Geophysical Research Abstracts
Vol. 15, EGU2013-1423, 2013
EGU General Assembly 2013

Regional Climate Simulations with COSMO-CLM for West Africa using different soil-vegetation-atmosphere-transfer module's (SVAT's)

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Climate predictions on decadal timescales constitute a new field of research, closing the gap between short-term and seasonal weather predictions and long-term climate projections. Therefore, the Federal Ministry of Education and Research in Germany (BMBF) has recently funded the research program MiKlip (Mittelfristige Klimaprognosen), which aims to create a model system that can provide reliable decadal climate forecasts.

Recent studies have suggested that one region with high potential decadal predictability is West Africa. Therefore, the DEPARTURE project (DEcadal Prediction of African Rainfall and ATlantic HURricanE Activity) was established within the MiKlip program to assess the feasibility and the potential added value of regional decadal climate predictions for West Africa. To quantify the potential decadal climate predictability, a multi-model approach with the three different regional climate models REMO, WRF and COSMO-CLM (CCLM) will be realized.

The presented research will contribute to DEPARTURE by performing hindcast ensemble simulations with CCLM, based on SST-driven global MPI-ESM-LR simulations. Thereby, one focus is on the dynamic soil-vegetation-climate interaction on decadal timescales. Recent studies indicate that there are significant feedbacks between the land-surface and the atmosphere, which might influence the decadal climate variability substantially. To investigate this connection, three different SVAT's (TERRA_ML, Community Land Model (CLM), and VEG3D) will be coupled with the CCLM. Thus, sensitive model parameters shall be identified, whereby the understanding of important processes might be improved.

As a first step, the influence of the model domain on the CCLM results was examined. For this purpose, recent CCLM results from simulations for the official CORDEX domain were compared with CCLM results achieved by using an extended DEPARTURE model domain to about 60°W. This sensitivity analysis was performed with a horizontal resolution of 0.44°. Thereby, the analysis showed that the domain size doesn't affect the quality of the simulation results significantly. The impact of different SVAT's on the model performance is supposed to be higher.

To investigate this assumption, TERRA_ML, the standard SVAT implemented in CCLM, is replaced by VEG3D using the OASIS3-MCT coupling software. Compared to TERRA_ML, VEG3D includes an explicit vegetation layer, inducing higher correlations with observations as it has been shown in previous studies. The results of both model configurations are analysed and presented for the DEPARTURE model domain.