Extreme event return times in long-term memory processes near 1/f

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The distribution of extreme event return times and their correlation are analyzed in observed and surrogate long-term memory (LTM) time series with 1/f power spectra. Extreme events are determined by Peak-Over-Threshold (POT) crossing. High resolution tropical data for the mixing ratio (specific humidity) and temperature with an approximate 1/f power spectrum reveal power laws for the return time distribution. This result suggests that the observational data cannot be derived from linear processes, which are the basis for the standard stretched exponential distribution.

For a comparison and an analysis of the return time predictability, a very long surrogate time series with a 1/f spectrum is produced by a fractionally differenced (FD) process. This surrogate data confirms the power law obtained for the exponential distribution. The return time sequences show distinctly weaker long-term correlations than the original time series.