Geophysical Research Abstracts
Vol. 16, EGU2014-13287-1, 2014
EGU General Assembly 2014

Simulating carbon, water and energy fluxes of a rainforest and an oil palm plantation using the Community Land Model (CLM4.5)

Yuanchao Fan (1), Martial Bernoux (2), Olivier Roupsard (3), Oleg Panferov (1), Guerric Le Maire (3), Merja Tölle (1), and Alexander Knohl (1)

(1) Bioclimatology Insitiute, University of Goettingen, Germany (yfan1@uni-goettingen.de), (2) IRD, UMR Eco&Sols, Montpellier, France, (3) CIRAD, UMR Eco&Sols, Montpellier, France

Deforestation and forest degradation driven by the expansion of oil palm (Elaeis guineensis) plantations has become the major source of GHG emission in Indonesia. Changes of land surface properties (e.g. vegetation composition, soil property, surface albedo) associated with rainforest to oil palm conversion might alter the patterns of land-atmosphere energy, water and carbon cycles and therefore affect local or regional climate. Land surface modeling has been widely used to characterize the two-way interactions between climate and human disturbances on land surface. The Community Land Model (CLM) is a third-generation land model that simulates a wide range of biogeophysical and biogeochemical processes. This project utilizes the land-cover/land-use change (LCLUC) capability of the latest CLM versions 4/4.5 to characterize quantitatively how anthropogenic land surface dynamics in Indonesia affect land-atmosphere carbon, water and energy fluxes. Before simulating land use changes, the first objective is to parameterize and validate the CLM model at local rainforest and oil palm plantation sites through separate point simulations. This entails creation and parameterization of a new plant functional type (PFT) for oil palm, as well as sensitivity analysis and adaptation of model parameters for the rainforest PFTs. CLM modelled fluxes for the selected sites are to be compared with field observations from eddy covariance (EC) flux towers (e.g. a rainforest site in Bariri, Sulawesi; an oil palm site in Jambi, Sumatra). After validation, the project will proceed to parameterize land-use transformation system using remote sensing data and to simulate the impacts of historical LUCs on carbon, water and energy fluxes. Last but not least, the effects of future LUCs in Indonesia on the fluxes and carbon sequestration capacity will be investigated through scenario study. Historical land cover changes, especially oil palm coverage, are retrieved from Landsat or MODIS archival images. Oil palm concession boundaries are used to define and project future land use scenarios.

Initial results include outputs from a single-point simulation for the Bariri rainforest site forced with locally measured meteorological data which already showed significant advantage over global forcing data in predicting net ecosystem exchange and latent and sensible heat fluxes. Modeled fluxes are being compared with EC flux observations and with Mixfor-SVAT model outputs from another project at the same site. In the next few months, focus will be on sensitivity analyses of model parameters including PFT optical, morphological and physiological parameters that are necessary to configure the new oil palm PFT and represent rainforest to oil palm conversion. The new parameterization will contribute to the development of the CLM model and its implementation in the modelling of LUC effects in tropical regions will help understanding land-climate interactions.