# “DEPARTURE REMO”

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**Abstract:**
This project is a part of the integrated project “Decadal Prediction of African Rainfall and Atlantic Hurricane Activity” (DEPARTURE) which is part of the BMBF funded research programme “Medium term climate prediction” (MiKlip) and a contribution to Module C (Regionalisation). The aim of the integrated project is to assess decadal climate predictability in the West African monsoon region and the Atlantic region of tropical cyclogenesis. Within DEPARTURE, regional climate models (RCMs) will be forced by SST anomalies, radiative heating and land cover changes (LCCs) in order to utilize the forecast potential from oceanic, atmospheric and land-surface boundary conditions at the spatial scale of political decisions in West African countries. The dynamical downscaling is intended to be done with the regional climate models REMO, CCLM and WRF on the basis of SST-driven ECHAM6/MPIOM and, possibly, HadCM3 simulations. This proceeding is very promising because RCMs have been shown to perform very well in tropical and northern Africa (e.g. Paeth et al. 2005), including specific features like the African easterly waves which are responsible for a major portion of total annual precipitation in sub-Saharan Africa (Fink and Reiner 2003) and affect the evolution of hurricanes in the tropical Atlantic (Peng et al. 2004, Ross and Krishnamurti 2008, Jones et al. 2008). Given the relatively large model domain and the high amount of multi-decadal simulations with three different RCMs, horizontal resolution will first be confined to 50 km.
The contributions to the integrated project by DEPARTURE REMO will be the following:

- LCC forcing as well as various direct and indirect aerosol effects have to be incorporated into REMO. In a addition a coupling of REMO with an ocean model (preferable MPIOM) will be done.
- Dynamical downscaling is first done with SST forcing alone, then SST + LCCs, finally SST + LCCs + aerosols + greenhouse gases. In addition, fully coupled ocean-atmosphere simulations with REMO will be carried out in order to assess the importance of an interactive ocean. For the hindcast experiments we rely on the decadal simulations with ECHAM6/MPIOM which arise from an assimilation run nudged to ocean temperatures and salinity from an oceanic reanalysis and will soon be provided by the MiKlip community. For reasons of computing time, we will not use all overlapping 10 time slices from ECHAM6/MPIOM but continuous boundary conditions for the 1960-2015 period.
- All RCM simulations as well as the driving ECHAM6/MPIOM (and HadCM3) runs will be validated with respect to available observations for Africa and tropical cyclones in the Atlantic Basin. In particular, the relative impacts of the various boundary conditions will be quantified and tested, for instance by appropriate methods of analysis of variance and Bayesian statistics (cf. Paeth and Hense 2002, Paeth et al. 2008c). Systematic model errors will be eliminated by statistical post-processing (s. Fig. 3). The model data validation will mainly focus on direct and statistical measures of hurricane activity, the hydrological cycle in sub-Saharan Africa and extreme events (cf. Paeth and Hense 2005). A focus will be on the representation of key atmospheric processes in the RCMs that are involved in rainfall generation and tropical cyclogenesis (e.g. African easterly waves, mesoscale convective systems, tropicalextratropical interactions). In case improved predictability through application of RCMs can be shown, further local refinement of decadal predictability may be tackled at the end of the project. This can be achieved by application of statistical downscaling techniques to RCM output variables or by higher-resolution RCMs.