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Ensembles of regional climate simulations over Africa including greenhouse forcing and land use changes

H. Paeth, R. Girmes and K. Born
Meteorological Institute, University of Bonn (hpaeth@uni-bonn.de)

When addressing the role of human activity in future climate, state-of-the-art model simulations in preparation of the fourth IPCC assessment report mainly account for changes in the chemical composition of the atmosphere. However, there is increasing evidence that in some regions, particularly in the low latitudes, land use changes may play an equally or even more important role in future climate change compared with enhanced greenhouse conditions. Given results from various sensitivity studies with global and regional climate models, tropical Africa appears to be a paradigm for the prominent link between land surface conditions and changes in the hydrological cycle and energy budget. Therefore, complex scenarios of future land cover changes are elaborated and combined with radiative forcing according to the IPCC scenarios A1 and B1. Based on these more realistic scenarios, ensemble simulations with the regional climate model REMO are carried out, nested in global ECHAM5/MPI-OM simulations between 1960 and 2050. The results reveal some remarkable changes in near-surface climate. In a broad band between the Guinean coast and 15°N as well as in the Congo basin annual precipitation is decreasing by 100 to 500 mm until the middle of the 21st century. At the same time, near-surface temperature increases by 2 to 5 K. The warming rate is much more pronounced in tropical Africa than in northern Africa and southern Europe, where greenhouse-gas concentrations are adequately rising, and basically reflects the pattern of enhanced land degradation. The large-scale monsoon circulation and the occurrence of extreme events are affected as well. Differences between the A1 and B1 ensembles are quite small, implying a reduced scope of action in climate policy and protection until 2050.