Geophysical Research Abstracts
Vol. 12, EGU2010-12886-1, 2010
EGU General Assembly 2010

Determining temporal scales of the soil moisture variations by Empirical Mode Decompositions and wavelet methods and its use for validation of SMOS data

Jerzy, B. Usowicz (1), Wojciech Marczewski (2), Boguslaw Usowicz (3), Jerzy Lipiec (3), and Mateusz I. Lukowski (3)

(1) Torun Centre of Astronomy of the Nicolaus Copernicus University, Gagarina 11, 87-100 Torun, Poland, Contact author (jerzy.usowicz@gmail.com) / Fax: 56 6113008 /Phone: +48 56 6113035, (2) Space Research Centre, Polish Academy of Sciences, Bartycka 18A, 00-716 Warsaw, Poland, (3) Institute of Agrophysics, Polish Academy of Sciences, Lublin, Poland

This paper presents the results of the time series analysis of the soil moisture observed at two test sites Podlasie, Polesie, in the Cal/Val AO 3275 campaigns in Poland, during the interval 2006-2009. The test sites have been selected on a basis of their contrasted hydrological conditions. The region Podlasie (Trzebieszow) is essentially drier than the wetland region Polesie (Urszulin). It is worthwhile to note that the soil moisture variations can be represented as a non-stationary random process, and therefore appropriate analysis methods are required. The so-called Empirical Mode Decomposition (EMD) method has been chosen, since it is one of the best methods for the analysis of non-stationary and nonlinear time series. To confirm the results obtained by the EMD we have also used the wavelet methods. Firstly, we have used EMD (analyze step) to decompose the original time series into the so-called Intrinsic Mode Functions (IMFs) and then by grouping and addition similar IMFs (synthesize step) to obtain a few signal components with corresponding temporal scales. Such an adaptive procedure enables to decompose the original time series into diurnal, seasonal and trend components. Revealing of all temporal scales which operates in the original time series is our main objective and this approach may prove to be useful in other studies. Secondly, we have analyzed the soil moisture time series from both sites using the cross-wavelet and wavelet coherency. These methods allow us to study the degree of spatial coherence, which may vary in various intervals of time. We hope the obtained results provide some hints and guidelines for the validation of ESA SMOS data.

References:
B. Usowicz, J.B. Usowicz, Spatial and temporal variation of selected physical and chemical properties of soil, Institute of Agrophysics, Polish Academy of Sciences, Lublin 2004, ISBN 83-87385-96-4
Rao, A.R., Hsu, E.-C., Hilbert-Huang Transform Analysis of Hydrological and Environmental Time Series, Springer, 2008, ISBN: 978-1-4020-6453-1

Acknowledgements. This work was funded in part by the PECS – Programme for European Cooperating States, No. 98084 „SWEX/R – Soil Water and Energy Exchange/Research".