Ann Inst Stat Math (2010) 62:943–966
DOI 10.1007/s10463-008-0195-z

# Wavelet variance analysis for gappy time series

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Received: 31 October 2007 / Revised: 22 May 2008 / Published online: 9 September 2008


**Abstract** The wavelet variance is a scale-based decomposition of the process variance for a time series and has been used to analyze, for example, time deviations in atomic clocks, variations in soil properties in agricultural plots, accumulation of snow fields in the polar regions and marine atmospheric boundary layer turbulence. We propose two new unbiased estimators of the wavelet variance when the observed time series is 'gappy,' i.e., is sampled at regular intervals, but certain observations are missing. We deduce the large sample properties of these estimators and discuss methods for determining an approximate confidence interval for the wavelet variance. We apply our proposed methodology to series of gappy observations related to atmospheric pressure data and Nile River minima.

**Keywords** Cumulant · Fractionally differenced process · Local stationarity · Nile River minima · Semi-variogram · TAO data