A Contrarian View on the Cause of CGCM Warm SST Biases in the Equatorial and Southeastern Atlantic

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Fig. 1

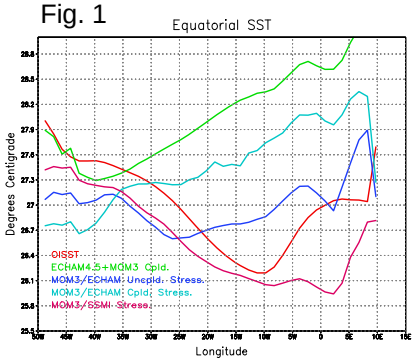


Fig. 2

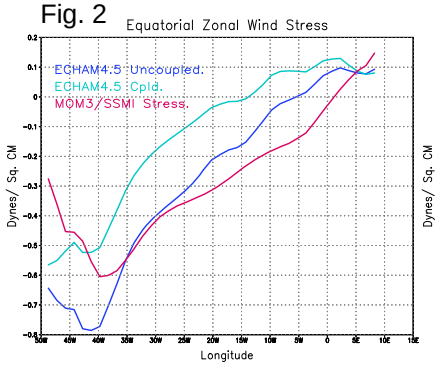
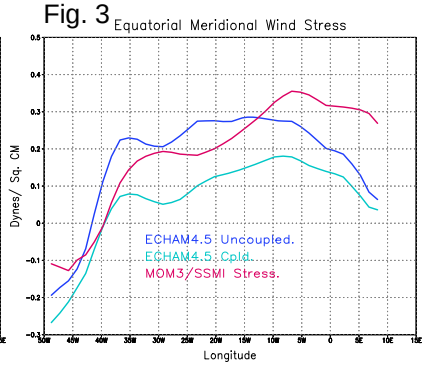


Fig. 3



Hypothesis: Wind stress errors are just as important as stratus cloud errors in equatorial and southeastern Atlantic CGCM SST biases.

Experimental Design: Use forced OGCM experiments to test sensitivity to surface stress from CGCM, uncoupled AGCM, and observations (SSMI). Weak restoring to annual mean SST (50 days^{-1}). Use surface heat flux from AGCM AMIP-type runs for all cases, i.e. keep heat flux same but vary stress.

Results:

Fig. 1. Both CGCM and AGCM stress produce incorrect equatorial SST gradient. Observed stress produces correct gradient.

Fig. 4

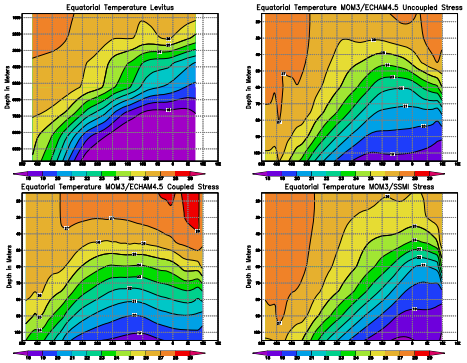


Fig. 5

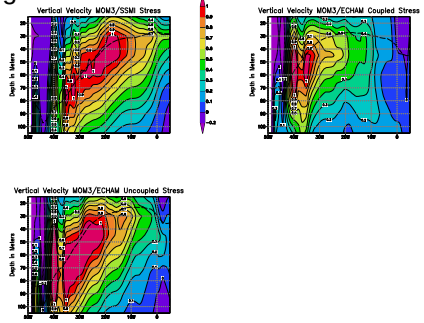
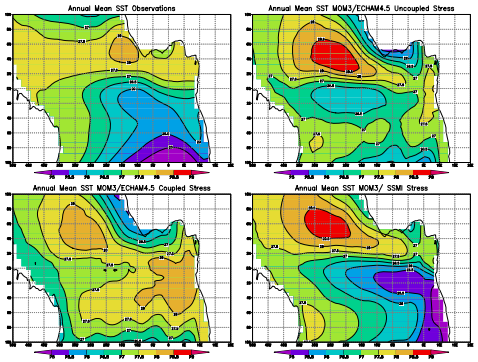


Fig. 6



Figs. 2 and 3. Systematically too weak stress for CGCM and AGCM.

Fig. 4. OGCM forced by CGCM and AGCM has too flat equatorial thermocline.

Fig. 5. Vertical velocity forced by CGCM and AGCM stress is too weak in upper ocean in eastern Pacific.

Fig. 6. No cold tongue for case of CGCM and AGCM stress. Observed stress produces cold tongue extending from SE South America coast.

Fig. 7

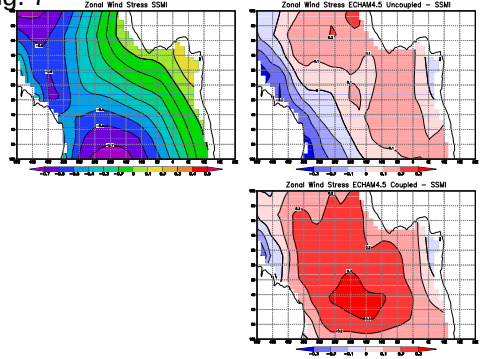


Fig. 8

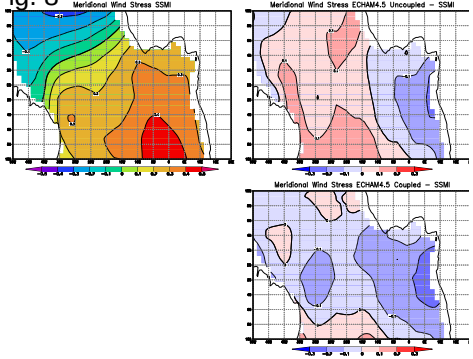
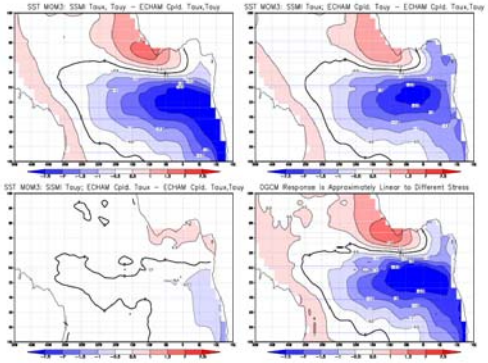


Fig. 9



Figs. 7 and 8. Wind stress errors in CGCM are largely an amplification of those in AGCM.

Fig. 9. Meridional wind stress errors are dominant cause of cold-tongue error.

Conclusions:

1. Wind stress errors seem as reasonable a candiate as solar radiation (marine stratus) errors in causing tropical Atlantic SST biases.
2. Wind stress errors in CGCM are amplification of those in AGCM so coupling is a secondary issue.