Geophysical Research Abstracts, Vol. 9, 06018, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06018

Multifractal properties of high frequency incident light fluctuations

FG Schmitt (1) & L Seuront (1,2)

(1) CNRS, Littoral and Coastal Ecosystem laboratory, Universite des Sciences et Technologies de Lille (francois.schmitt@univ-lille1.fr); (2) School of Biological Sciences, Flinders University, Australia

The characterization of the high frequency fluctuations of incident light is important for the study of primary production, for both terrestrial and aquatic ecosystem studies. Up to now, most primary production models consider a purely deterministic sinusoidal daily variation of PAR (photosynthetic available radiation). To our knowledge, random fluctuations have only been introduced through the addition of Gaussian random noise.

Here we consider large datasets of PAR data recorded at 1 second resolution during several weeks from a sampling point located on the French coast of the Eastern English Channel under various meteorological conditions ranging from sunny to cloudy. We consider the high variability of experimental data as the product of a stochastic component and a sinusoidal behaviour representing the day/night cycle. This stochastic component is analyzed using statistical methods coming from the field of turbulence: power spectra, structure functions, pdf of increments. We obtain a very nice scaling behaviour for the power spectra, and show (to our knowledge for the first time) its multifractal nature. We estimate the multifractal moment function, and consider its characterization in association to weather conditions. Finally we discuss the consequences of such a stochastic behaviour on available primary production models in the field of phytoplankton studies.