Decadal Prediction of African Rainfall and Atlantic Hurricane Activity (DEPARTURE)

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Simulations using the RCM COSMO-CLM (CCLM) contribute to a multi RCM ensemble that will be created within DEPARURE, a joint project within the frame of the research program MiKlip. Within DEPARTURE it is intended to assess the decadal climate predictability in the West African monsoon region and the Atlantic region of tropical cyclogenesis. The decadal forecast skill will be assessed for decadal hindcast periods by downscaling decadal MPI-ESM-LR (ECHAM6/MPIOM) simulations and the comparison of the results with appropriate observations. Further initial and boundary conditions, whose impact will be studied, are anthropogenic land-cover changes (LCCs), greenhouse-gas (GHG) and aerosol (AER) emissions. In addition, a series of sensitivity studies with different Soil-Vegetation-Atmosphere-Transfer (SVAT) models coupled to CCLM will assess the effect of interactive soil and vegetation processes on decadal climate predictability in Africa.

Sensitivity studies have been carried out in order to find an appropriate configuration for the CCLM (COSMO-CLM). The impact on key parameters like the temperature in 2 m height and the total precipitation over Africa has been investigated. The configuration studies dealt with the sensitivities of the CCLM results to different soil initial and SST boundary conditions as well as various AOD (Aerosol Optical Depth) distributions. For these tests the decade 2001 - 2010 has been considered. As forcing data the realization r1i1p1 of the corresponding initialized Baseline 0 MPI-ESM-LR decadal simulation has been used. The results are evaluated in a number of African sub-regions and compared with climatological data according to Willmott-Matsuura (http://climate.geog.udel.edu/~climate/).

This study showed that changes in the initial conditions related to soil and vegetation properties change the results, even years after the initialization. However, these changes were not very striking. In comparison to the observation the changes did not improve or deteriorate the model results very much. Only for the first one to three years a slight improvement (lower RMSE) could be observed for temperature. The use of more realistic SST improved the results with respect to precipitation of the CCLM simulations especially along coastal regions, not in all years of the decade considered, but in some. The change from long-term AOD climatology to monthly climatologies improved systematically the results for the 2 m temperature. This is valid for nearly all African regions but with varying grade of improvement.