Karlsruhe Institute of Technology
Institute of Meteorology and Climate Research
Atmospheric Environmental Research (IMK - IFU)

FONA Decadal Climate Prediction BMBF

MiKlip

Assessing Decadal Predictabilty in the West African Monsoon Region
Sensitivity of the RCM WRF to physics parameterizations setup in reproducing African precipitation characteristics

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Project Overview DEPARTURE

Part of BMBF project MiKlip ("Mittelfristige Klimaprognosen"), Modul C (Regionalization)

DKRZ project DEPARTURE-WRF (BMBF)

Project aim:
Assessment of decadal predictability of West African monsoon and Atlantic hurricane activity

Project partners:
University of Würzburg (Prof. Dr. Heiko Paeth), Goethe University, Frankfurt / Main (Prof. Dr. Bodo Ahrens), Karlsruhe Institute of Technology IMK-TRO (Dr. Hans-Jürgen Panitz), Karlsruhe Institute of Technology IMK-IFU (Prof. Dr. Harald Kunstmann), University of Cologne (Prof. Dr. Andreas Fink), Max Planck Institute for Meteorology (Prof. Dr. Daniela Jacob)

Methodology

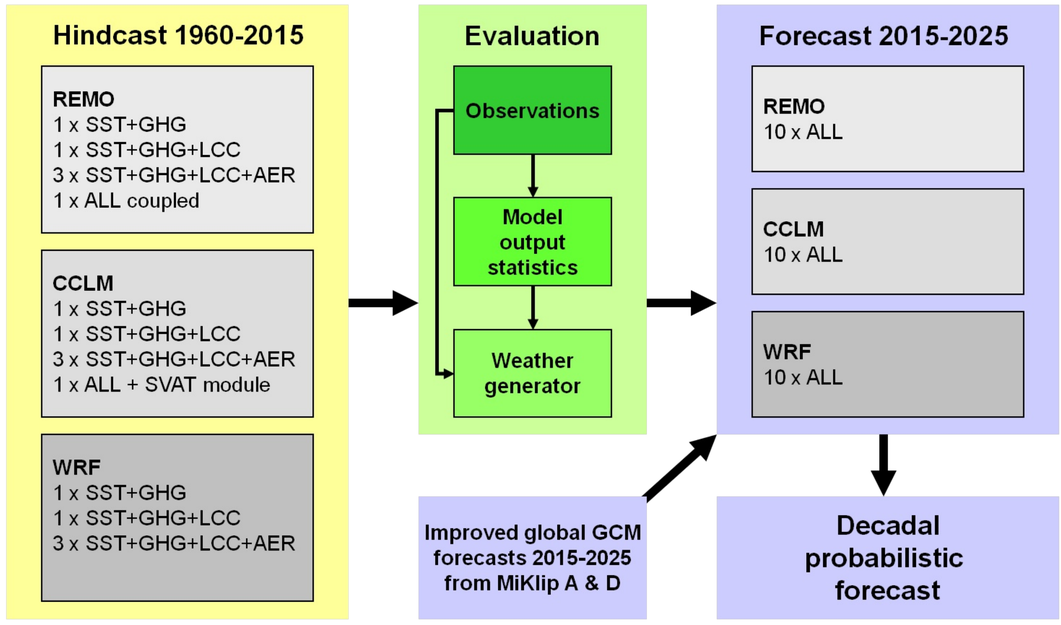
Multi Model Approach (WRF, REMO, CCLM)

Downscaling of MiKlip model system MPI-ESM-LR data

Testing the sensitivity to boundary conditions sea surface temperature (SST), greenhouse gas concentrations (GSG), and land cover changes (LCC)

Target processes: West African rainfall generation and tropical cyclogenesis

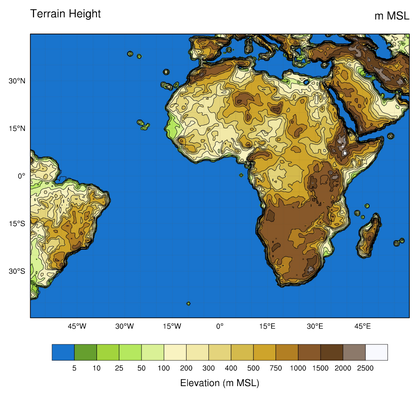
Identification of optimal model configuration (WRF)



Model Domain and Experiment Setup

Model setup for RCM simulations:

- Domain: 60.28°W-60.28°E / 45.32°S-45.32°N
- Spatial resolution: 0.44° horizontally with 38 vertical levels
- Forcing: ERA-Interim reanalysis for development of model setup
- Forcing: GCM MPI-ESM-LR (baseline 1) for hindcast experiments
- First hindcast decade: 1966-1975, GHG forcing with RCP4.5 scenario



WRF on DKRZ's IBM Power 6 system "blizzard"

Regional Climate Model WRF (model version WRF-ARW 3.3.1 / 3.4) running on high performance system "blizzard"

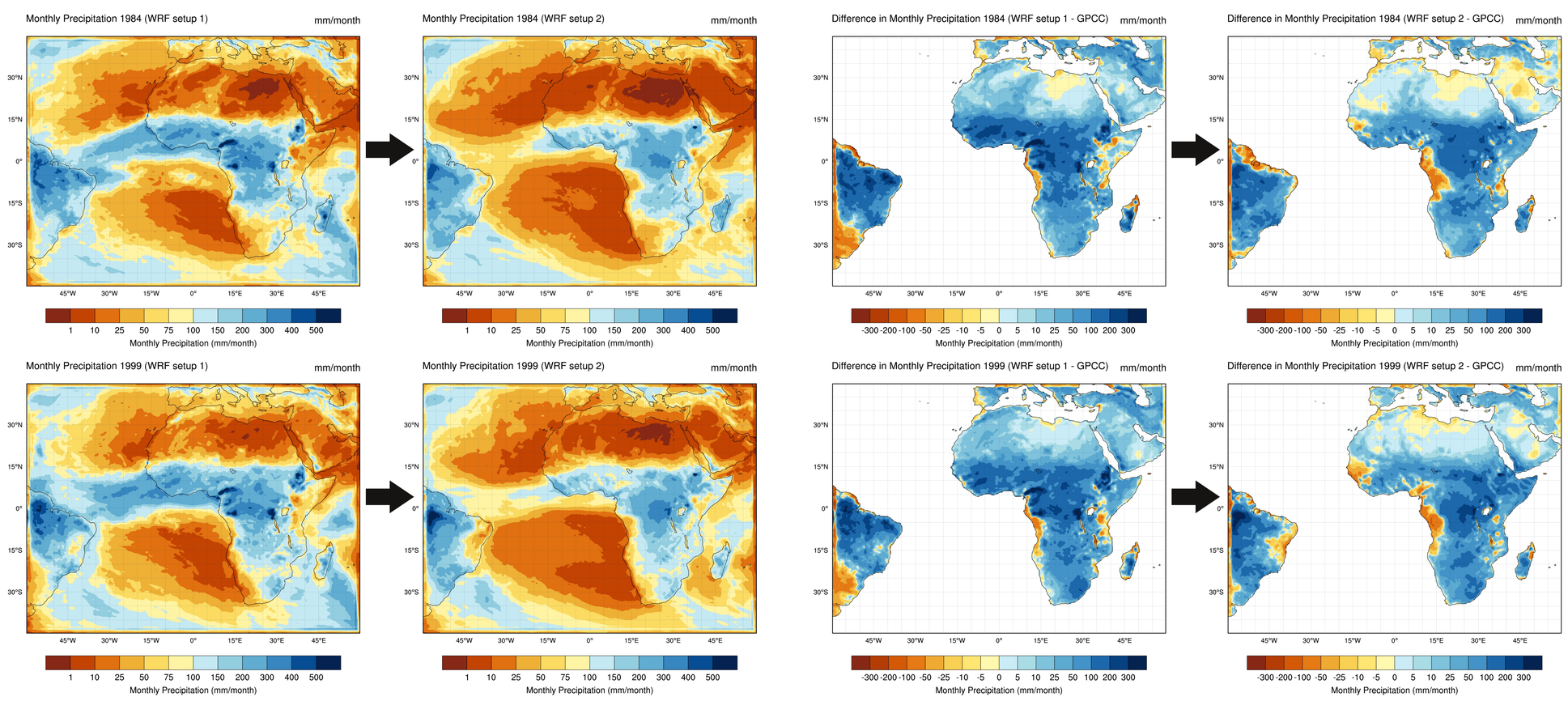
Parallelized model setup using 4 Nodes * 32 CPUs (64 Cores)

Tools used on blizzard for programming, analysis and visualization: Fortran/C/C++ Compiler, OpenMP, MPI, NetCDF, CDO, NCO, NCL

First Results and Outlook

Results of WRF forced by reanalysis data (ERA-Interim) in a dry and wet year using different physics parameterization schemes (radiation, planetary boundary layer, cumulus physics) are compared to GPCC observations. The configuration of the modules is listed in the table below. The choice of optimal settings reduces WRF wet bias over the Guinean Coast and Central Africa.

Next steps: Decadal hindcast simulations with optimized model system, development and testing decade 1966-1975, global forcing system MPI-ESM-LR (baseline 1), SST from global system as lower boundary condition for RCM.



The optimization of the WRF model setup for the target region was performed in collaboration with the project WASCAL (West African Science Service Center on Climate Change and Adapted Land Use).

MiKlip: www.fona-miklip.de **WASCAL: www.wascal.org**

	Setup 1	Setup 2
Microphysics	WRF Single-Moment 5-class Microphysics	WRF Single-Moment 5-class Microphysics
Longwave radiation	Rapid Radiative Transfer Model	Rapid Radiative Transfer Model (global)
Shortwave radiation	Goddard	Rapid Radiative Transfer Model (global)
Surface Layer	Monin-Obukhov	Monin-Obukhov (Janjic Eta)
Land surface	Noah Land Surface Model	Noah Land Surface Model
Plantary boundary layer	Yonsei State University	Mellor-Yamada-Janjic
Cumulus physics	Betts-Miller-Janjic	Kain-Fritsch