Geophysical Research Abstracts
Vol. 21, EGU2019-18015-2, 2019
EGU General Assembly 2019

Analysis of spectral entropy on maize agro-ecosystem's stability and change with disturbances

Yohana Indrawati (1), Joon Kim (1), Andrew Suyker (2), Jihye Lee (3), and Kyungdo Lee (4)

(1) Interdisciplinary Program in Agricultural and Forest Meteorology, Seoul National University, Republic of Korea (yohana.m.indrawati@gmail.com; joon@snu.ac.kr), (2) School of Natural Resources, University of Nebraska, Lincoln, NE, USA (asuyker1@unl.edu), (3) National Center for AgroMeteorology, Seoul, Republic of Korea (ji1222@kangwon.ac.kr), (4) National Institute of Agricultural Science and Technology, Rural Development Administration, Republic of Korea (kdlee11@korea.kr)

Information theory and entropy measures were applied to the time series of the MODIS-based gross primary production (GPP) data from a maize agro-ecosystem at Mead, Nebraska, USA. The aim of this study is to ascertain the agro-ecosystem's stability and change with different degree of disturbances by examining the spectral entropy-related index describing part of the structural regularity of a time series based on its power spectrum. We examined three distinct years (i.e. a normal year, a year with storm and flooding, and a year with severe drought), using both MODIS-based and tower flux-based GPP time series. The latter data were used for the validation of MODIS-based GPP and also for the investigation of the effect of different temporal resolution of data interval in the time series. Despite the absence of high frequency domain in the power spectra (i.e, sub-daily range), the daily time series of the MODIS-based GPP produced the values of the normalized spectral entropy (Hsn), which were distinguishable among the three years with varying disturbances, suggesting a potential use of entropy measure for gauging dynamical transitions in ecosystem stability. The results of stability metrics changed depending on the use of original time series vs. anomaly time series, demonstrating that caution must be exercised in the interpretation of these metrics. Further implications of our results are presented along with limitation and improvement of the use of a Fourier transformation-based spectral entropy by considering the analyses of wavelet and dynamic process network in tandem.