



Atlantic Cold Tongue in CMIP5 models: mean characteristics and interannual variability



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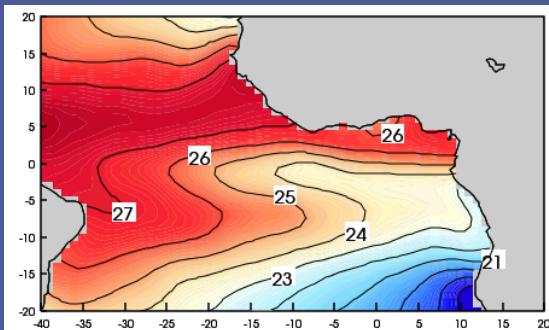


Outline

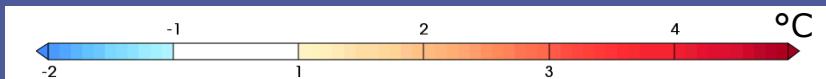
- CMIP models
 - Atlantic Cold Tongue representation
 - Location of the Equatorial cooling and interannual variability
- Focus on CNRM-CM5
 - A first sensitivity experiment to the surface wind
 - Role of heat fluxes biases vs wind biases
- Perspectives

JJA SST 1971-2000

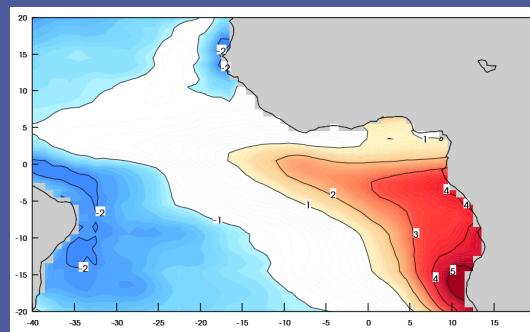
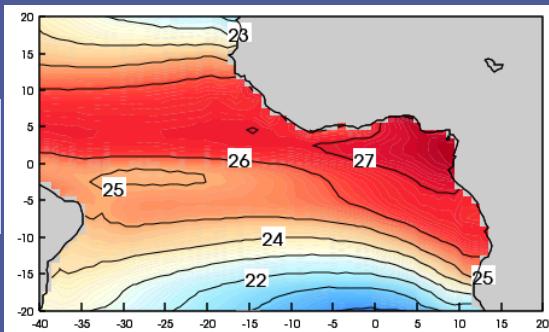
HadSST



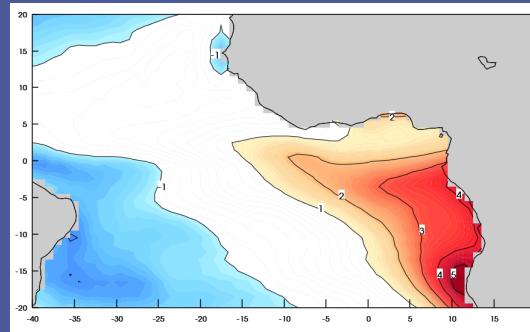
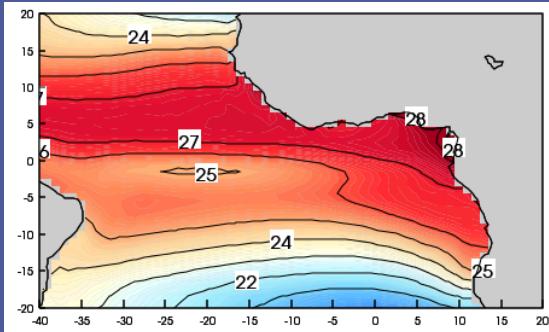
Anomaly
to
HadSST



CMIP3
(12 models)



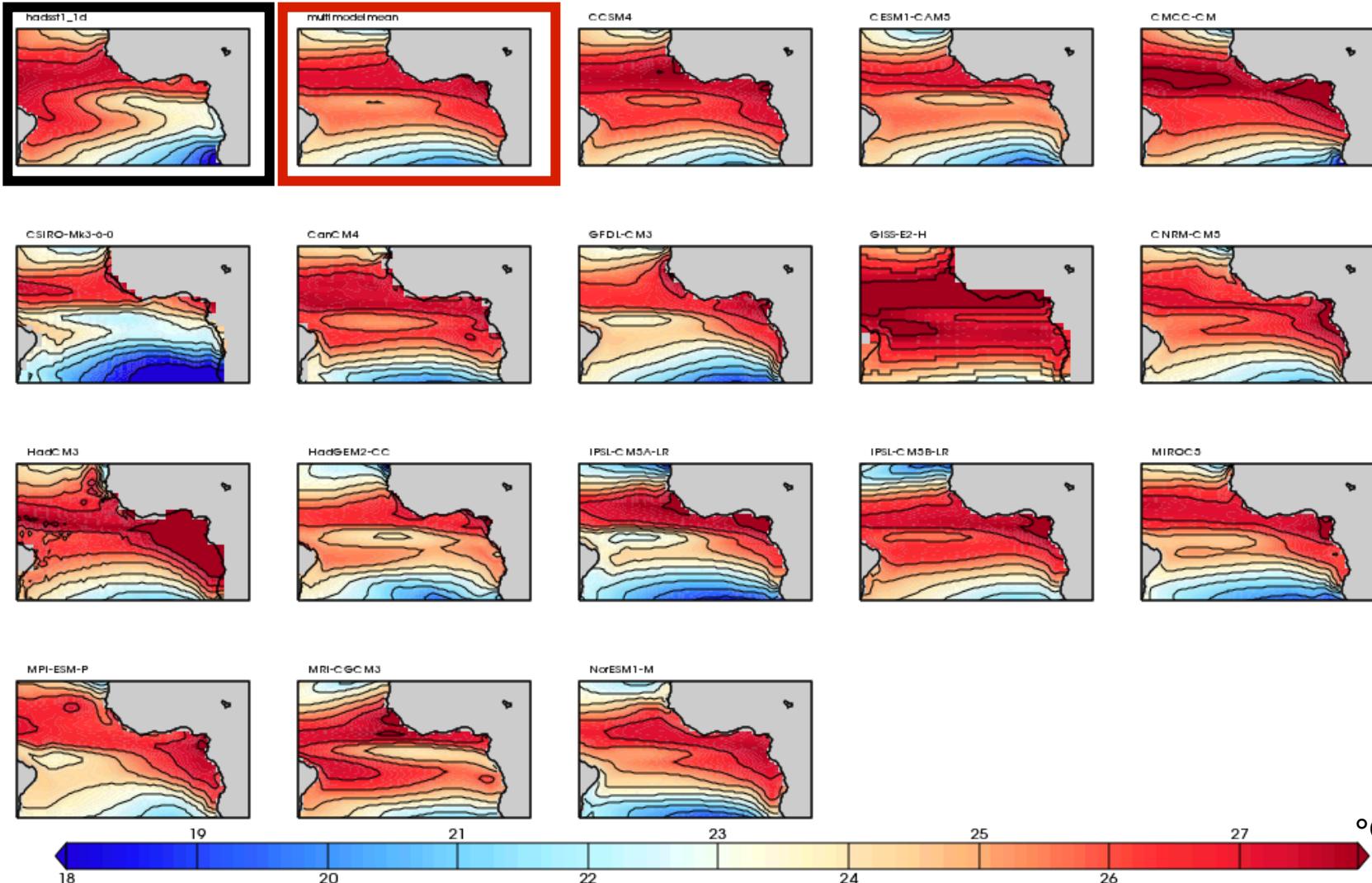
CMIP5
reduced to
CMIP3
models



JJA SST 1971-2000

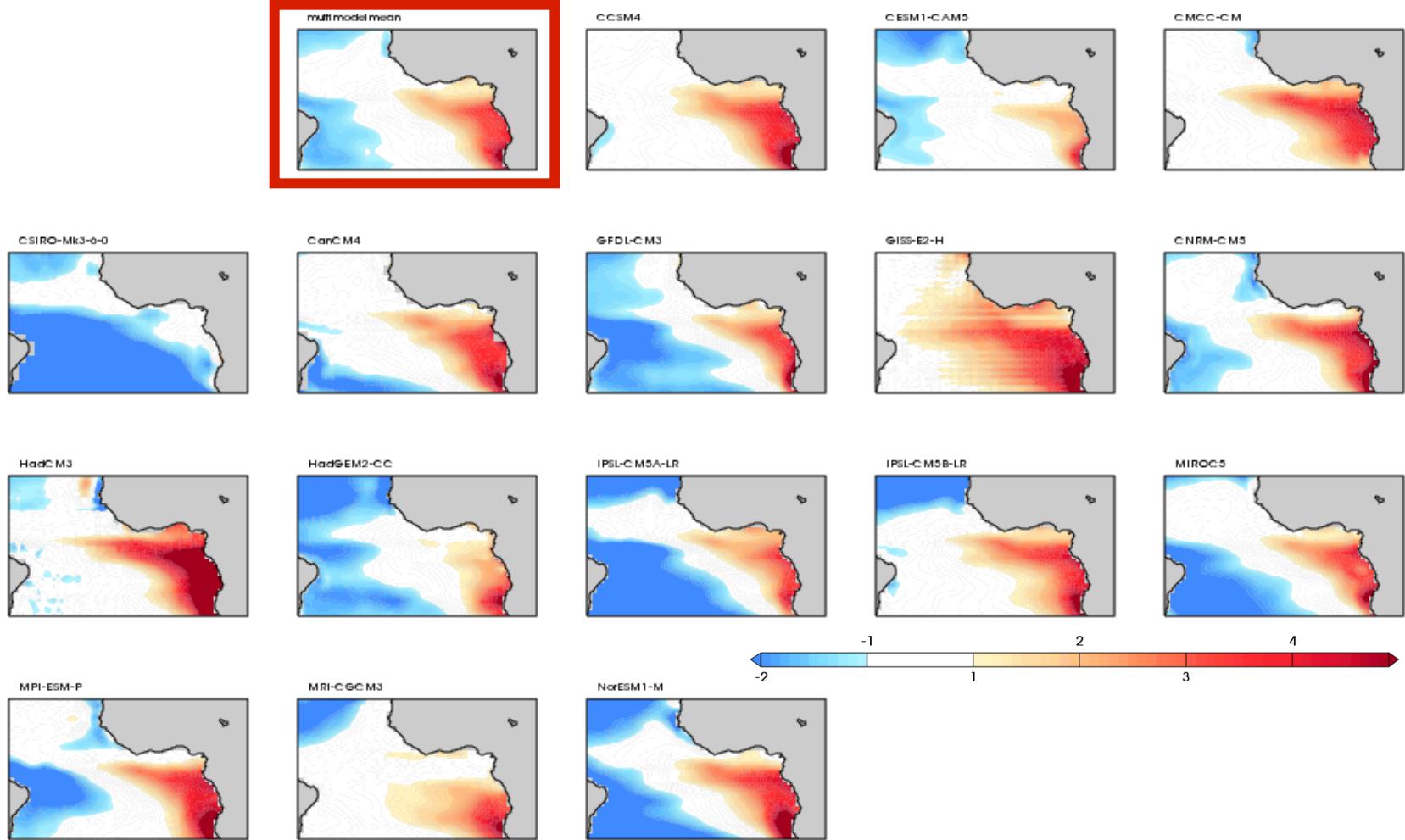
HadSST1

Multi-model mean



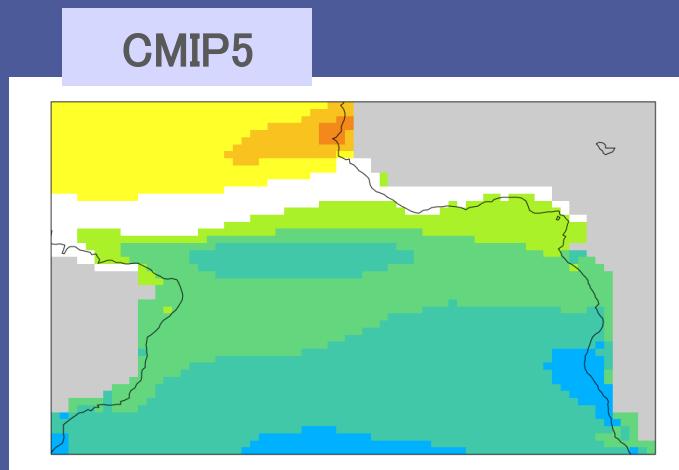
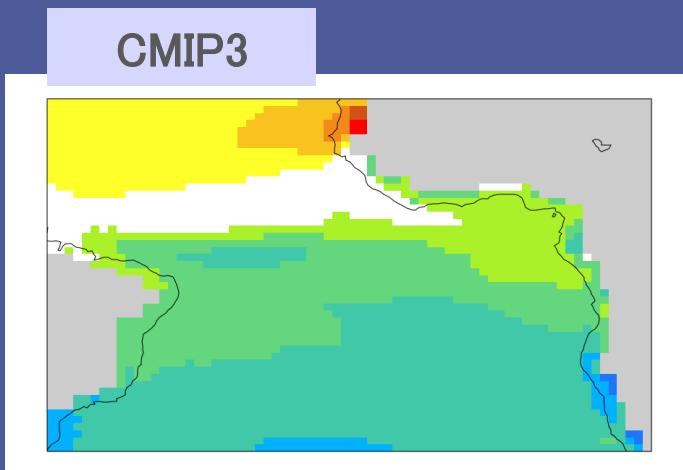
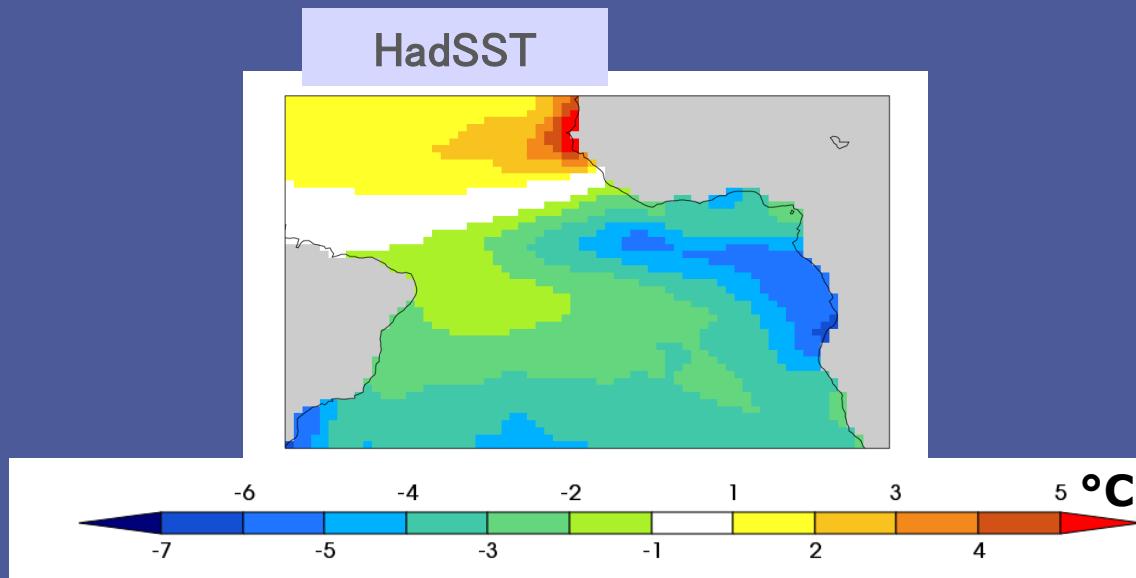
JJA SST bias (to HadSST)

Multi-model mean

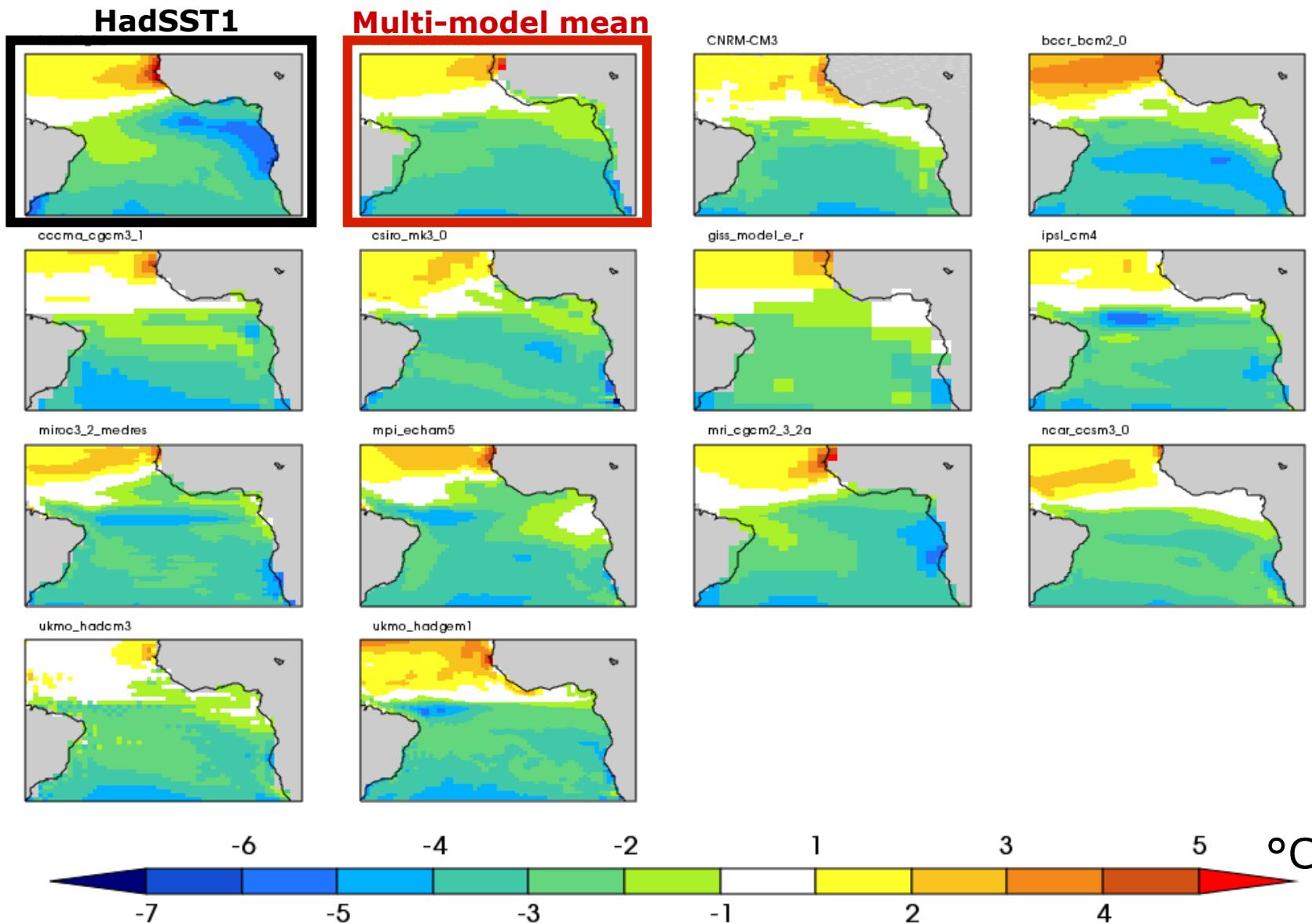


Spring SST cooling

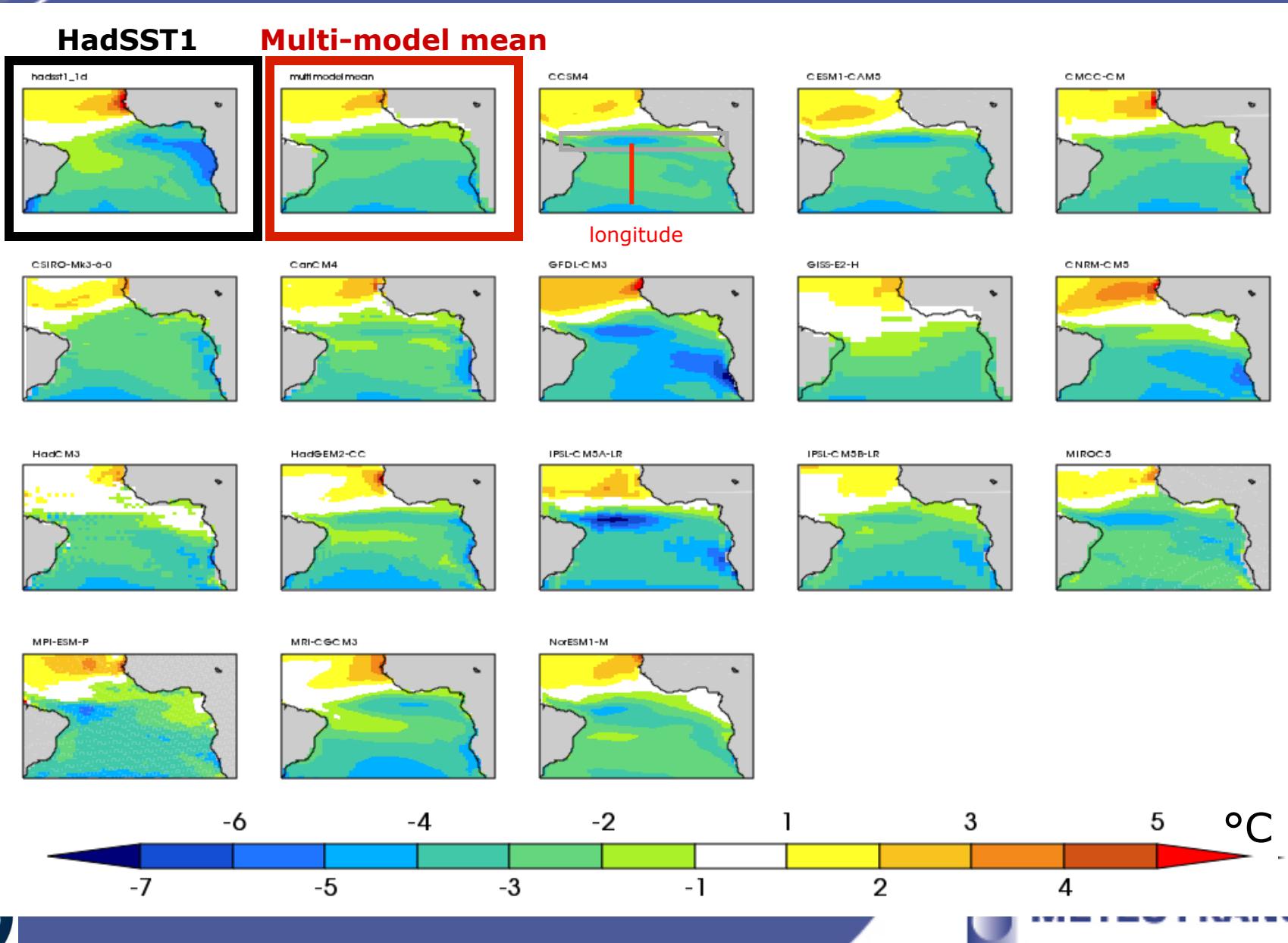
July – April mean SST



CMIP3 : SST Spring cooling (July – April)

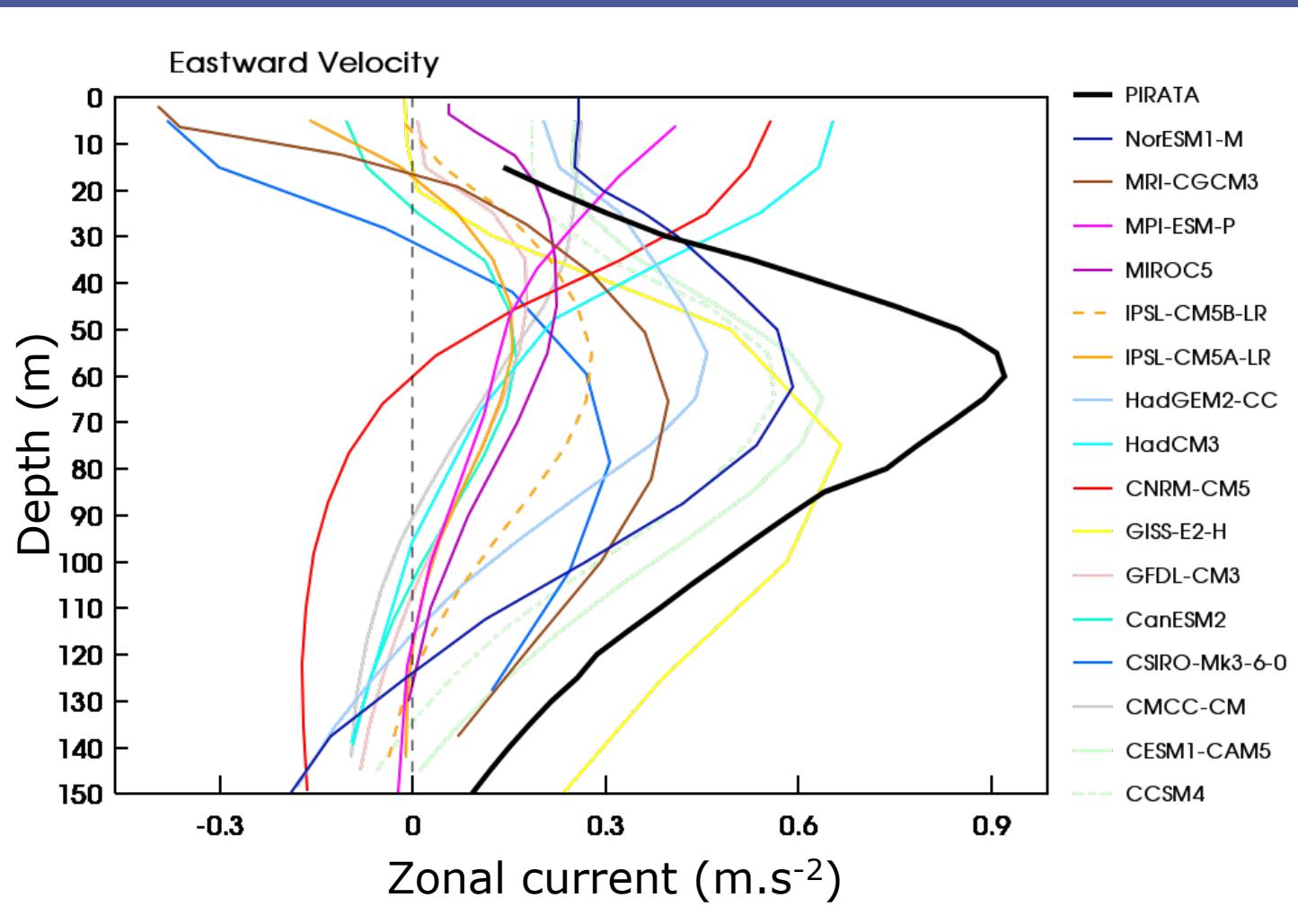


CMIP5 : SST Spring cooling (July – April)

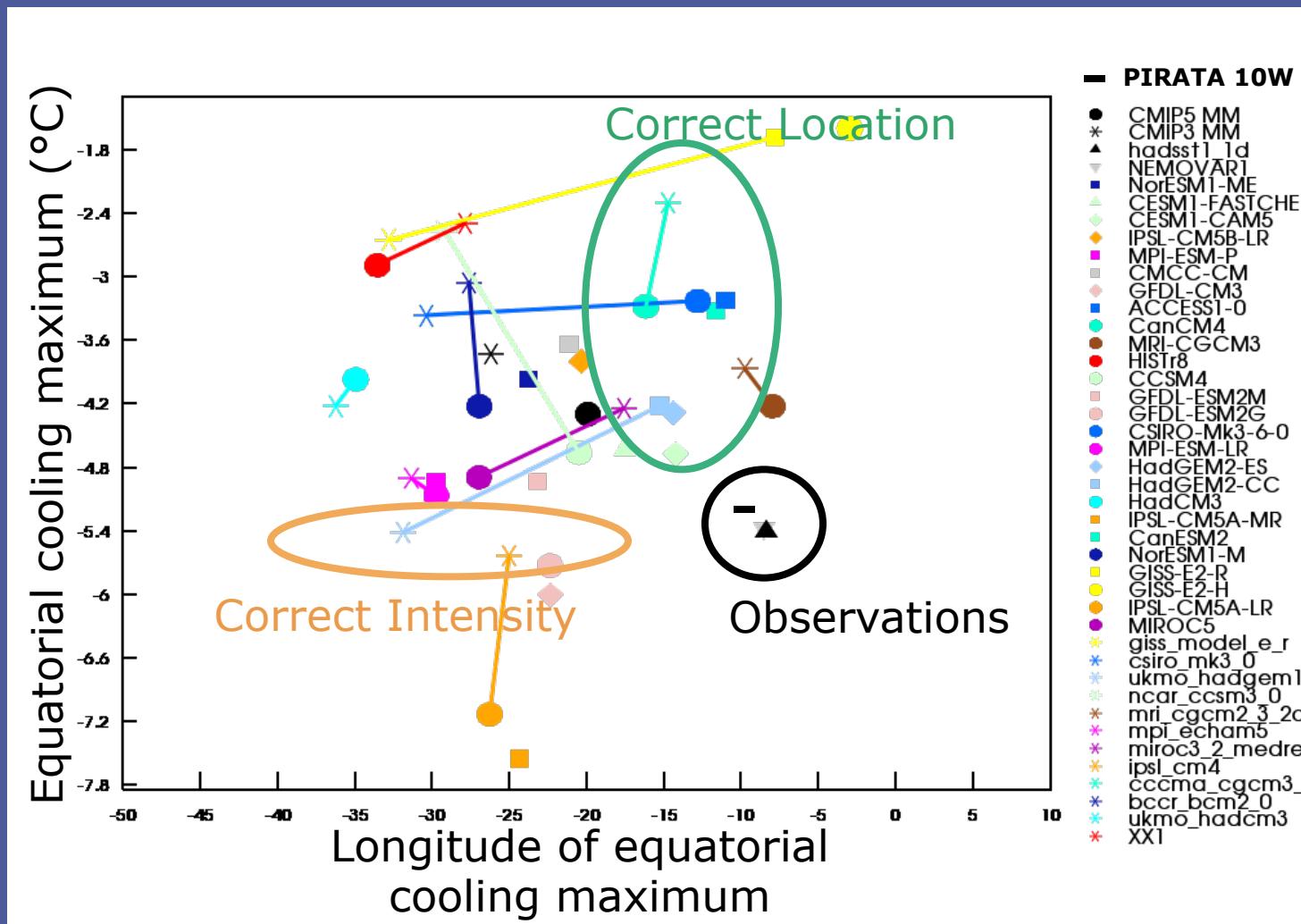


Comparison with PIRATA buoys

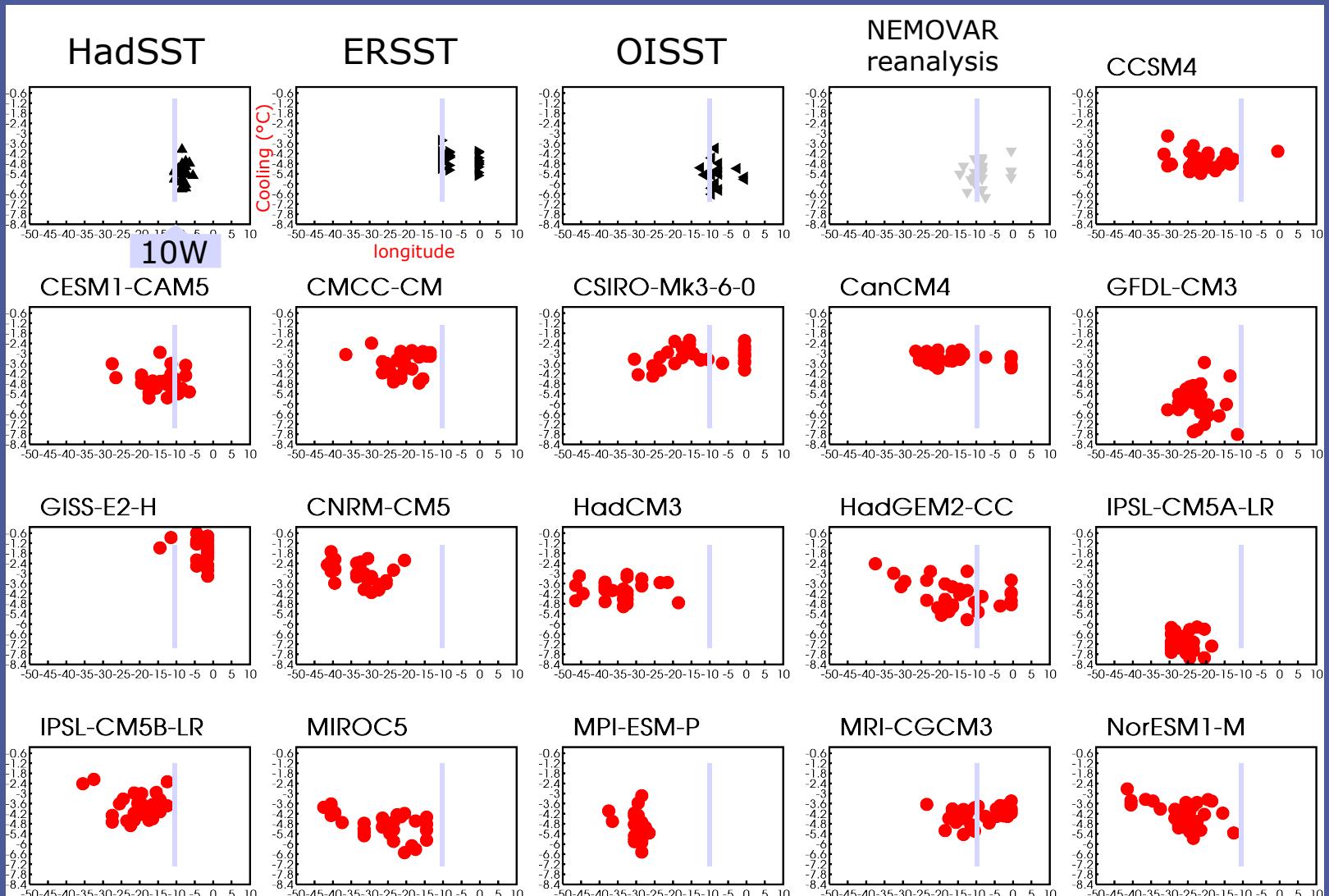
Vertical profile of zonal current at 23°W in April



Position of the maximum of cooling along the Equator



Interannual variability of the cooling max vs location

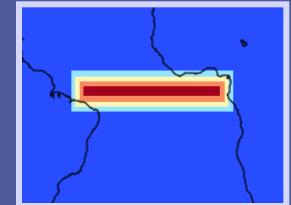


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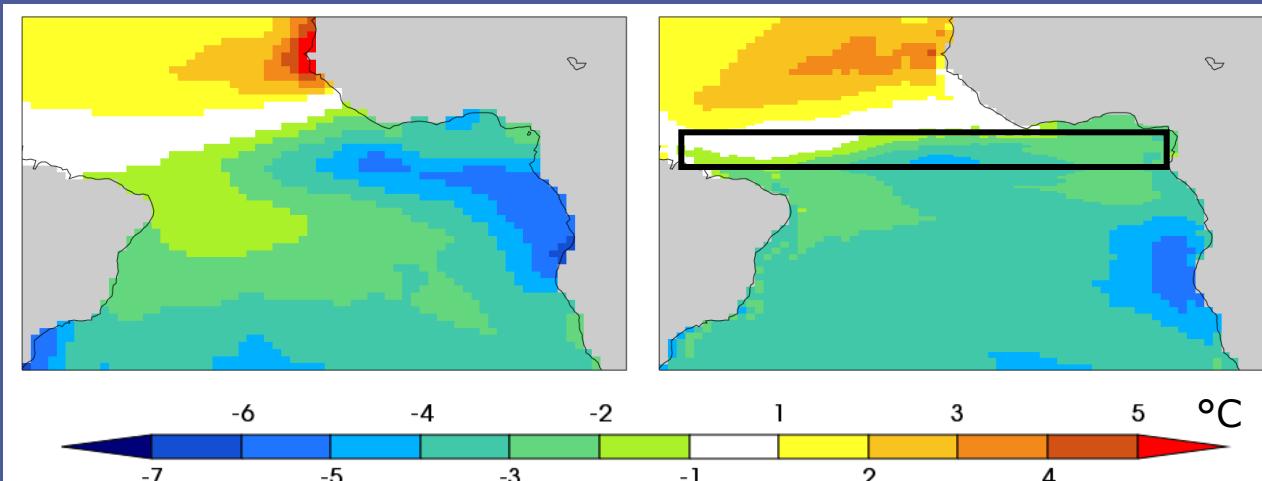
Sensitivity of CNRM-CM5 to surface winds

In CNRM-CM5, the surface wind is nudged towards ERAInterim reanalysis over the Atlantic Equatorial region



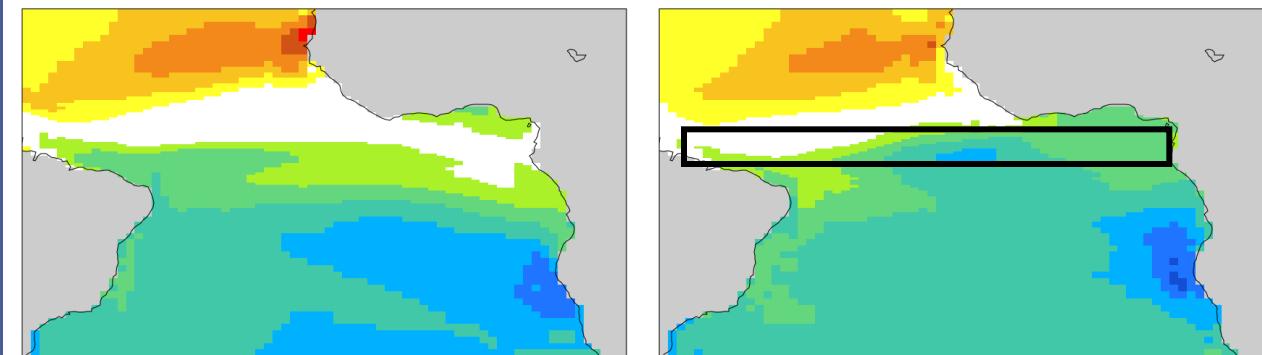
Spring cooling July-April

HadSST



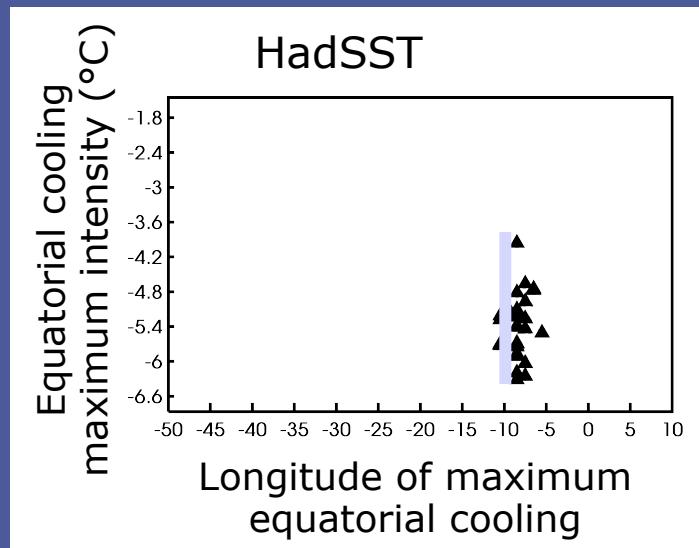
CNRM-CM5
Usurf/Vsurf
corrected

CNRM-CM5

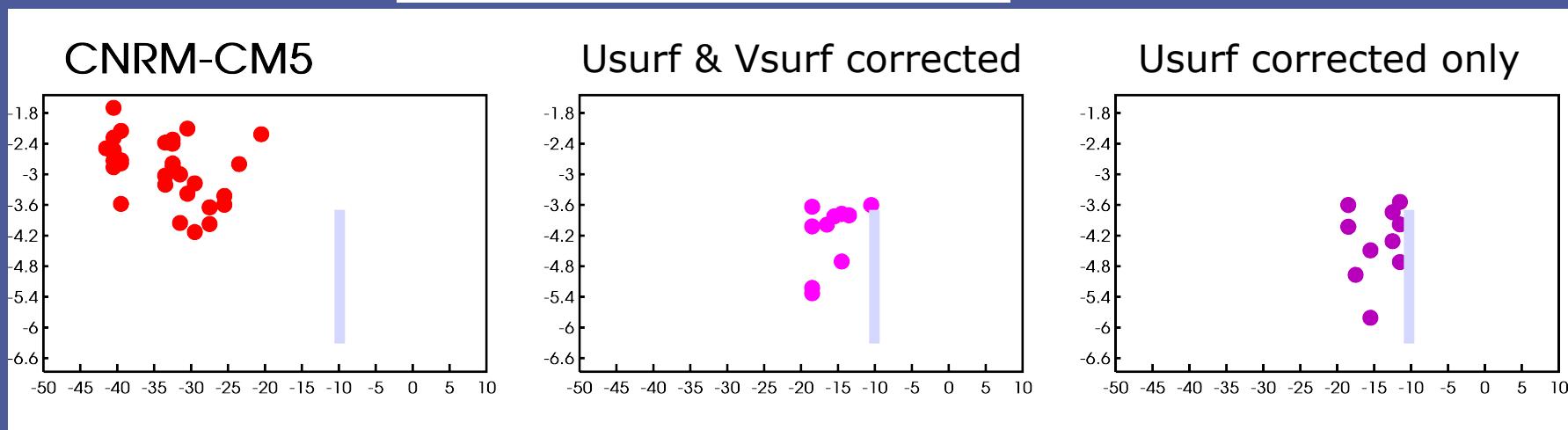


CNRM-CM5
Usurf
corrected
only

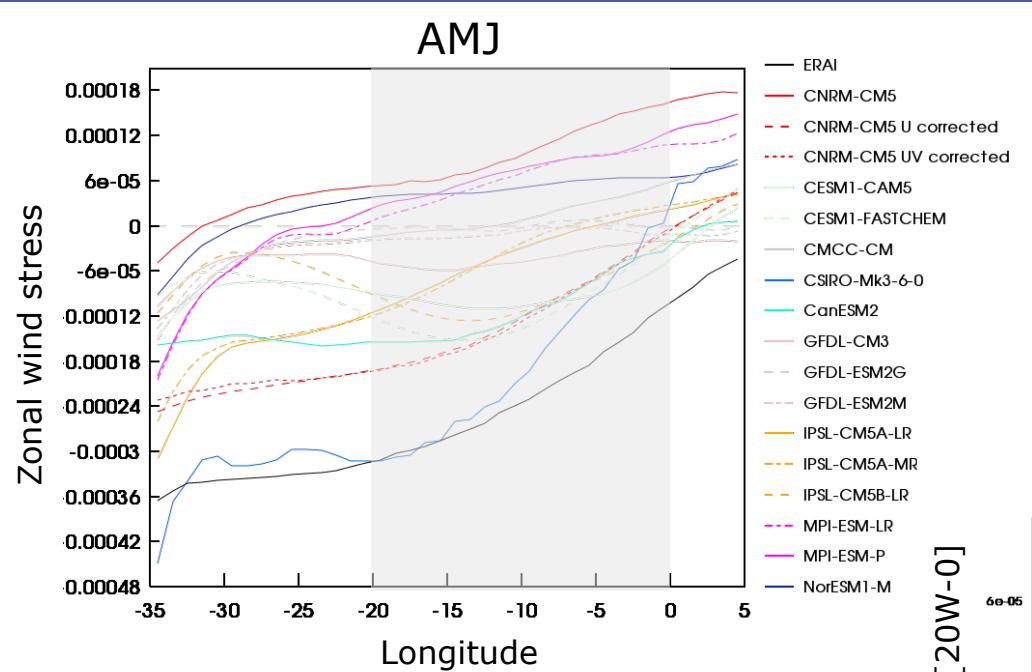
Sensitivity of CNRM-CM5 to surface winds



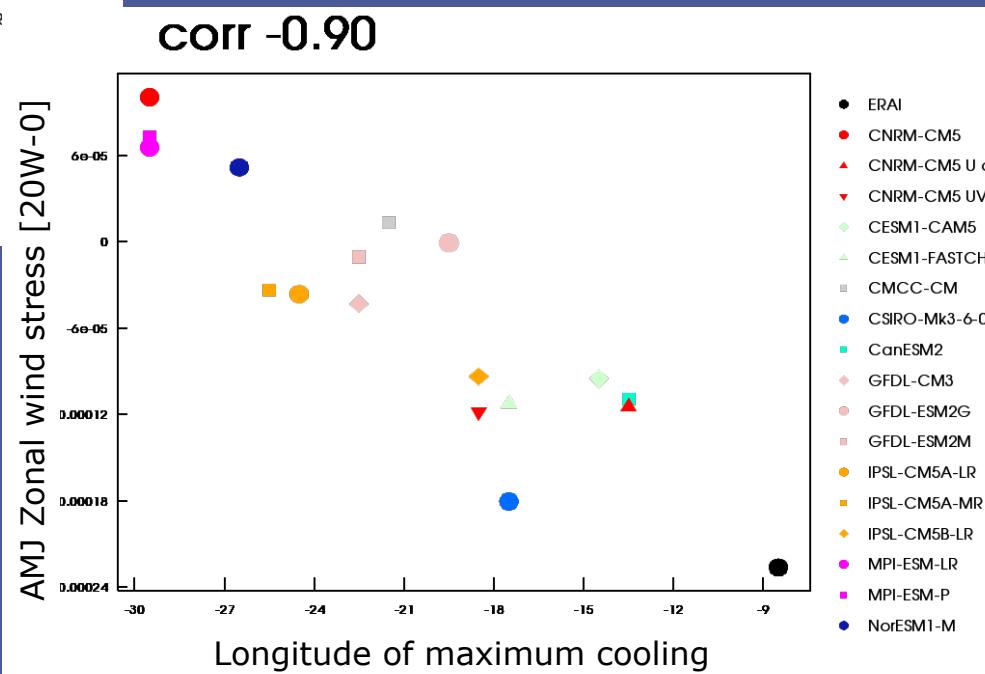
The local zonal wind drives the **mean location** of the Atlantic Cold Tongue and its **interannual variability**



Surface zonal wind stress at the Equator

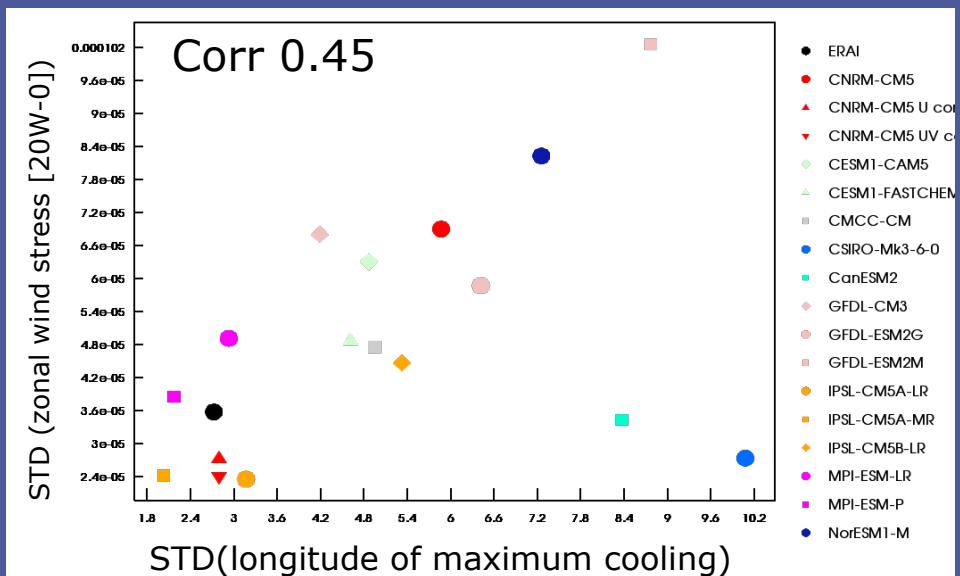
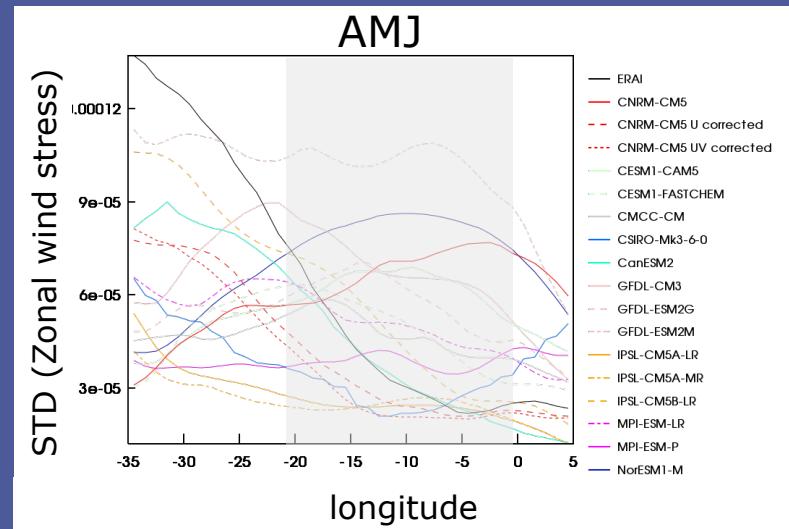
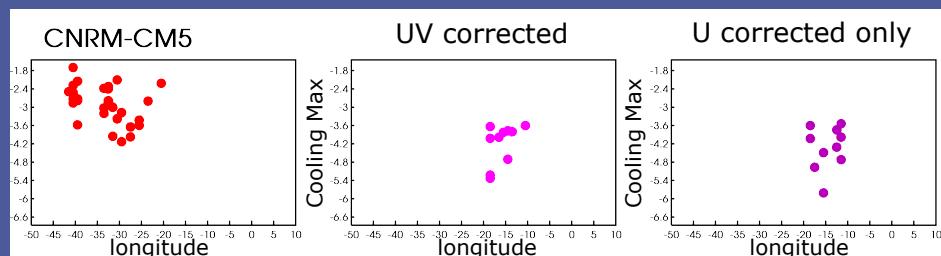


Spring (average AMJ)
wind forcing is
particularly important



Interannual variability of the wind stress at the Equator

Standard deviation of spring (AMJ)
wind stress at the Equator



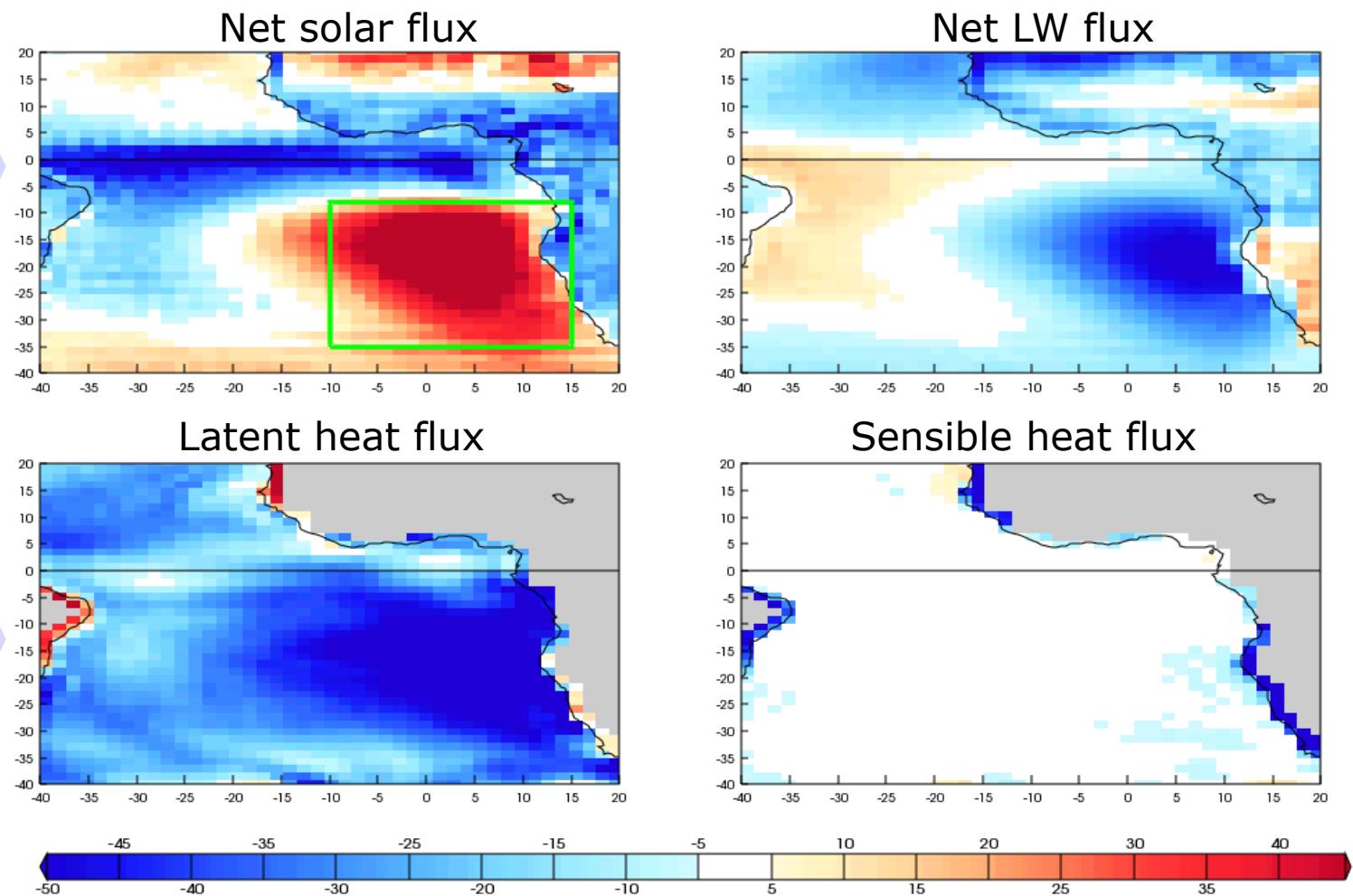
The variability of
the longitude of
cooling is linked
to the zonal wind
stress variability
around 10W

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Heat fluxes biases in CNRM-CM5

CNRM-CM5
- isccp



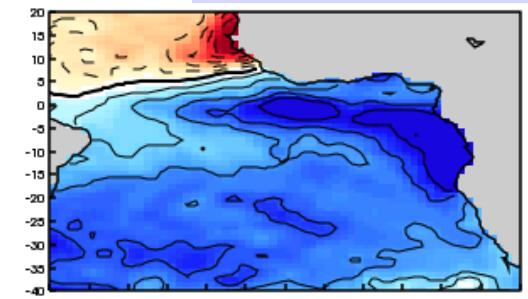
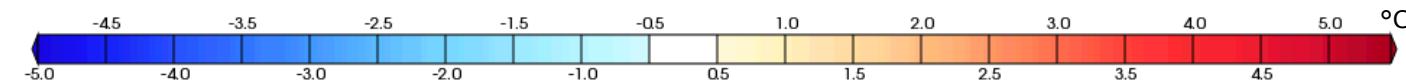
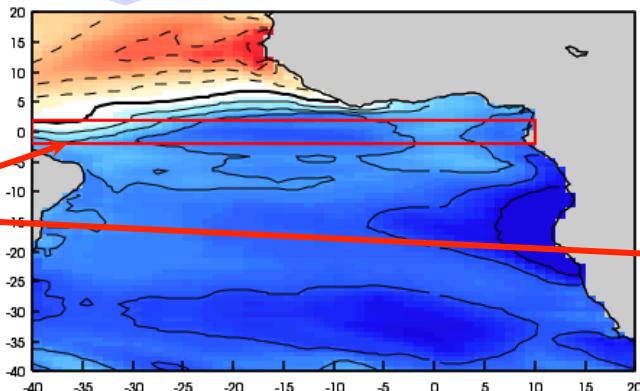
CNRM-CM5
- oaflux

Role of heat fluxes biases in CNRM-CM5

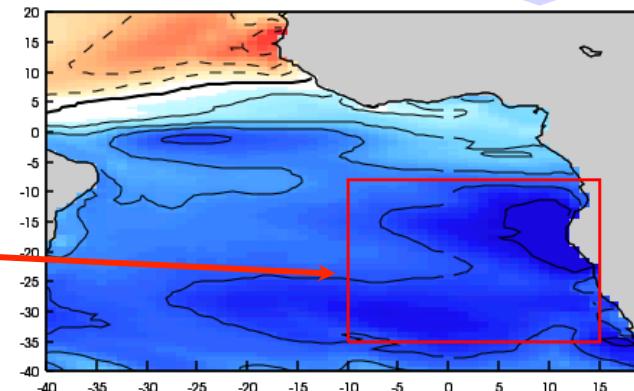
Spring SST cooling (July –April)

CNRM-CM5

Wind
corrected



Solar flux
corrected



Zone of
correction

Conclusion

- CMIP5 models still have difficulties in simulating the annual mean cycle of SSTs in the Tropical Atlantic region
- The location of the equatorial cooling is often shifted to the West (10W in observations)
- The interannual variability of the cooling position is weak in observations but high in models
- This feature is strongly linked to the zonal wind stress forcing in CNRM-CM5 but also in most CMIP5 models
- The atmospheric biases explain a large part of SST biases except in the Eastern part of the Gulf of Guinea