Geophysical Research Abstracts
Vol. 18, EGU2016-6142, 2016
EGU General Assembly 2016

Assessing global vegetation activity using spatio-temporal Bayesian modelling

Vera L. Mulder (1), Christel M. van Eck (1), Pierre Friedlingstein (1,2), and Pierre A.G. Regnier (1)

(1) Université Libre de Bruxelles, Biogeochemistry and Earth System Modelling, Brussels, Belgium (vlmulder0@gmail.com), (2) University of Exeter, College of Engineering, Mathematics and Physical Sciences, Exeter, United Kingdom

This work demonstrates the potential of modelling vegetation activity using a hierarchical Bayesian spatio-temporal model. This approach allows modelling changes in vegetation and climate simultaneous in space and time. Changes of vegetation activity such as phenology are modelled as a dynamic process depending on climate variability in both space and time. Additionally, differences in observed vegetation status can be contributed to other abiotic ecosystem properties, e.g. soil and terrain properties. Although these properties do not change in time, they do change in space and may provide valuable information in addition to the climate dynamics.

The spatio-temporal Bayesian models were calibrated at a regional scale because the local trends in space and time can be better captured by the model. The regional subsets were defined according to the SREX segmentation, as defined by the IPCC. Each region is considered being relatively homogeneous in terms of large-scale climate and biomes, still capturing small-scale (grid-cell level) variability. Modelling within these regions is hence expected to be less uncertain due to the absence of these large-scale patterns, compared to a global approach. This overall modelling approach allows the comparison of model behavior for the different regions and may provide insights on the main dynamic processes driving the interaction between vegetation and climate within different regions. The data employed in this study encompasses the global datasets for soil properties (SoilGrids), terrain properties (Global Relief Model based on SRTM DEM and ETOPO), monthly time series of satellite-derived vegetation indices (GIMMS NDVI3g) and climate variables (Princeton Meteorological Forcing Dataset).

The findings proved the potential of a spatio-temporal Bayesian modelling approach for assessing vegetation dynamics, at a regional scale. The observed interrelationships of the employed data and the different spatial and temporal trends support our hypothesis. That is, the change of vegetation in space and time may be better understood when modelling vegetation change as both a dynamic and multivariate process. Therefore, future research will focus on a multivariate dynamical spatio-temporal modelling approach. This ongoing research is performed within the context of the project "Global impacts of hydrological and climatic extremes on vegetation" (project acronym: SAT-EX) which is part of the Belgian research programme for Earth Observation Stereo III.