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Nonlinear Trends, Long-Range Dependence and Climate Noise Properties of Surface Temperature

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My presentation will focus on the significance of trends of four exemplary temperature time series - Central England Temperature (CET), Stockholm (Sweden), Faraday-Vernadsky (Antarctica) and Alert (Canada). First the robustness and accuracy of various trend detection methods will be discussed: ordinary least squares, robust and generalized linear model regression, Ensemble Empirical Mode Decomposition (EEMD) and wavelets. Tests are carried out with surrogate data with nonlinear trends, superposed autocorrelated and non-Gaussian fluctuations.

An analysis of the four temperature time series reveals evidence of long-range dependence (LRD) and nonlinear warming trends. The significance of these trends are tested against climate noise representing the background climate variability. Three different methods are used to generate climate noise: (i) a short-range dependent model AR(1), (ii) a LRD model and (iii) phase scrambling. I will discuss the ability of the trend detection methods to distinguish the observed warming trend from stochastic trends and the implications for general trend identification in the geosciences.