

Bias remains in CCSM4 & Two new worries: SLP bias and missing coastal advection

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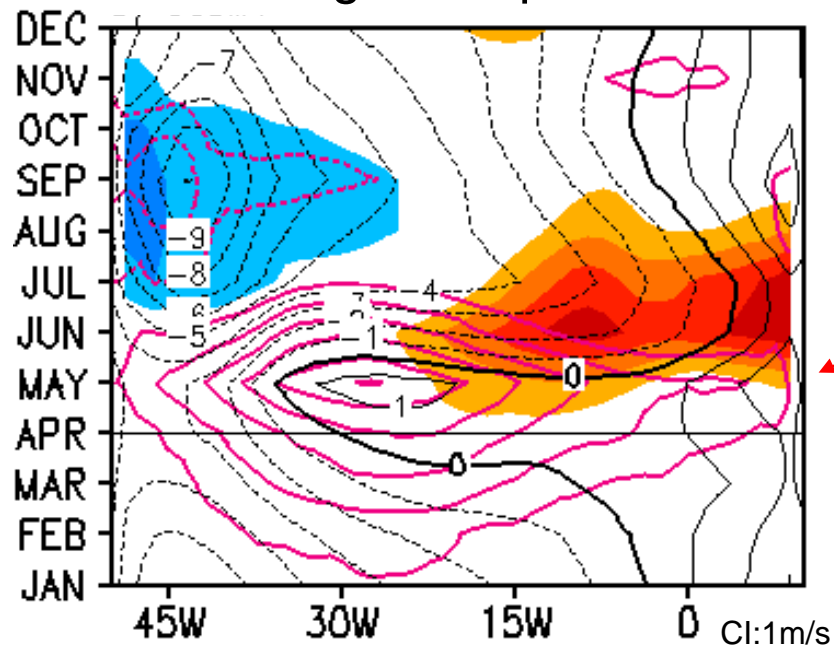
We'll focus on 100yrs of a CCSM4 control simulation
(years 863-959) along with the corresponding CAM4
AMIP simulation

Also: Sensitivity of Tropical Climate to Low-Level Clouds
in the NCEP Climate Forecast System (CFS1) – Hu,
Huang et al.

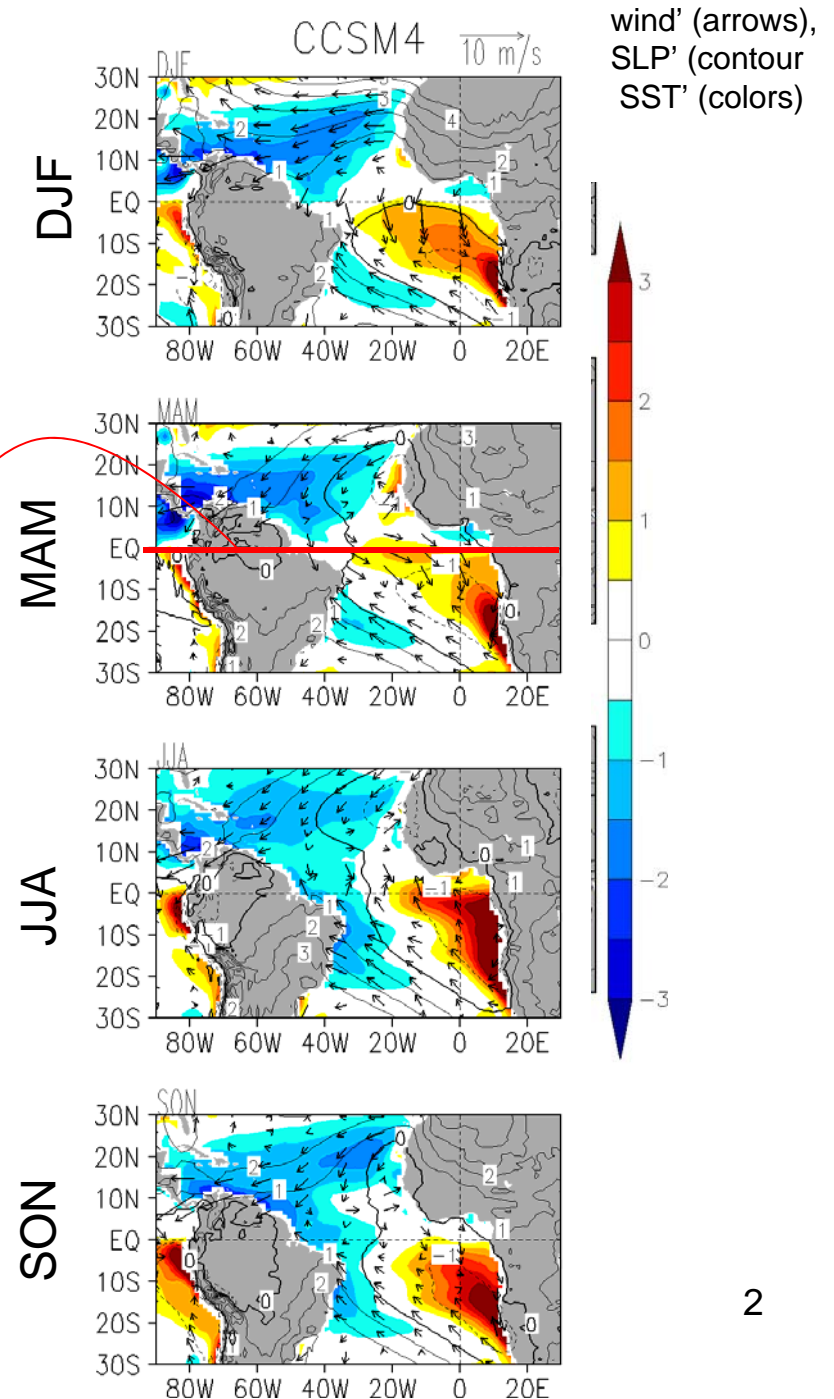
Seasonal bias remains in CCSM4

Anomalous westerlies in spring and problems with continental convection
 {Chang et al., 2008; Wahl, Latif, et al., 2009; Richter, Xie et al., 2010 mechanisms}

Bias along the Equator

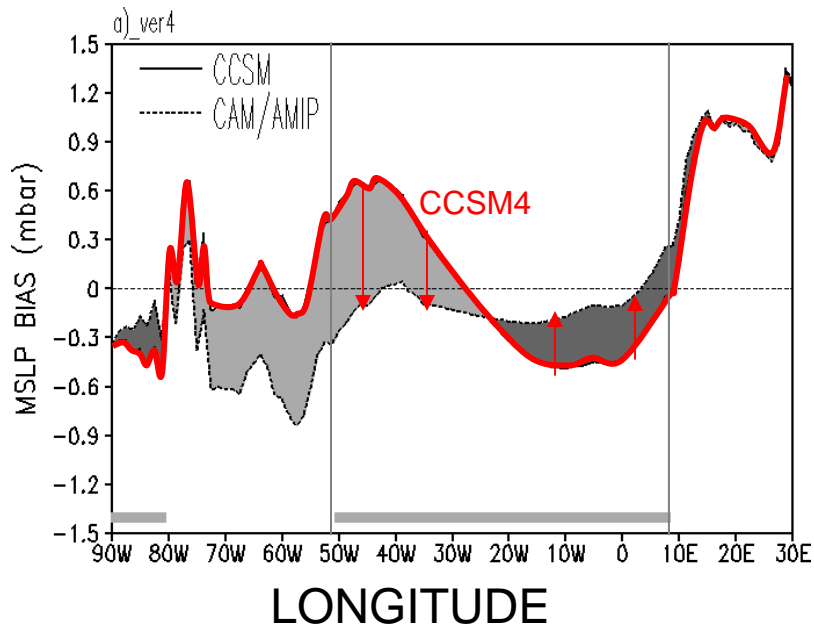


Black: TAUX; Red: TAUX'; Colors: SST'

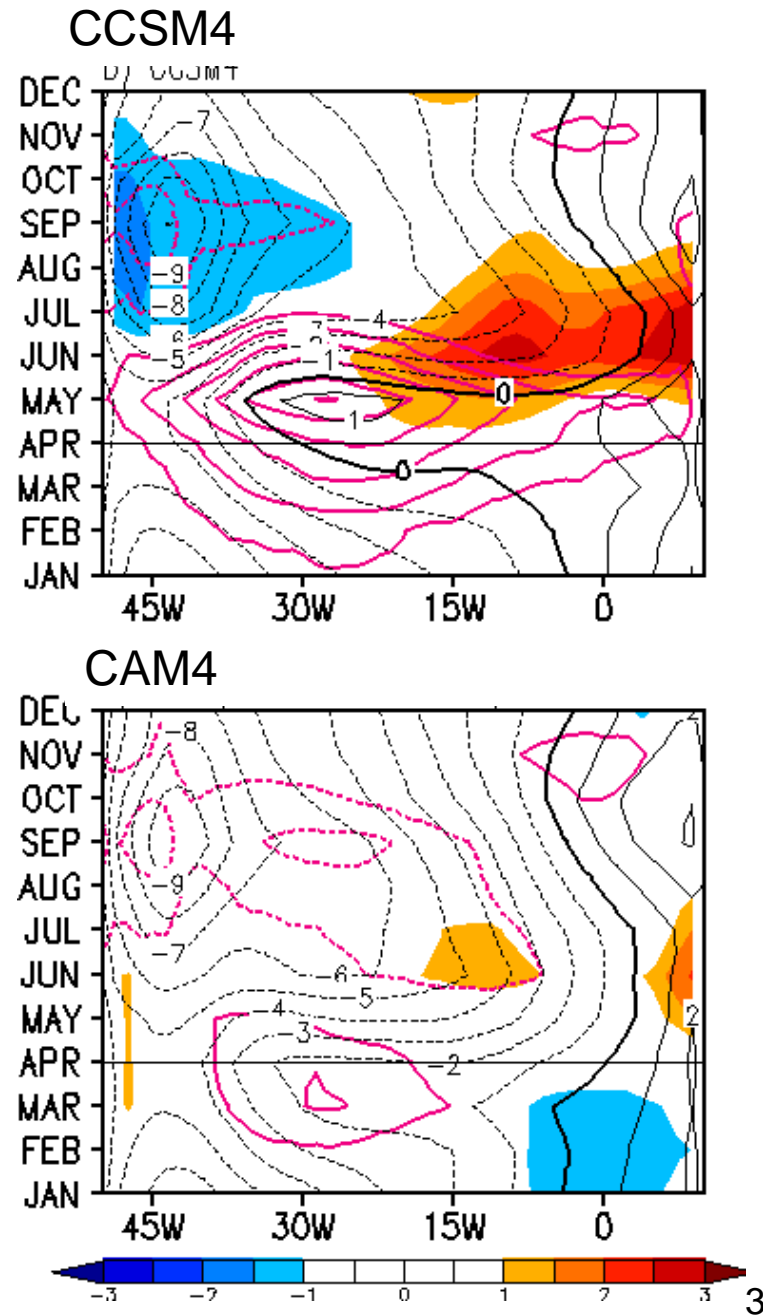


The problems are more severe in CCSM4 than CAM4

SLP along Equator



Coupling still seems to be the source of most bias

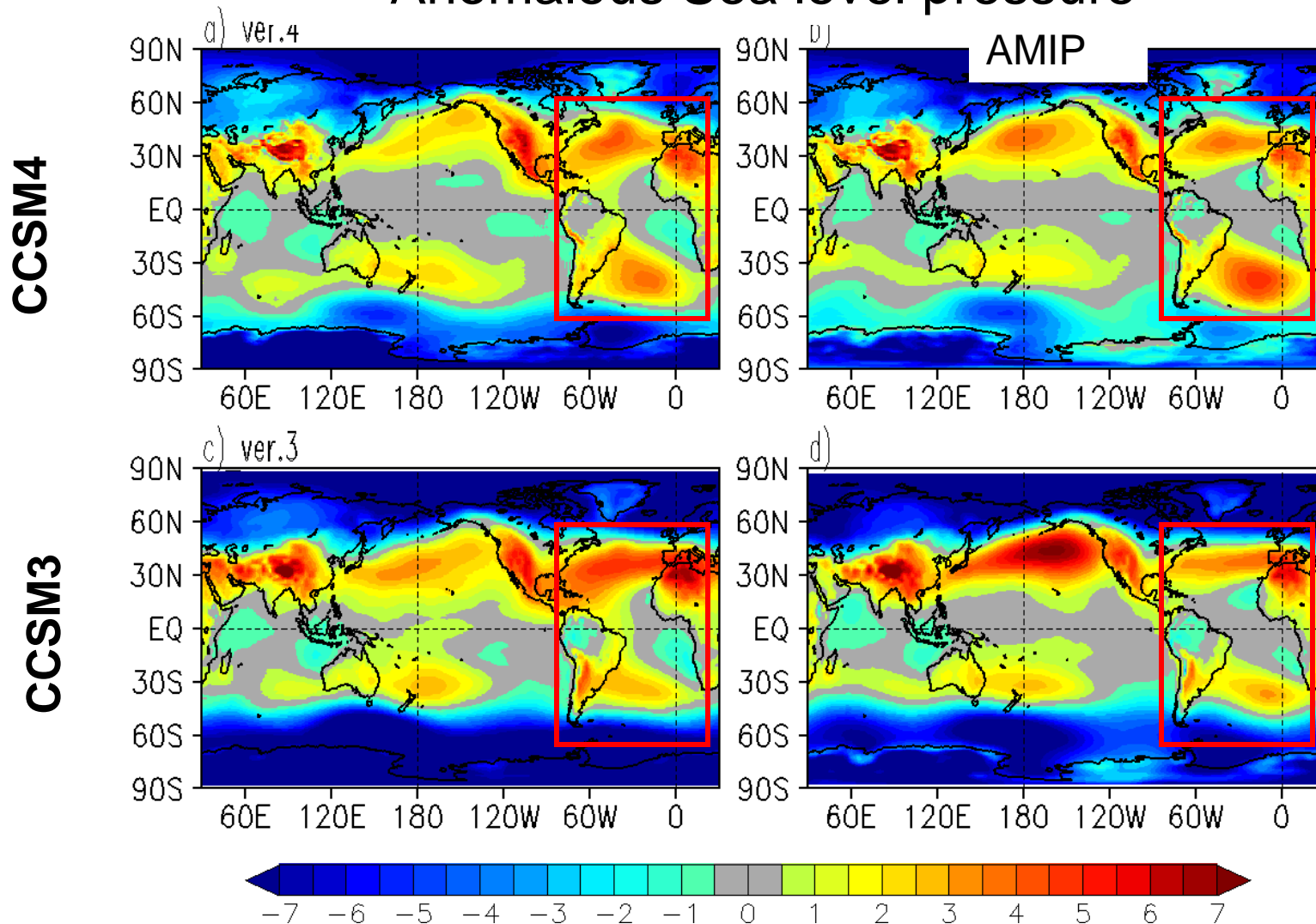


Black: TAUX; Red: TAUX'; Colors: SST'

SLP Bias

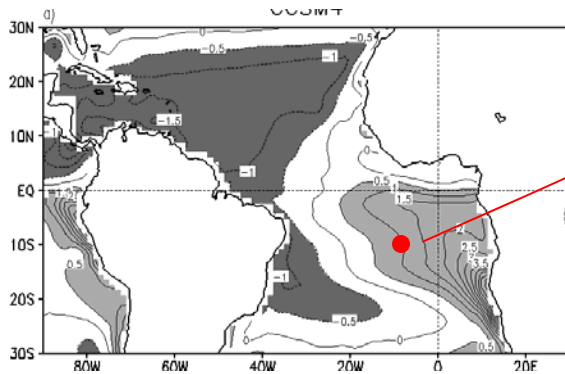
it remains in CCSM4

Anomalous Sea level pressure

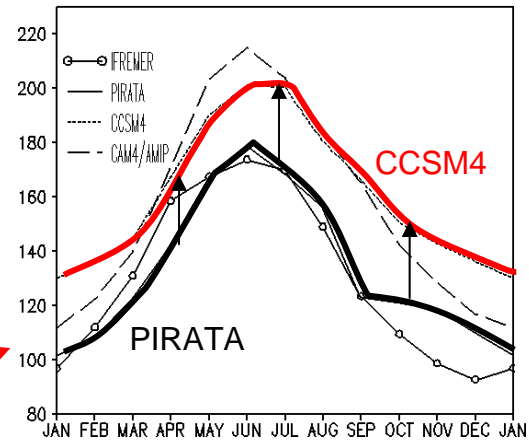


Trades too strong
means too much latent
heat loss

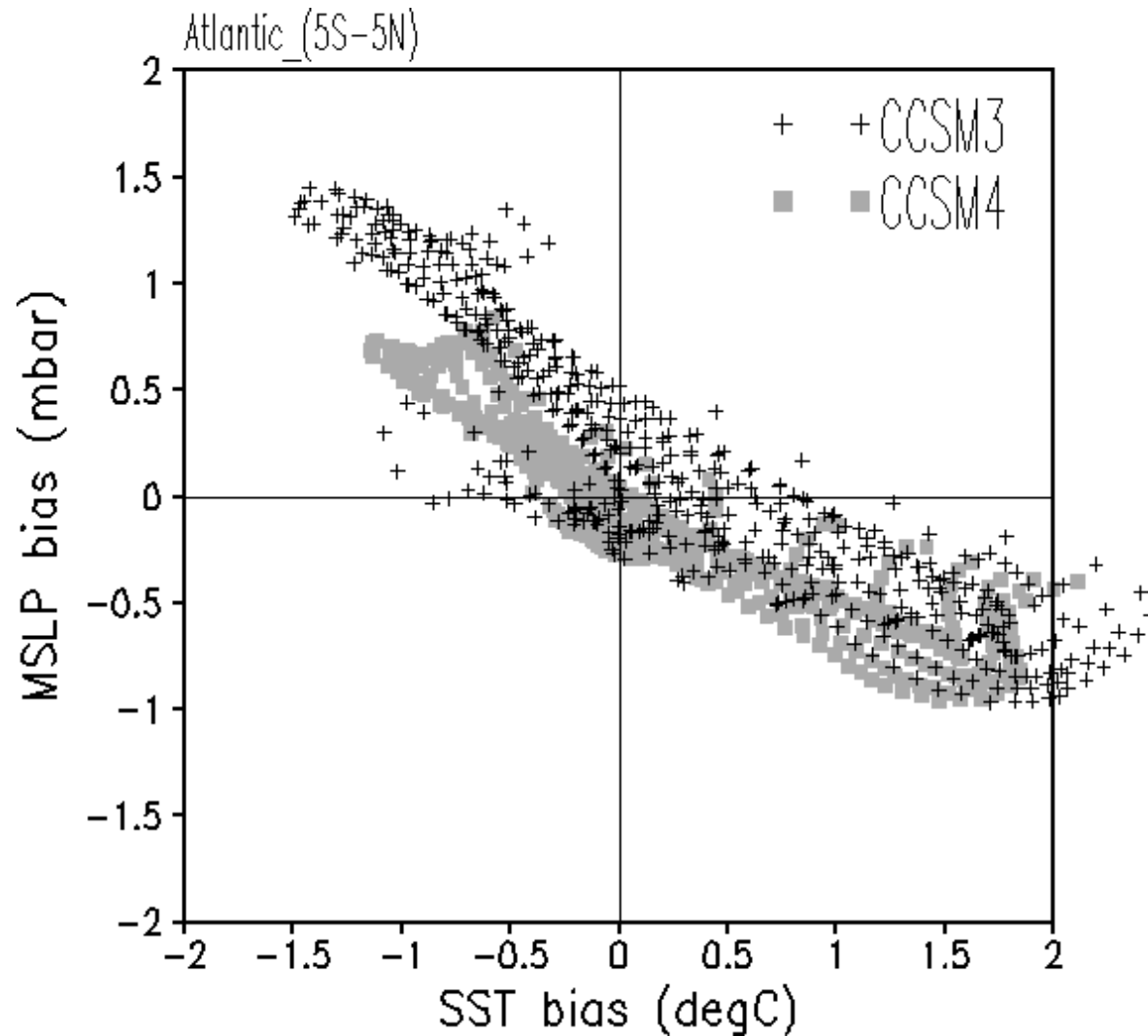
Time mean SST bias



LATENT HEAT



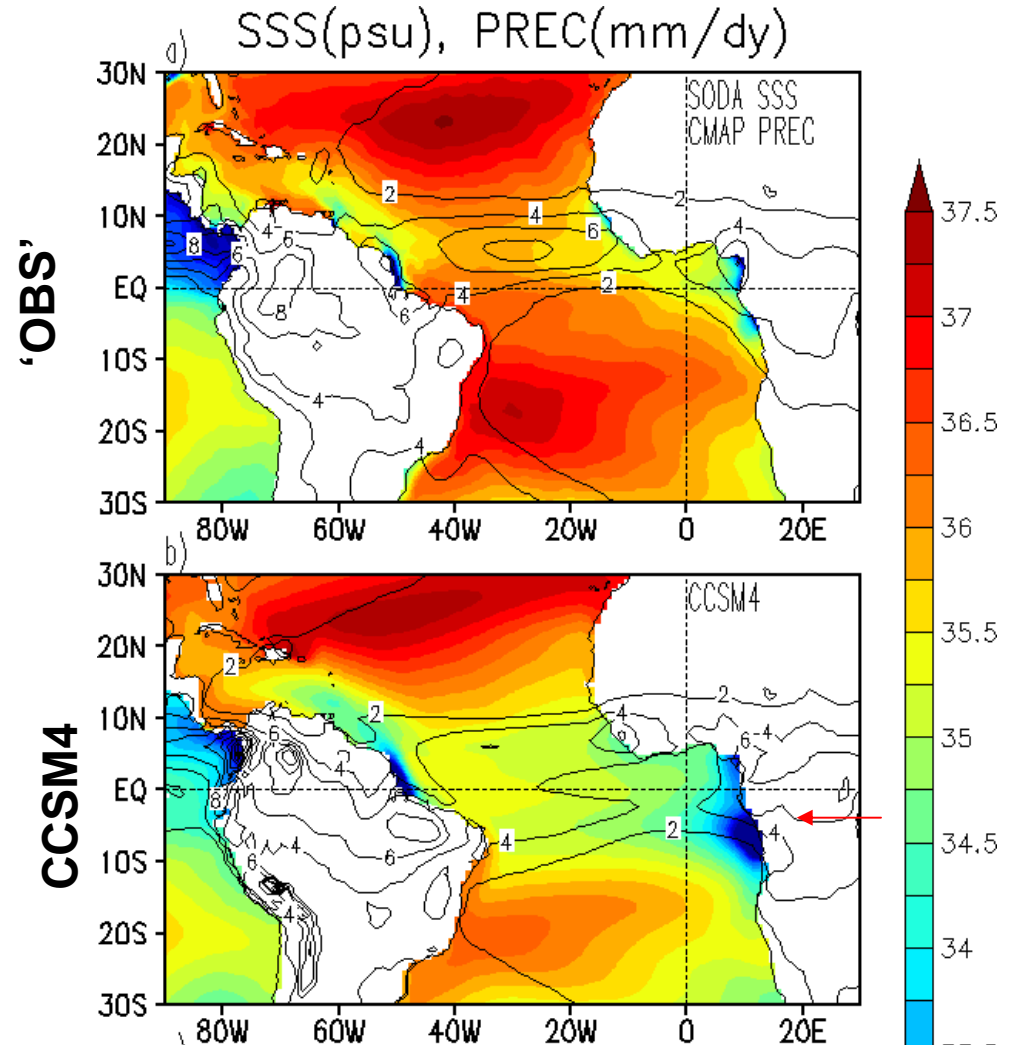
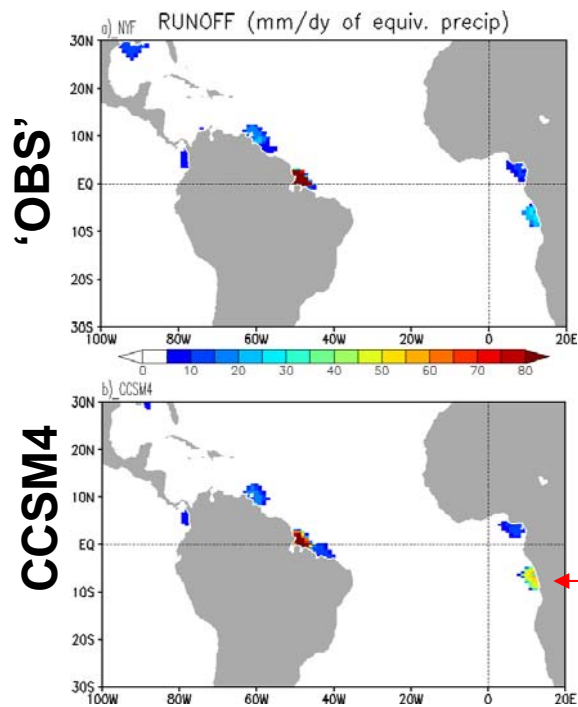
SLP bias \rightarrow SST bias in the deep tropics



CCSM4 still has SSS, Precip bias

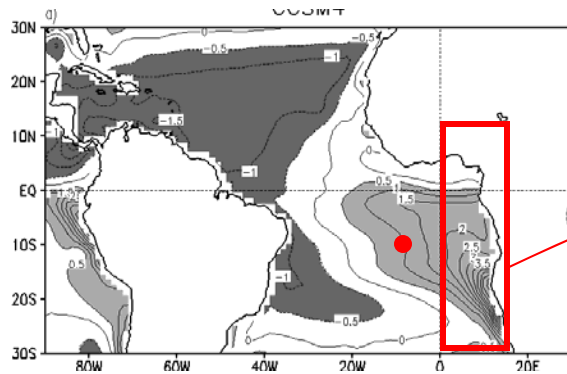
{ Breugem, Chang, et al., 2008 mechanism }

River Discharge bias

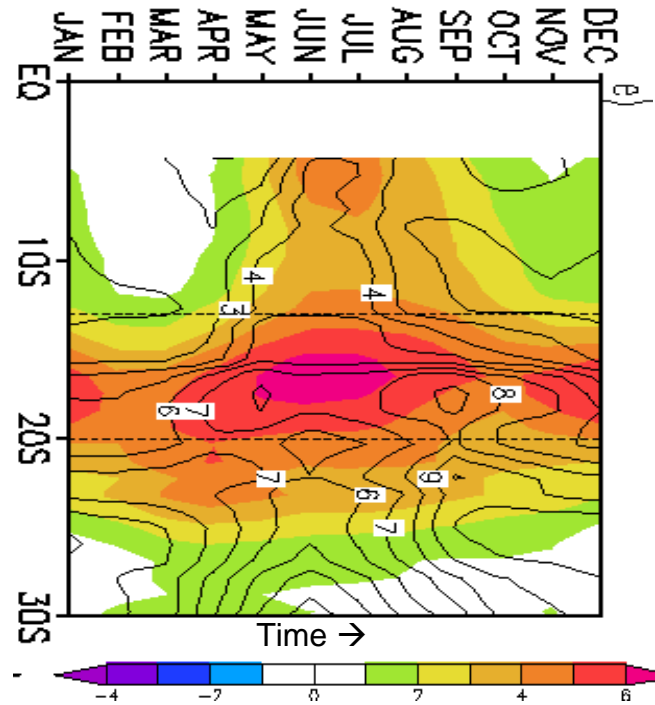


SST bias along Southeast Africa

Time mean SST bias

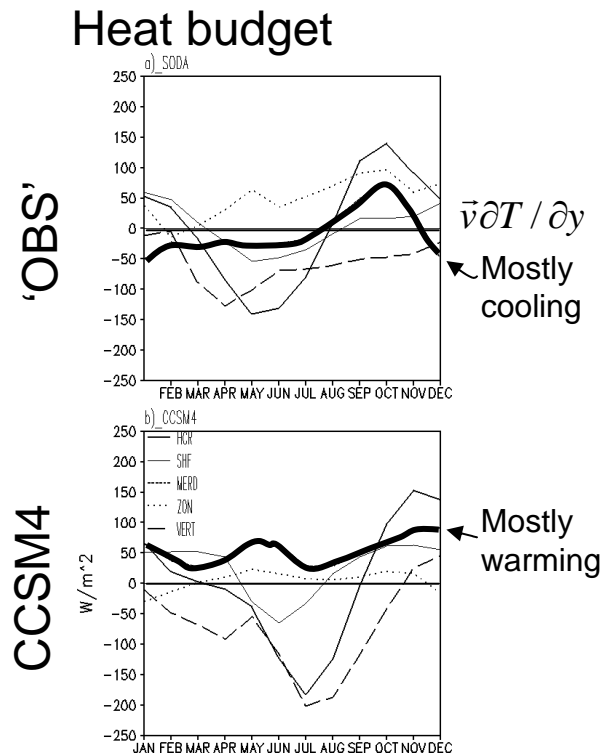


SST bias along coast

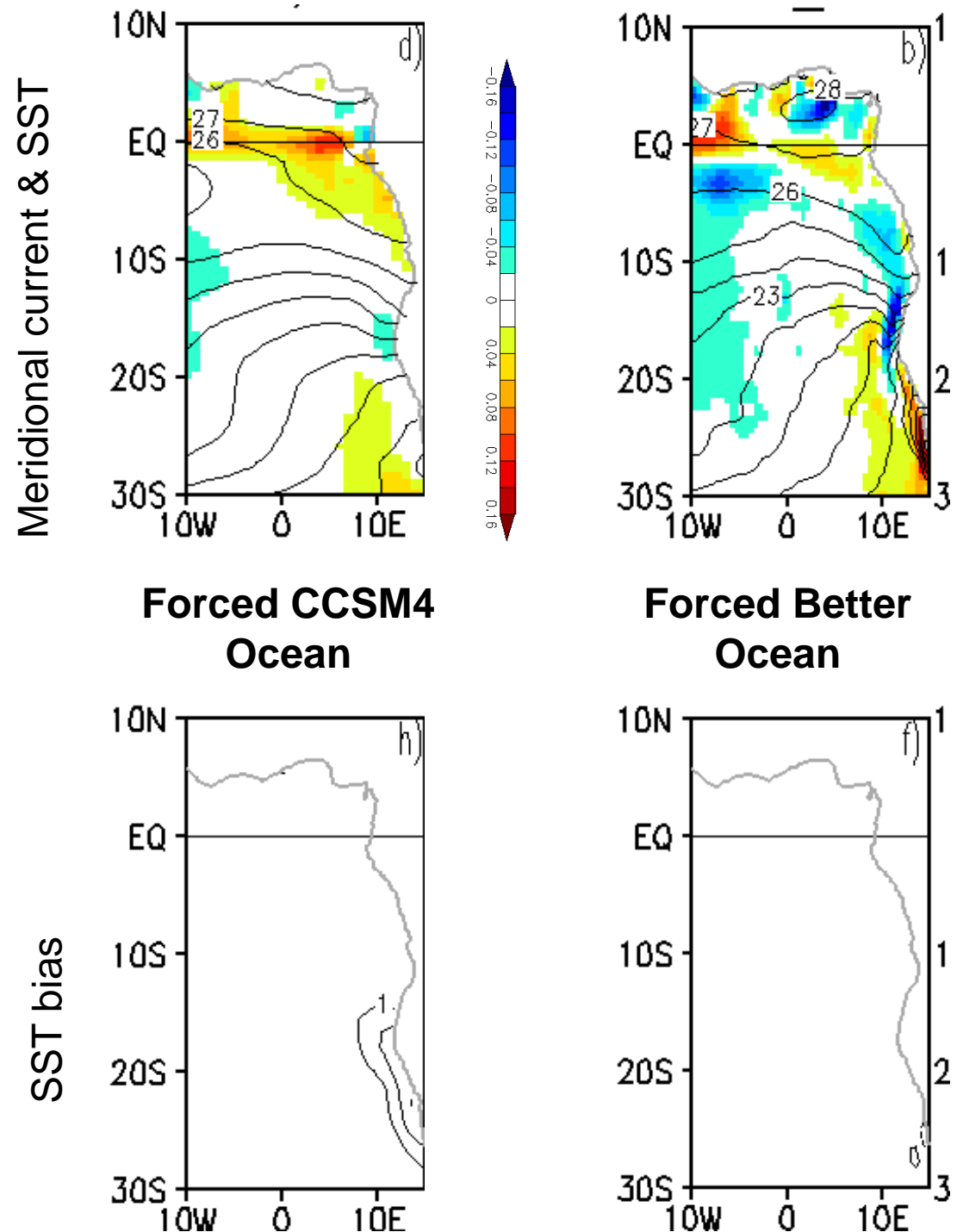


Black: TAU; Colors: SST'

Missing heat advection by the Benguela current



Is part of the problem the inability to resolve the Benguela Current?



Conclusions

SLP Bias:

Strong anticyclones lead to excessive latent heat loss.

Poor ocean resolution:

Large and Danabasoglu (2006): *“Ocean biases ... most likely reflect problems with the ocean model component.”*

Heat advection depends on the square of the amplitude of the coastal current.

$$\overline{V\eta} = V_o^2 \frac{c}{g}$$

Weak Benguela Current leads to insufficient cooling and hot coastal SSTs.

Sensitivity of Tropical Climate to Low-Level Clouds in the NCEP Climate Forecast System (CFS1) – Hu, Huang et al.

Main Conclusions:

1: Change of low cloud cover alone has a minor influence on the amount of net shortwave radiation reaching the surface and on the warm biases in the southeastern Atlantic.

2: Change of cloud liquid water path (CLWP) can significantly improve the mean climate and the seasonal cycle in the tropics.

3: Prescribing CLWP in the CFS1 is then an effective interim technique to reduce model biases and to improve the simulation of seasonal cycle in the tropics.