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Space-time structure of extreme precipitation in Europe over the last century: a climate perspective.

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We analyze over a century of continuous rainfall data available from the ECA&D archive for spatio-temporal trends in extreme precipitation. The data base includes 515 stations with records longer than 100 years. For each station, we identify daily rainfall events in the winter 6 months (Oct-Mar) that exceed the 99th percentile of daily rainfall. An annual time series of the frequency of such events is created, as well as an annual time series of the average daily rainfall in these events. Space and time analyses of the variation of the frequency and intensity time series are then pursued using multivariate time and frequency domain (multi-taper method) methods. The key trends and organized spectral modes identified are related to potential anthropogenic change and to well established climate indices (e.g., NAO, EAWR and SL). The simultaneous analysis of monotonic trends over the secular period and quasi-oscillatory phenomena is informative as to the attribution of changes in extreme precipitation over the region. The spatial patterns associated with each quasi-oscillatory mode and the "trend" signal are identified, and an envelope of the time reconstruction centered at the key frequency bands deemed significant is also identifies and related to potential teleconnections through correlation with key atmospheric circulation indices and SST fields. The potential implications for future risks are discussed in the context of a Global Flood project that aims to characterize the climate risk factors and develop instruments for prediction and mitigation of these risks.