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Detrended fluctuation analysis with missing data

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Detrended fluctuation analysis (DFA) has become a popular tool for studying the scaling behavior of time series in a wide range of scientific disciplines. Many geophysical time series contain "gaps", meaning that some observations of a regularly sampled time series are missing. We show how DFA can be modified to properly handle signals with missing data without the need for interpolation or re-sampling. A new result is presented which states that one can write the fluctuation function in terms of a weighted sum of variograms (also known as second-order structure functions). In the presence of gaps this new estimator is equal in expectation to the fluctuation function in the gap-free case. A small-sample Monte Carlo study, as well as theoretical argument, show the superiority of the proposed method against mean-filling, linear interpolation and resampling.