Geophysical Research Abstracts
Vol. 17, EGU2015-3536, 2015
EGU General Assembly 2015

Implications of land use change in tropical West Africa under global warming

Tim Brücher (1) and Martin Claussen (1,2)

(1) Max Planck Institute for Meteorology, Land department, Hamburg, Germany (tim.bruecher@mpimet.mpg.de), (2) Centrum für Erdsystemforschung und Nachhaltigkeit (CEN), Universität Hamburg, Germany

Northern Africa, and the Sahel in particular, are highly vulnerable to climate change, due to strong exposure to increasing temperature, precipitation variability, and population growth. A major link between climate and humans in this region is land use and associated land cover change, mainly where subsistence farming prevails. But how strongly does climate change affect land use and how strongly does land use feeds back into climate change? To which extent may climate-induced water, food and wood shortages exacerbate conflict potential and lead changes in land use and to migration?
Estimates of possible changes in African climate vary among the Earth System Models participating in the recent Coupled Model Intercomparison (CMIP5) exercise, except for the region adjacent to the Mediterranean Sea, where a significant decrease of precipitation emerges. While all models agree in a strong temperature increase, rainfall uncertainties for most parts of the Sahara, Sahel, and Sudan are higher.
Here we present results of complementary experiments based on extreme and idealized land use change scenarios within a future climate.. We use the MPI-ESM forced with a strong green house gas scenario (RCP8.5) and apply an additional land use forcing by varying largely the intensity and kind of agricultural practice. By these transient experiments (until 2100) we elaborate the additional impact on climate due to strong land use forcing. However, the differences are mostly insignificant. The greenhouse gas caused temperature increase and the high variability in the West African Monsoon rainfall superposes the minor changes in climate due to land use. While simulated climate key variables like precipitation and temperature are not distinguishable from the CMIP5 RCP8.5 results, an additional greening is simulated, when crops are demanded. Crops have lower water usage than pastureland has. This benefits available soil water, which is taken up by the natural vegetation and makes it more productive.
Given the limitations of an ESM, the findings of our study show that changes in the kind and intensity of land use have minor effects on the climate. Consequently, implications of extreme land use on e.g. human security, conflict or migration can be investigated in offline simulations.