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Satellite time series analysis using Empirical Mode Decomposition

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Geophysical fields possess large fluctuations over many spatial and temporal scales. Satellite successive images provide interesting sampling of this spatio-temporal multiscale variability. Here we propose to consider such variability by performing satellite time series analysis, pixel by pixel, using Empirical Mode Decomposition (EMD). EMD is a time series analysis technique able to decompose an original time series into a sum of modes, each one having a different mean frequency. It can be used to smooth signals, to extract trends. It is built in a data-adaptative way, and is able to extract information from nonlinear signals.

Here we use MERIS Suspended Particulate Matter (SPM) data, on a weekly basis, during 10 years. There are 458 successive time steps. We have selected 5 different regions of coastal waters for the present study. They are Vietnam coastal waters, Brahmaputra region, St. Lawrence, English Channel and McKenzie. These regions have high SPM concentrations due to large scale river run off.

Trend and Hurst exponents are derived for each pixel in each region. The energy also extracted using Hilberts Spectral Analysis (HSA) along with EMD method. Normalised energy computed for each mode for each region with the total energy. The total energy computed using all the modes are extracted using EMD method.