Geophysical Research Abstracts, Vol. 9, 08339, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08339

Analysis of Daily River Flow Fluctuations Using Empirical Mode Decomposition

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River flows fluctuate on many scales: at small scales, river turbulence induces stochastic fluctuations and at larger scales (months or seasons) the river flow fluctuations are the result of complex nonlinear interactions between rainfall processes, topography and geography. Daily river flow time series thus show fluctuations possessing stochastic properties, as well as deterministic forcing resulting from seasonal or annual meteorological and climatic cycles, such as E1 Niño/Southern Oscillation (ENSO), solar-cycle, etc. Due to the complexity, it is very difficult to separate them.

In this work we present the analysis of two long (20 and 30 years) time series of daily river flow data, recorded in two different type rivers: Wimereux river (Wimereux, France) and Seine river (France) respectively. Wimereux river is located at at Wimereux, eastern English Channel, France, and is a really small one; it should be strongly affected by the environment, such as topography, rainfall etc. Seine river is the third largest river in France. And the distance between these two river is less than 300km. Hence they should be affected by the same meteorology factors, such as seasonal cycle, etc: they should demonstrate some strong correlation at large scales.

Empirical mode decomposition is a new promising analysis technique, which was proposed recently. This method is especially suitable for the nonstationary and nonlinear time series analysis. In the present work, it is applied to give a better understanding of the random/deterministic dichotomy of river flows. After decomposition, the original flow discharge signal is separated into several modes associated to different scales. This can help to separate the original time series into a trend and small-scale stochas-

tic fluctuations . We have considered the Hilbert-Huang spectrum and discuss their scaling properties.