

The Application of Wavelets to GPS Time Series Analysis

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Wavelet signal analysis has been successfully applied to edge detection, data compression, harmonic analysis, etc. In the present study, multiresolution analysis (MRA) and wavelet transformation are introduced to the analysis of the daily position variation of the GPS sites, which are extracted from the SINEX data of Geographical Survey Institute. With this new kind of tool of signal analysis, we can extract the details and features from the GPS time series. The applications are focused on revealing signal trends, or the long-term evolution, on detecting outliers and data jumps caused by earthquakes and on denoising the signals, which are important issues when we analyze the velocity field and strain field by using short-term daily GPS measurements.

In recent years wavelet signal analysis has been successfully applied to the processing of geodetic data, such as gravity tide data, GPS signals, etc. In the present study, multiresolution analysis (MRA) and wavelet transformation are introduced to the analysis of the daily position variation of the GPS sites, which are extracted from the SINEX data of Geographical Survey Institute during the period between March of 1996 and March of 1998. We have applied the Autoregressive Moving Average (ARMA) method previously. The presence of noise, which is a fairly common situation in the geodetic data processing, makes identification of data jumps and extraction of the long-term changes more complicated. With wavelet signal analysis, however, we can extract some more details and features of the GPS time series. The applications are focused on revealing signal trends, or the long-term evolution, on detecting outliers and data jumps and on denoising and smoothing the signals, which are important issues when we analyze the velocity field and strain field by using short-term daily GPS measurements.