

***M*-estimation of wavelet variance**

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Abstract The wavelet variance provides a scale-based decomposition of the process variance for a time series or a random field and has been used to analyze various multi-scale processes. Examples of such processes include atmospheric pressure, deviations in time as kept by atomic clocks, soil properties in agricultural plots, snow fields in the polar regions and brightness temperature maps of South Pacific clouds. In practice, data collected in the form of a time series or a random field often suffer from contamination that is unrelated to the process of interest. This paper introduces a scale-based contamination model and describes robust estimation of the wavelet variance that can guard against such contamination. A new *M*-estimation procedure that works for both time series and random fields is proposed, and its large sample theory is deduced. As an example, the robust procedure is applied to cloud data obtained from a satellite.

Keywords Hermite expansion · Multiscale processes · Pockets of open cells · Robust estimation · Time series analysis