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Interannual and interdecadal Oscillations in the monthly Precipitation Extremes in Germany during the 20^{th} Century: Time Series scaling Properties and Detection of distribution-independent Periodicities

D Markovic and M. Koch

Department of Geotechnology and Geohydraulics

University of Kassel

Germany

(kochm@uni-kassel.de)

Monthly precipitation extremes during the 20^{th} century from selected gauging stations across Germany were analyzed using the continuous wavelet tool, the wavelet modulus maxima method and the detrended fluctuation analysis. While the high frequency, 1 yr. oscillation remains significant for all mean and low altitude locations, the low frequency spectral characteristics of the analyzed data sets showed to be both spatially and time dependant. From the mid 20^{th} century on, distinct low frequency oscillations at the interannual (7-8yr.) and interdecadal (11-14yr.) scale extend the precipitation frequency distribution. Applying Detrended Fluctuation Analysis (DFA) and the Wavelet Transform Modulus Maxima method (WTMM) we investigate the scaling properties of precipitation time series through the computation of the Hurst parameter. It is apparent that data with low frequency components, regardless whether significant or not, show higher H values, i.e. some amount of persistence, than data without such components where possible negative autocorrelations (anti-persistence) are suspected. The possibility of false low frequency oscillations due to the heavy tails in the probability distribution is tested using a random permutations shuffling procedure. A comparison of the global wavelet spectrum of the original time series with the 95% envelope from the time-shuffled time series indicates those stations with distribution independent periodicities and provides support for the interdecadal oscillations

in the time series found above. The latter will be discussed in terms of a possible teleconnective influence of the North Atlantic Oscillation.