Geophysical Research Abstracts
Vol. 16, EGU2014-2208, 2014
EGU General Assembly 2014


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

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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 project DEPARTURE (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, driven by global decadal 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, two different SVATs (Community Land Model (CLM), and VEG3D) will be coupled with the CCLM, replacing TERRA_ML, the standard SVAT implemented in CCLM. Thus, sensitive model parameters shall be identified, whereby the understanding of important processes might be improved.

As a first step, TERRA_ML is substituted by VEG3D, a SVAT developed at the IMK-TRO, Karlsruhe, Germany. Compared to TERRA_ML, VEG3D includes an explicit vegetation layer by using a big leaf approach, inducing higher correlations with observations as it has been shown in previous studies. The coupling of VEG3D with CCLM is performed by using the OASIS3-MCT coupling software, developed by CERFACS, Toulouse, France. Results of CCLM simulations using both SVATs are analysed and compared for the DEPARTURE model domain. Thereby ERA-Interim driven CCLM simulations with VEG3D showed better agreement with observational data than simulations with TERRA_ML, especially for dense vegetaded areas. This will be demonstrated exemplarily. Additionally, results for MPI-ESM-LR driven decadal hindcast simulations (1966 - 1975) are analysed and presented.