Fourth International Conference on Earth System Modelling
4ICESM-143, 2017

Evaluation of fire-vegetation-climate relations for the tropics

G. Lasslop (1), T. Moeller (1), D. D'Onofrio (2), S. Hantson (3), and S. Kloster (1)

(1) Max-Planck Institute for Meteorology, Land in the Earth System, Hamburg, Germany (gitta.lasslop@mpimet.mpg.de), (2) Institute of Atmospheric Sciences and Climate (ISAC-CNR), Torino, Italy, (3) Karlsruhe Institute of Technology, Institute of Meteorology and Climate research, Atmospheric Environmental Research, 82467 Garmisch-Partenkirchen, Germany

Fire is the major disturbance mechanism, besides the human impact, on the global carbon cycle. Fire is strongly driven by climate but also modulated by vegetation. With global warming fire occurrence is often expected to increase. This may lead to increased carbon emissions and in consequence an amplification of human induced climate change. However, increased drought and higher temperatures might also lead to a reduction in fuel load and a reduction of fire emissions. To increase our confidence in projections of fire emissions we evaluate the relation between tropical climate, vegetation and fire in a global vegetation model which incorporates both a simple and a complex fire scheme. We aim at identifying potential for model improvement with respect to the interaction between climate, vegetation and fire based on the evaluation. Model simulations are used to investigate the effect of land use on differences in climate-vegetation-fire relations between continents.

We use two global vegetation datasets based on remote sensing and one site level dataset for Africa to analyze the relationship between precipitation, vegetation cover and fire for the tropical area. We compare these relationships to model simulations of the land surface model JSBACH coupled to both a simple and a complex (SPITFIRE) fire algorithm.

The complex fire algorithm strongly improves the spatial pattern of burned area compared to the simple fire scheme. JSBACH shows too high tree cover for low precipitation in comparison to the satellite data and the site-level dataset. The multivariate comparison between observations and model indicate opportunities for model improvement in drought effects on tree cover and adaptation of trees to fire. We find that the relationship between maximum tree cover and precipitation depends on the spatial scale. Relationships between tree cover and climate might therefore require a scale dependent parameterization. The anthropogenic land use contributes to differences in the climate-vegetation-fire relationships between continents and strongly modifies the patterns of the climate-vegetation relation in the model simulations.