

Decadal predictability of West African monsoon rainfall and Atlantic tropical cyclones applying regional climate models

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- Introduction to DEPARTURE project
- Validation of SST-forced ECHAM5 and REMO simulations (P)
- Validation of ECHAM6/MPI-OM simulations (SST)





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DEPARTURE project

FONA

MiKlip

- Project aim: Decadal prediction of West African monsoon rainfall and Atlantic hurricane activity → embedded in MiKlip research programme
- Group members: H. Paeth (Univ. Würzburg), B. Ahrens (Univ. Frankfurt), H. Kunstmann (KIT Garmisch-Partenkirchen), H.-J. Panitz (KIT Karlsruhe), A. Fink (Univ. Köln), D. Jacob (MPIM Hamburg)







• Validation of SST-forced ECHAM5 and REMO simulations (P)

Overview

• Validation of ECHAM6/MPI-OM simulations (SST)

Julius-Maximilians-**UNIVERSITÄT** Precipitation totals 1961-1999 WÜRZBURG ECHAM5 REMO (T42~2.8125°, 5 runs, (0.5°, 5 runs, GPCC (0.5°) forced by observed SST) nested in ECHAM5) whole 20' 20 year 10 20 30



→ REMO reduces systematic ECHAM5 bias over Guinea Coast



Precipitation trends 1961-1999

GPCC (0.5°)

significance level α = 5%

REMO (0.5°)

ECHAM5 (T42)



-250915091009-500-300-100-50 -20 0 20 50 100 300 500 100015002500

 \rightarrow REMO shows more realistic inter-decadal variability

Precipitation interannual variability 1961-1999



 \rightarrow some agreements between models+observations (1960-70, 1983/84)



Correlation between simulated and observed precipitation 1961-1999

ECHAM5-GPCC ECHAM5-CRU REMO-GPCC REMO-CRU

Coefficient of determination R² for different low pass filter lengths [years]

Guinea Coast



→ large decadal predictability of West African P due to SST





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SST means and trends 1961-1999

→ ECHAM6/MPI-OM-LR: T63 ~ 1.875°/GR15 ~ 12-150km, 10 runs, initialisation every 10 years (1961-70, 1971-80, 1981-90, 1991-2000)



 \rightarrow good agreement in SST means but large differences in trends

UNIVERSITÄT WÜRZBURG Correlation between observed precipitation and SST 1961-1999



SST interannual variability 1961-1999



 \rightarrow large disagreement between models and observations

Summary and Conclusions

- ECHAM5 and REMO precipitation (forced by observed SST):
 - added values of REMO in precipitation means, trends and decadal predictability over the Guinea Coast in summer
 - some agreement with observations in interannual variability
 - SST promising for decadal prediction of West African precipitation
 - → inclusion of further real boundary conditions probably further improves decadal predictability of West African precipitation
- ECHAM6/MPI-OM SST:
 - large differences in trends and interannual variability to observations
 - strong impacts of North Atlantic SST (whole year) and North Pacific and surrounding oceans SST (summer) on Guinea Coast precipitation
 - → better SST boundary conditions needed for predictability of West African precipitation



Attachment

Thank you very much for your attention !!!

Models and observations

- Model data:
 - ECHAM5 (P): T42 ~ 2.8125°, 1960-1999,
 6-hourly, 5 runs, forced by observed SST
 - REMO (P): 0.5°, 1960-1999, 6-hourly, 5 runs, nested in ECHAM5
 - ECHAM6/MPI-OM-LR (SST): T63 ~ 1.875°/GR15 ~ 12-150km, monthly, 10 runs, initialisation every 10 years (1961-70, 1971-80, 1981-90, 1991-2000)
- Observations:
 - CRU (P): 0.5°, 1901-2009, monthly
 - GPCC (P): 0.5°, 1901-2009, monthly
 - GPCP (P): 2.5°, 1979-2007, monthly
 - GISST (SST): 1°, 1931-2002, monthly

