Barcelona Supercomputing Center
Centro Nacional de Supercomputación

PREFACE

Relation between mean bias and Atlantic Niño representation in the CMIP5 models

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SPECS
Seasonal-to-decadal climate Prediction for the improvement of European Climate Services

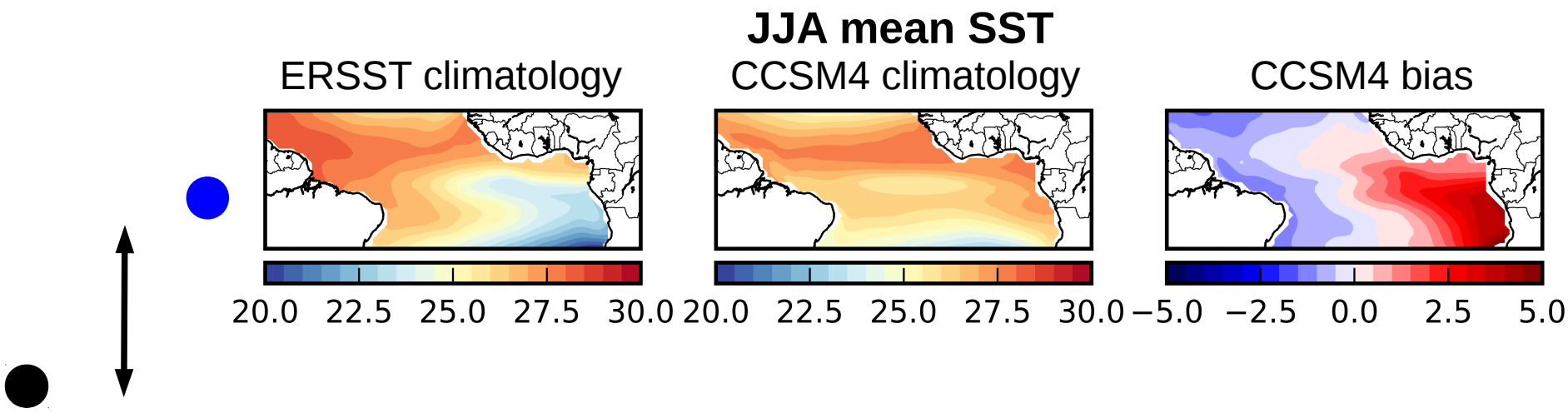
REFUGEES WELCOME

EGU 2016, Vienna, 21th April 2016

Bias

Climate models try to reproduce reality, in other words to be as close as possible to the observations:

→ In terms of mean state

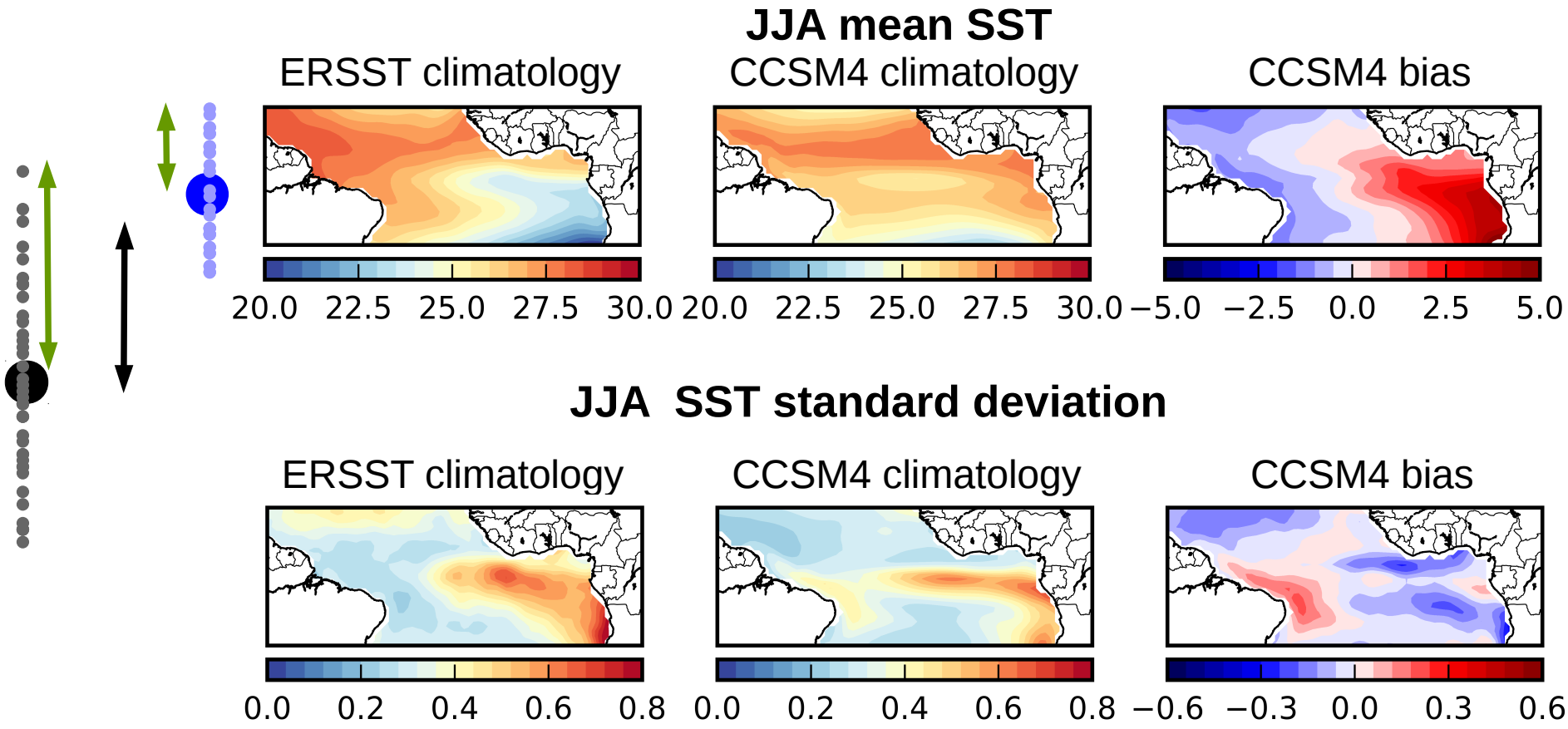


Bias and variability

Climate models try to reproduce reality, in other words to be as close as possible to the observations:

→ In terms of mean state

→ and interannual variability



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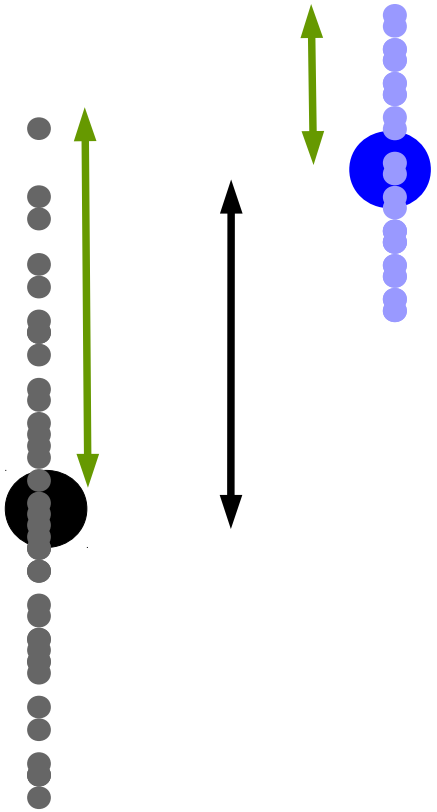
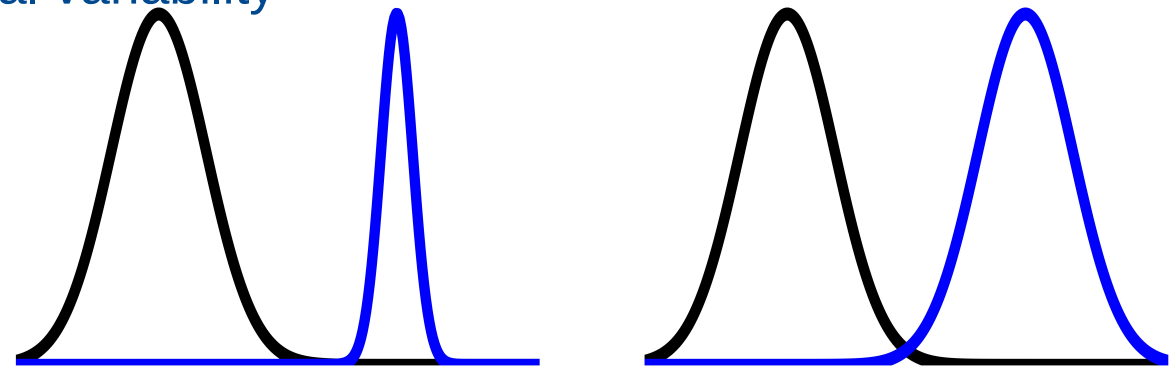
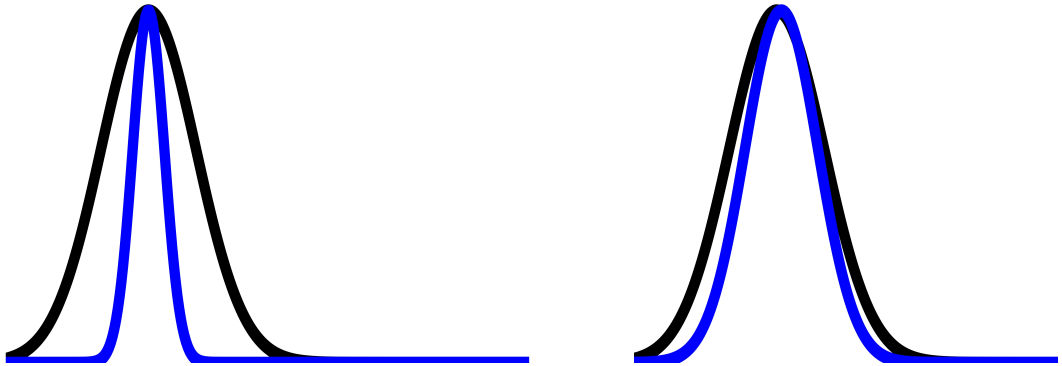




Is the representation of these two moments of the distribution linked in the Tropical Atlantic?

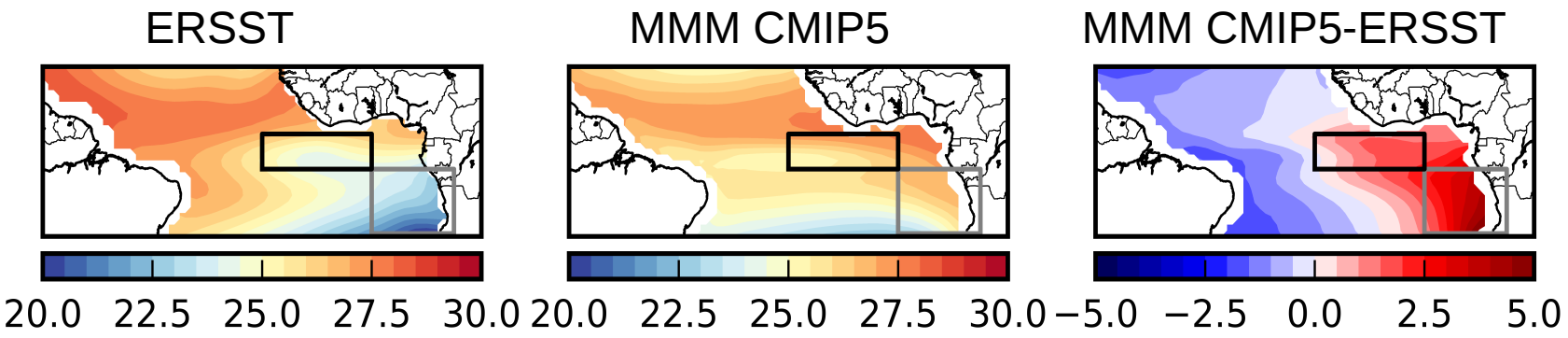


CMIP5 models

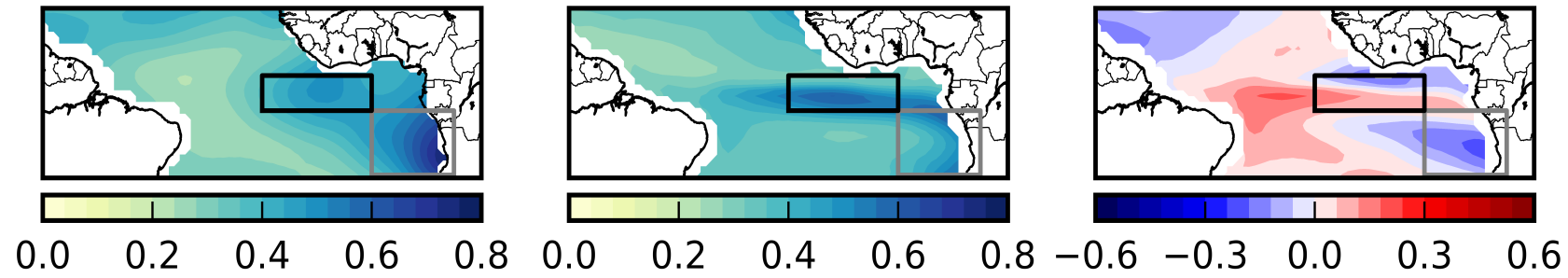
- All the CMIP5 pre-industrial simulations (38 models)
- two observational products: ERSST and HadSST (1954-2015)

- GISS-E2-H-CC
- GFDL-ESM2M
- GFDL-ESM2G
- GFDL-CM3
- FIO-ESM
- ERSST
- CanESM2
- CSIRO-Mk3-6-0
- CNRM-CM5
- CMCC-CMS
- inmcm4
- bcc-csm1-1
- bcc-csm1-1-m
- NorESM1-ME
- NorESM1-M
- MRI-CGCM3
- MPI-ESM-P
- MPI-ESM-MR
- MPI-ESM-LR
- MIROC-ESM
- CMCC-CM
- CMCC-CESM
- CESM1-WACCM
- CESM1-FASTCHEM
- CESM1-CAM5
- CESM1-CAM5-1-FV2
- CESM1-BGC
- CCSM4
- ACCESS1-3
- ACCESS1-0
- MIROC-ESM-CHEM
- IPSL-CM5B-LR
- IPSL-CM5A-MR
- IPSL-CM5A-LR
- HadSST --
- HadGEM2-ES
- HadGEM2-CC
- GISS-E2-R
- GISS-E2-R-CC
- GISS-E2-H

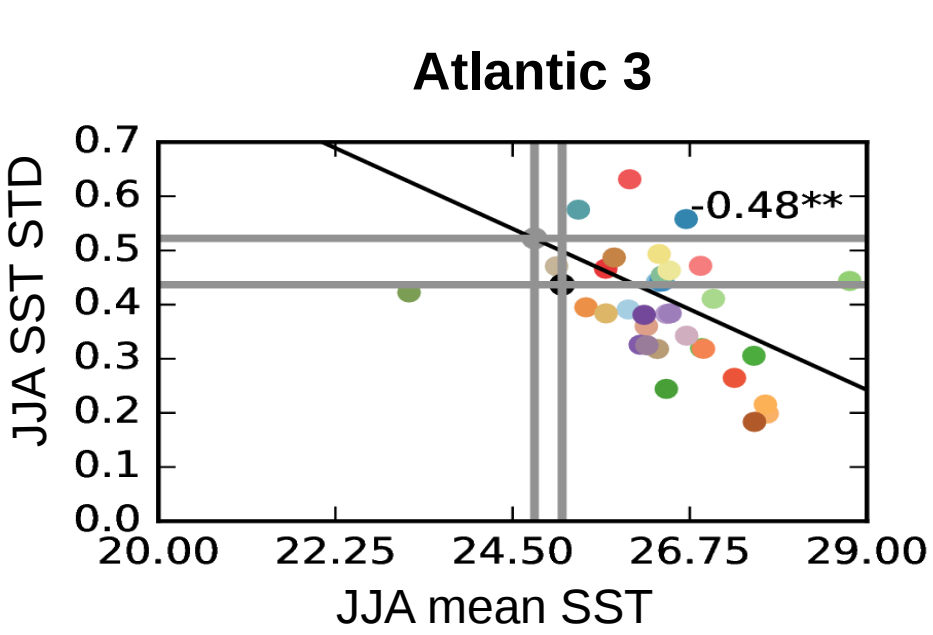
JJA mean SST

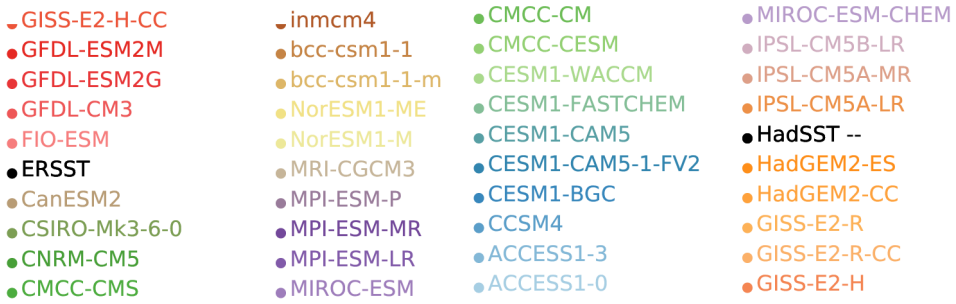


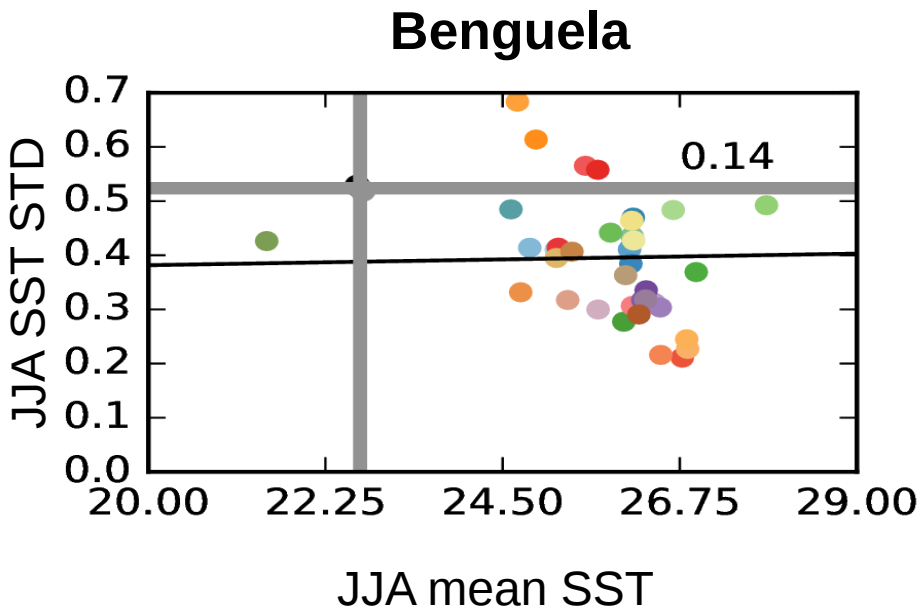
JJA SST standard deviation



Mean state versus variability







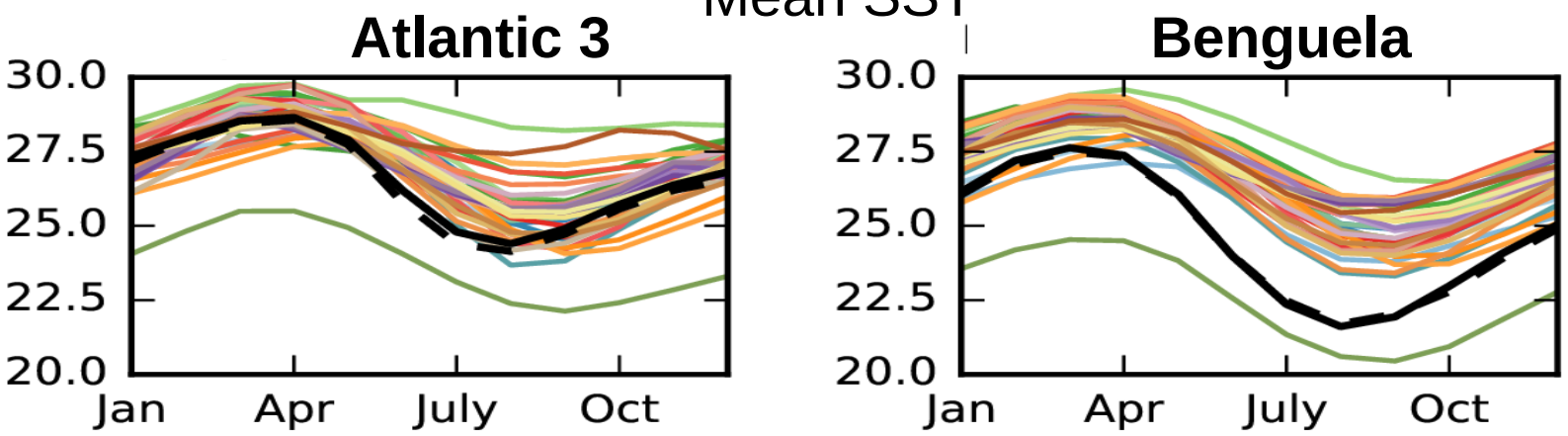
→ There is a weak but significant relationship between the mean and standard deviation representation in Atl3.

→ There is no relation is the Benguela region.

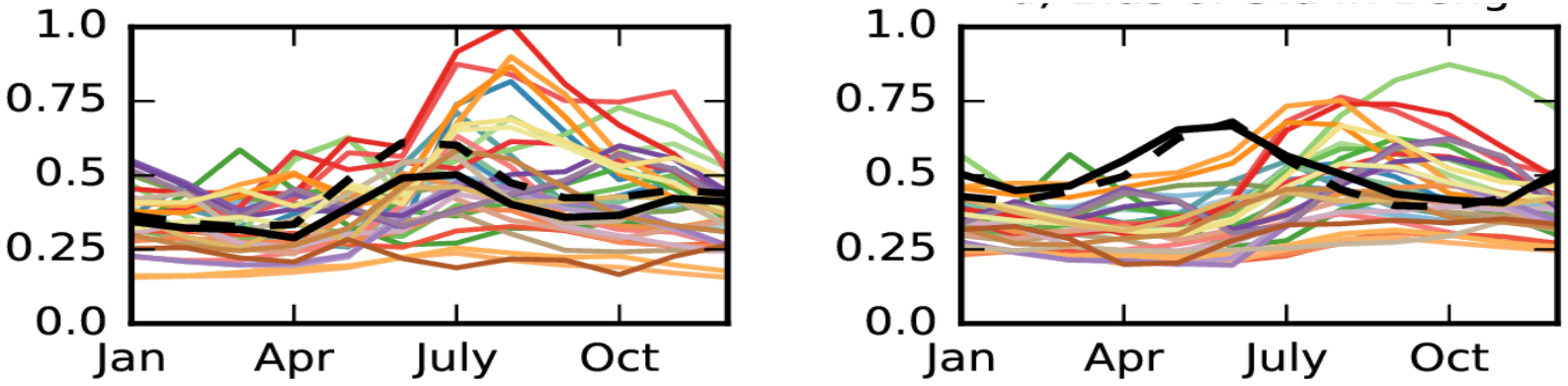
Seasonal cycle

GISS-E2-H-CC
GFDL-ESM2M
GFDL-ESM2G
GFDL-CM3
FIO-ESM
ERSST
CanESM2
CSIRO-Mk3-6-0
CNRM-CM5
CMCC-CMS
inmcm4
bcc-csm1-1
bcc-csm1-1-m
NorESM1-ME
NorESM1-M
MRI-CGCM3
MPI-ESM-P
MPI-ESM-MR
MPI-ESM-LR
MIROC-ESM
CMCC-CM
CMCC-CESM
CESM1-WACCM
CESM1-FASTCHEM
CESM1-CAM5
CESM1-CAM5-1-FV2
CESM1-BGC
CCSM4
ACCESS1-3
ACCESS1-0
MIROC-ESM-CHEM
IPSL-CM5B-LR
IPSL-CM5A-MR
IPSL-CM5A-LR
HadSST --
HadGEM2-ES
HadGEM2-CC
GISS-E2-R
GISS-E2-R-CC
GISS-E2-H

Mean SST

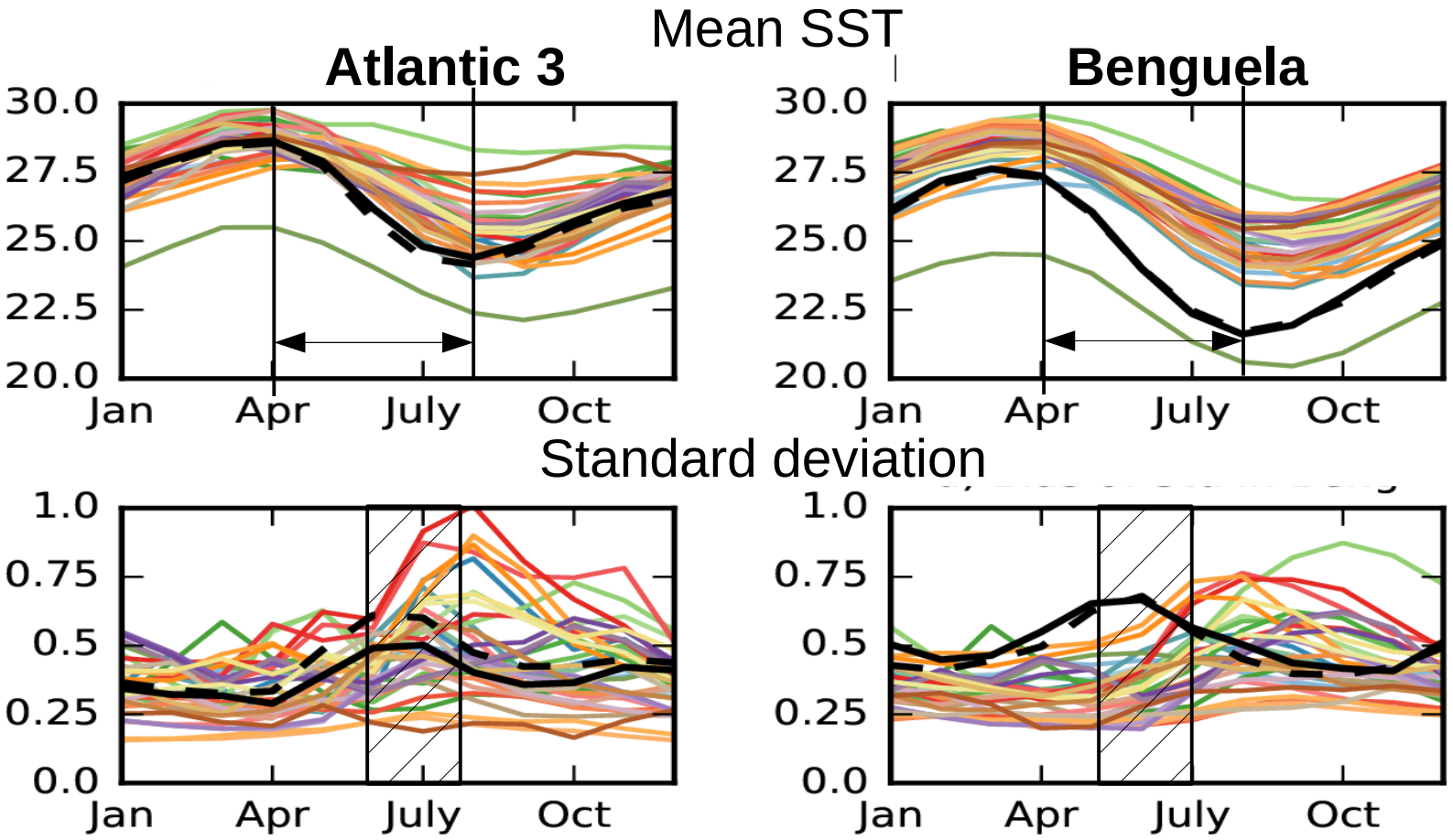


Standard deviation



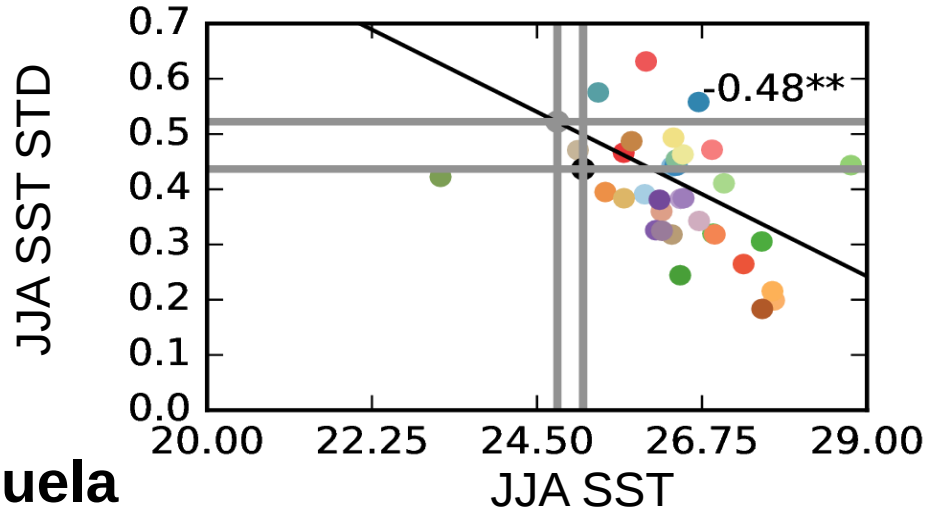
Seasonal cycle

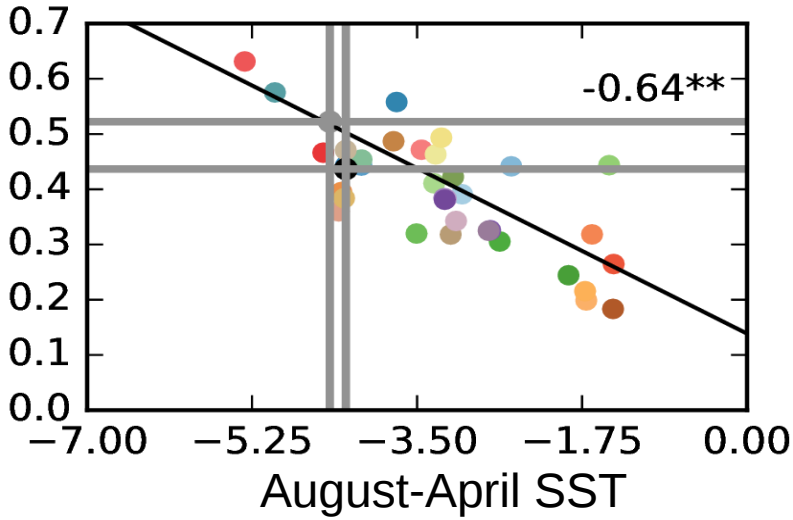
Is the misrepresentation of variability related to the misrepresentation of the seasonal cycle ?



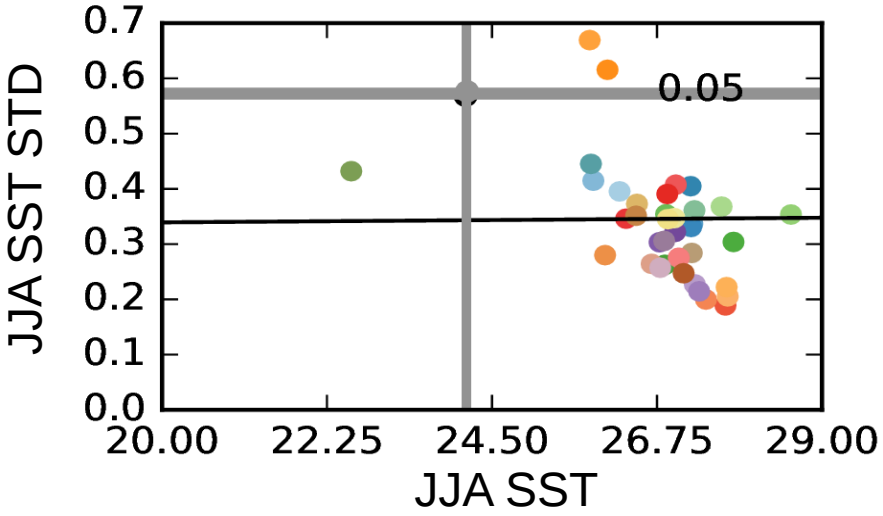
Seasonal cycle and variability

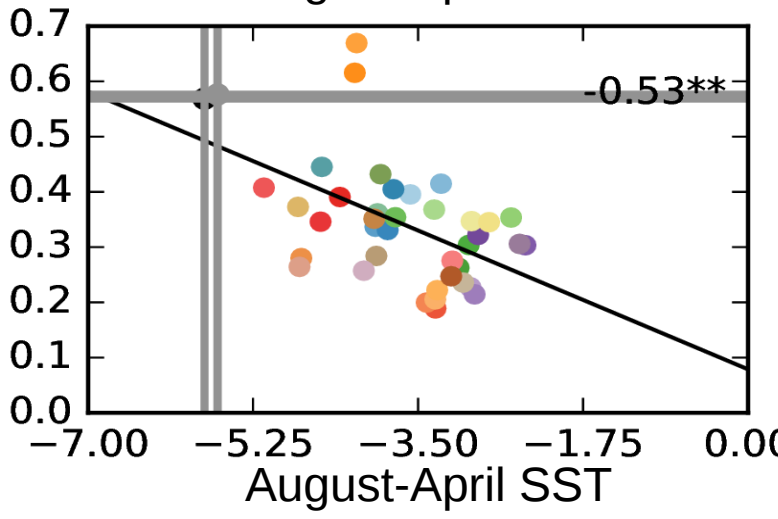
Atlantic 3





Benguela



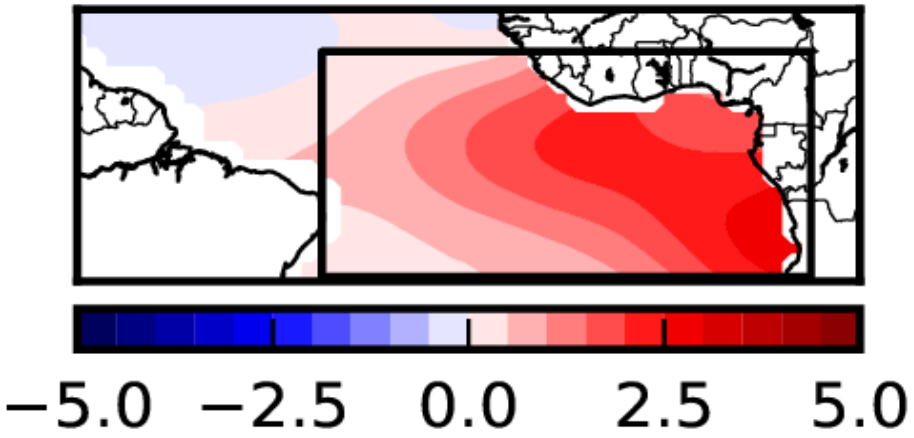


→ The ability of the model to reproduce a correct interannual variability is more linked to the ability to reproduce a realistic seasonal cycle than a correct mean state.

Atlantic Niño

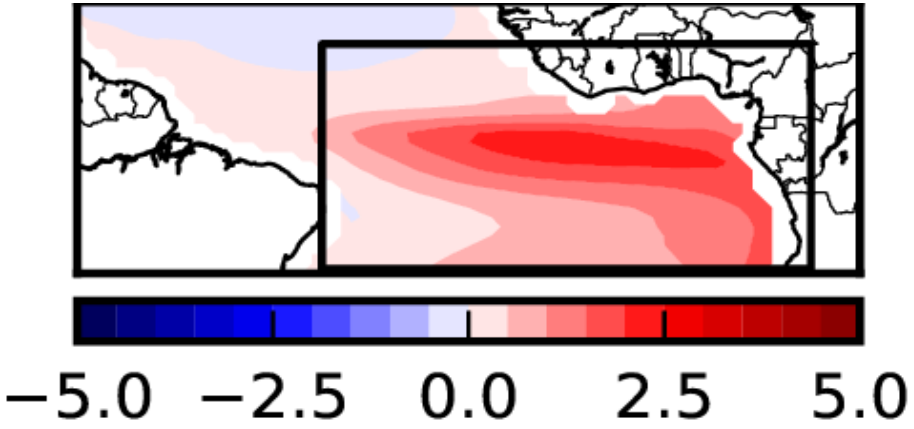
ERSST

EOF1 (49.57%)



CMIP5 MMM

EOF1 (43.44%)

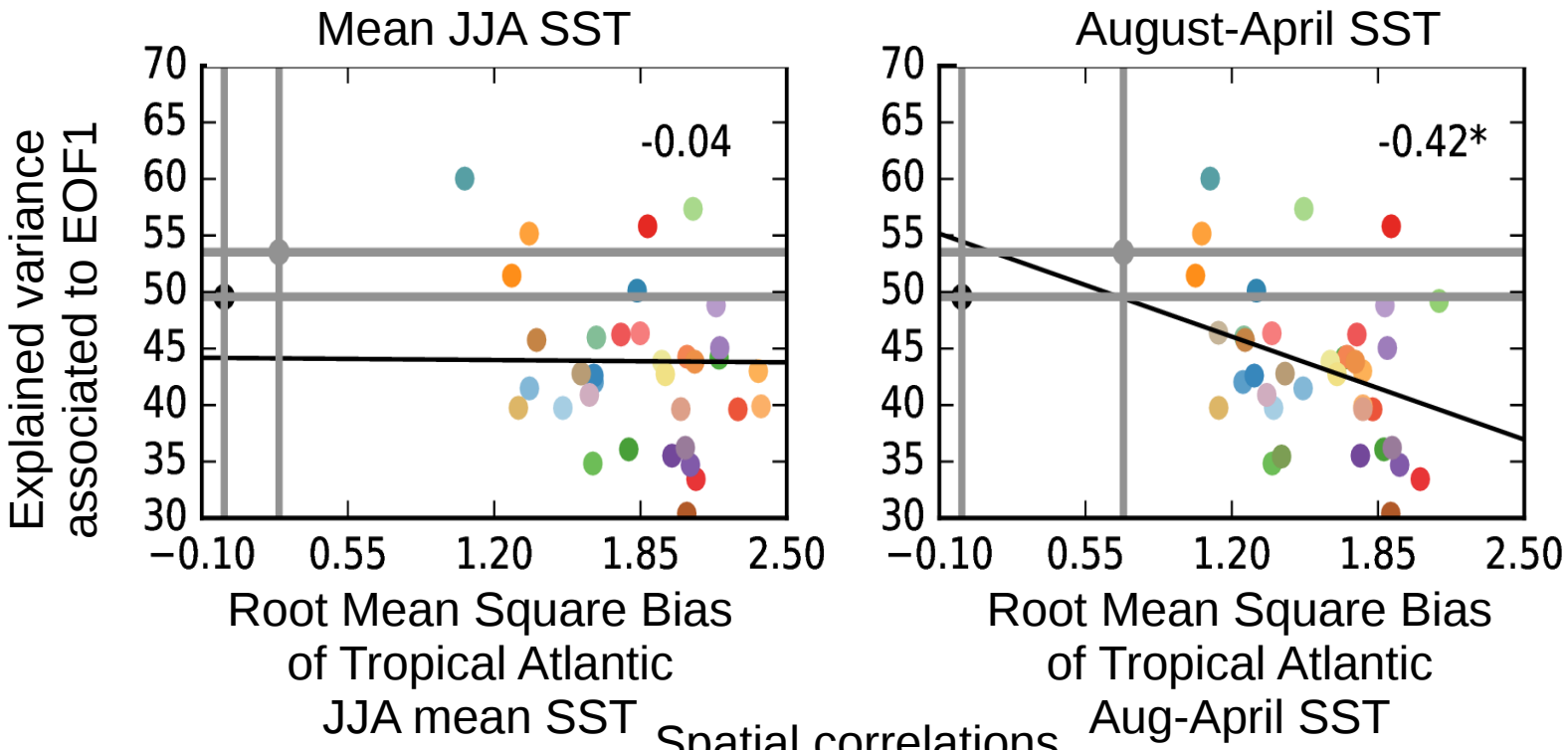


The first EOF in the tropical atlantic is associated to the Atlantic Niño.

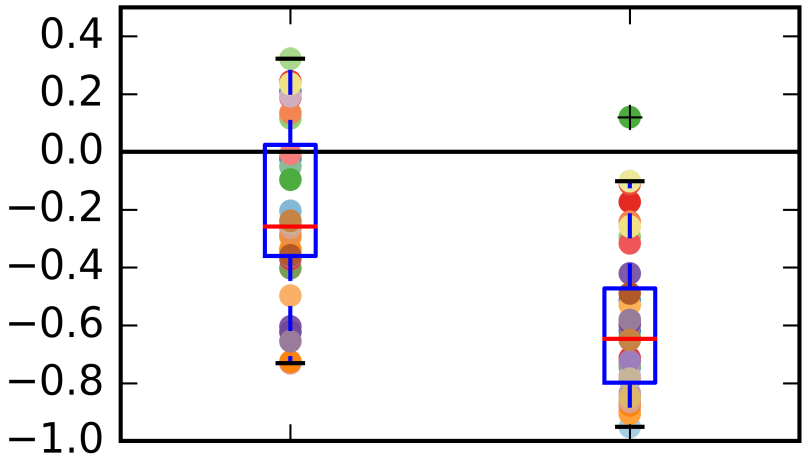
The CMIP5 models reproduce this mode of variability but the spatial pattern and the explained variance are different.

Is this mode of variability related to the mean state representation?

Atlantic Niño and SST bias



No relation between Niño representation and mean SST



Both spatial pattern and explained variance are related to the representation of the cold tongue development

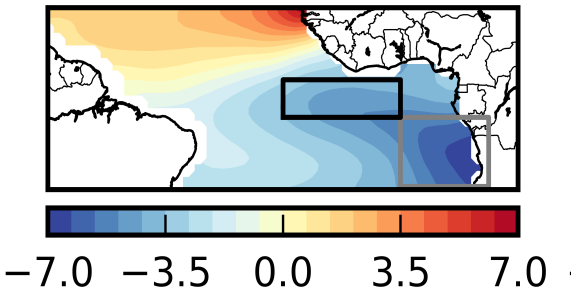
Summary

→ To reproduce a correct interannual variability it is essential that the model are able to reproduce a realistic seasonal cycle.

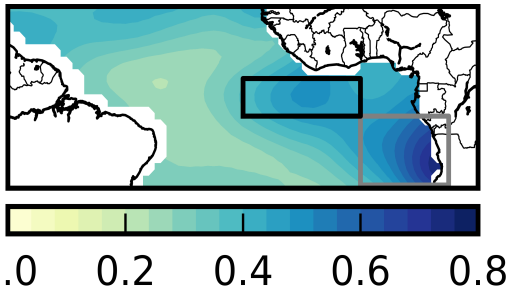
→ The representation of the Atlantic Niño is not linked to the mean state representation, neither in term of spatial pattern neither in term of explained variance.

→ The spatial pattern of the Atlantic Niño is related with the spatial pattern of the cold tongue development and the explained variance associated with the Atlantic Niño is depends on the strength of the cold tongue.

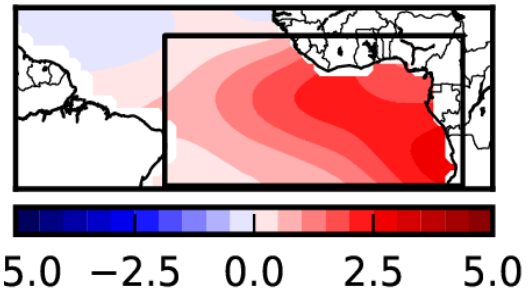
ERSST: August-April SST



ERSST: standard deviation



ERSST: Atlantic Niño



Message and prospects....

=> When performing tuning of coupled models, it might be important to pay attention to the representation of seasonal cycle and not only to the mean state representation.

What are the mechanisms relating seasonal cycle and Atlantic Niño?

Prospects coming from the session OS1.6/CL2.11:

→ Investigate mixed-layer depth and thermocline seasonal evolution.
→ representation of the Bjerkness feedback.
→ Northward migration of the ITCZ and associated wind background.
→ Remote biases.

Could we find similar relations in other regions of large variability?

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Thank you!

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