of the shape parameter, which is empirically adjusted in order to minimize the influence of sample uncertainty. Finally, we seek for the possible correlations among the derived parameter values and hydroclimatic characteristics of the studied basins, and also depict their spatial distribution across USA.