International workshop on seasonal to decadal prediction
Toulouse, France, 13-16 May, 2013

Decadal predictability of West African monsoon rainfall applying the regional climate model REMO forced by ECHAM5 and MPI-ESM

Andreas PAXIAN

Institute of Geography and Geology, University of Wuerzburg, Germany, andreas.paxian@uni-wuerzburg.de

Heiko Paeth (Institute of Geography and Geology, University of Wuerzburg, Germany

Presenter : Andreas Paxian

The DEPARTURE project investigates the decadal predictability of West African monsoon rainfall and Atlantic hurricane activity embedded in the MiKlip research project on decadal climate prediction. During the hindcast period 1966-1975 global MPI-ESM simulations (based on ECHAM6/MPIOM) are "dynamically downscaled" by the regional climate models (RCMs) REMO, CCLM and WRF on 0.44° resolution. Step by step, the RCMs are forced by sea surface temperatures (SSTs), greenhouse gases, aerosols and land cover changes and sensitivity studies and three member ensembles are realised. In addition, coupled atmosphere-ocean simulations are carried out with REMO and a SVAT (Surface-Vegetation-Atmosphere-Transfer) module is applied in CCLM. The forecast skill and uncertainty of the RCM multi-model ensemble is assessed in comparison to observations. The impacts of the various boundary conditions are quantified by analysis of variance and Bayes statistics and systematic model errors are corrected by means of statistical post-processing. Finally, probabilistic decadal predictions for 2015-2025 are realised for each RCM as 10-member ensemble with global MPI-ESM forcing.

We present assessments of the potential of several climate model simulations for decadal climate predictability in the hindcast period in comparison to gridded GPCC and GISST observations: First, simulations of the RCM REMO and the driving global model ECHAM5 forced by observed AMIP SSTs in 1961-1999 reveal strong impacts of the boundary condition SST (e.g. over the North Atlantic, Pacific and Gulf of Guinea) on the decadal predictability of the West African monsoon and large added values of dynamical downscaling concerning means, trends and decadal predictability of monsoon rainfall. Furthermore, the decadal global MPI-ESM-LR (Baseline 0) simulations in 1961-1999 show opposite trends and negative correlations to observed monsoon rainfall related to trend differences and lacking phase relationships to observed SST variability in several global ocean basins connected to the West African monsoon. This describes a rather unfavourable starting point for dynamical downscaling with RCMs. However, REMO simulations with global MPI-ESM-LR (Baseline 0) forcing in the hindcast decade 1966-1975 are prepared applying a quality criterion of global SST validation for choosing the appropriate global forcing simulations and a REMO soil spin-up with ERA40 reanalyses in 1960-1965.