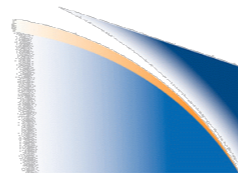


Gravity Waves in CAM 3.5

Jadwiga H. Richter
Fabrizio Sassi
Chris A. Fischer
Rolando R. Garcia



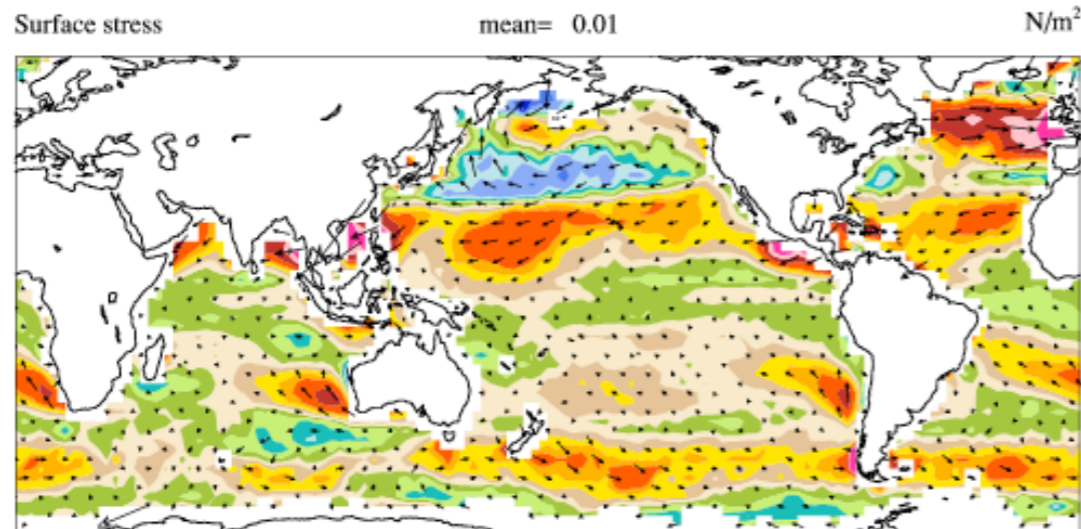
NCAR

Motivation:

- New GW parameterization in WACCM 3.5
- Noted significant improvements to the tropospheric climate:

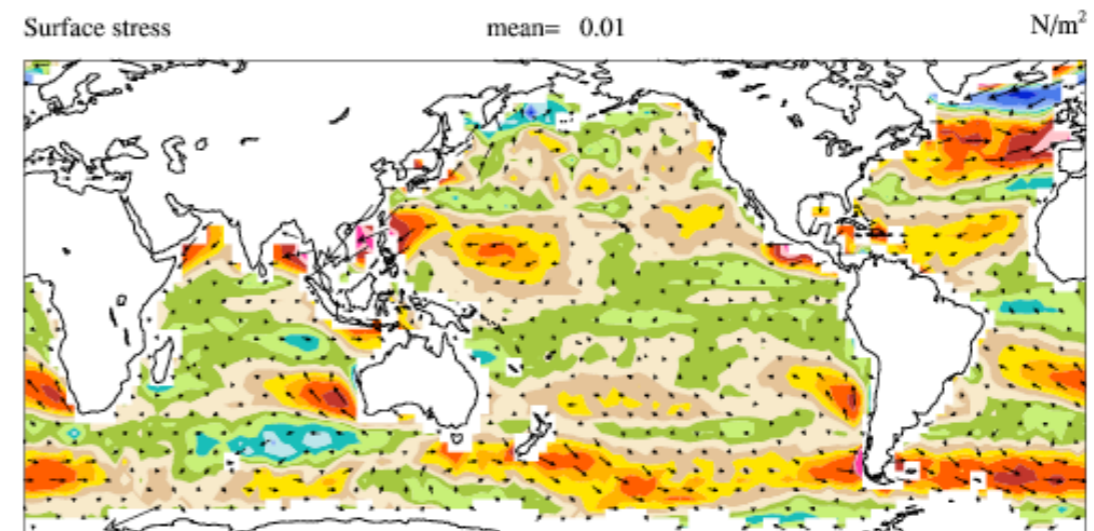
CAM - OBS

cam3_5_07_sst - ERS

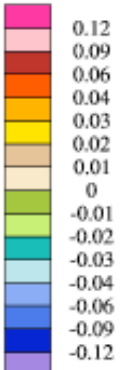


WACCM - OBS

trsnob16_sst - ERS



MIN = -0.13 MAX = 0.28

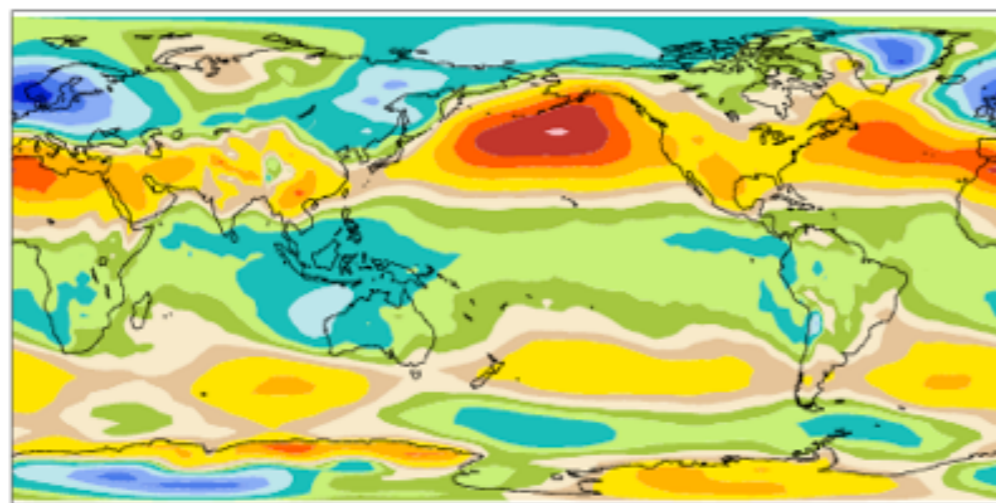


Created: Fri May 16 09:52:54 MDT 2008

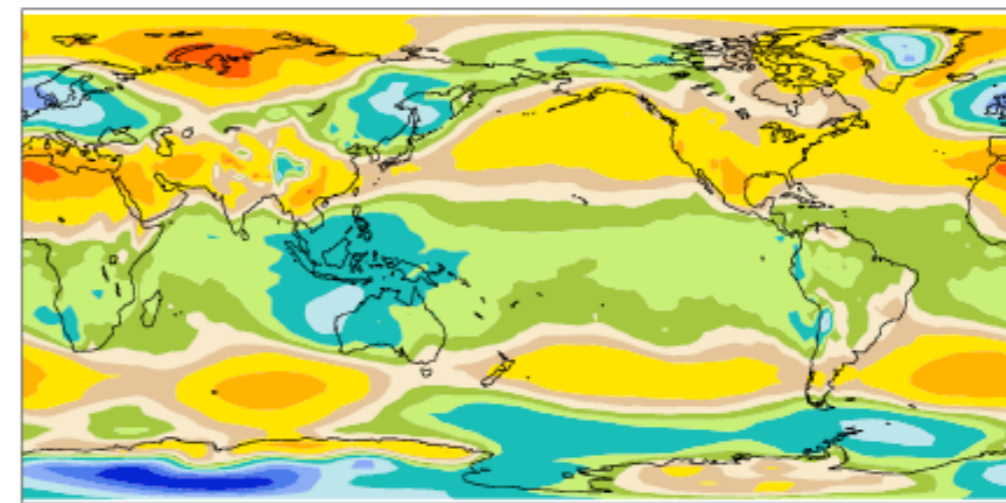
DIAG Version: 04081

cam3_5_07_sst - NCEP

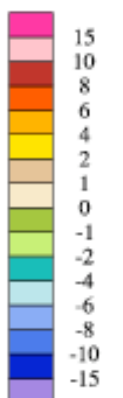
mean = 0.27 rmse = 2.88 millibars



mean = 0.26 rmse = 2.36 millibars



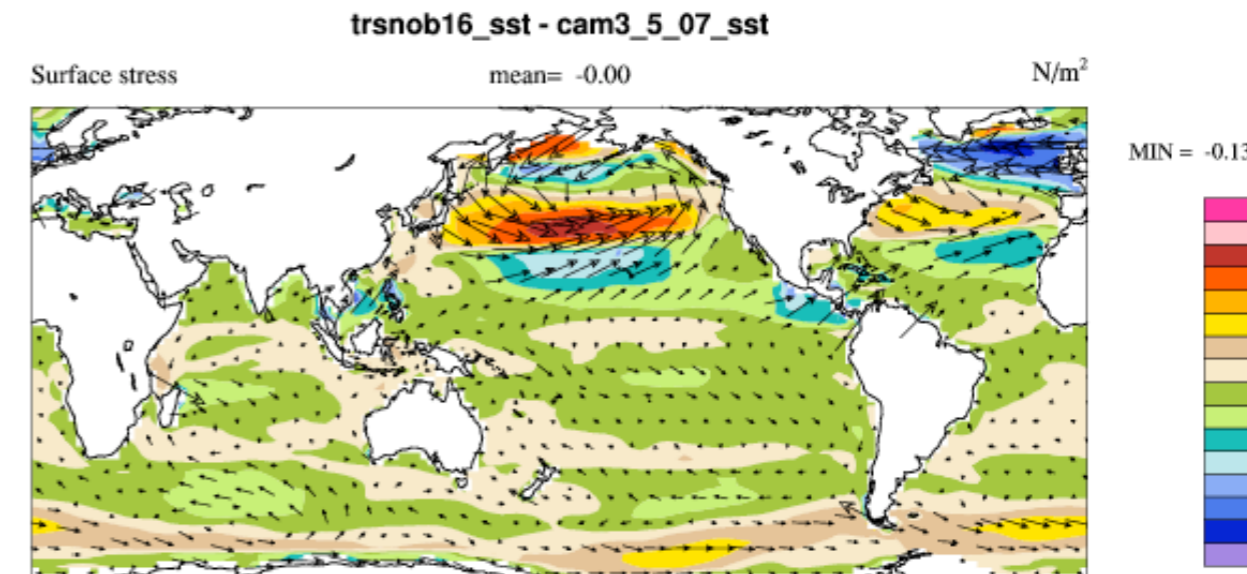
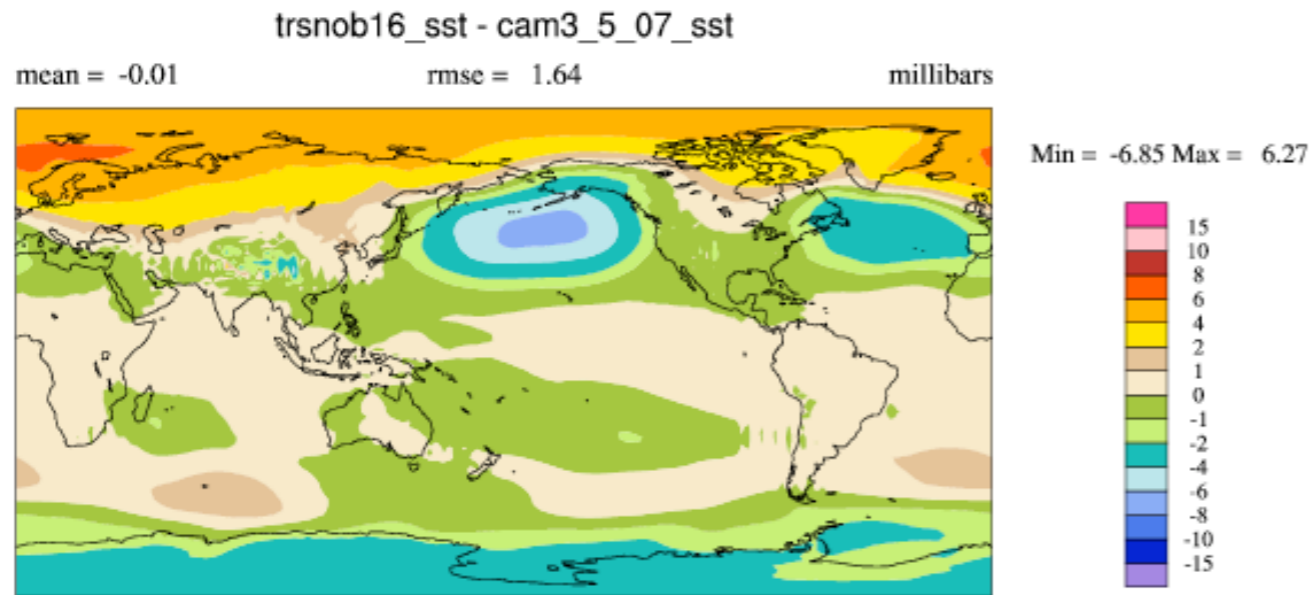
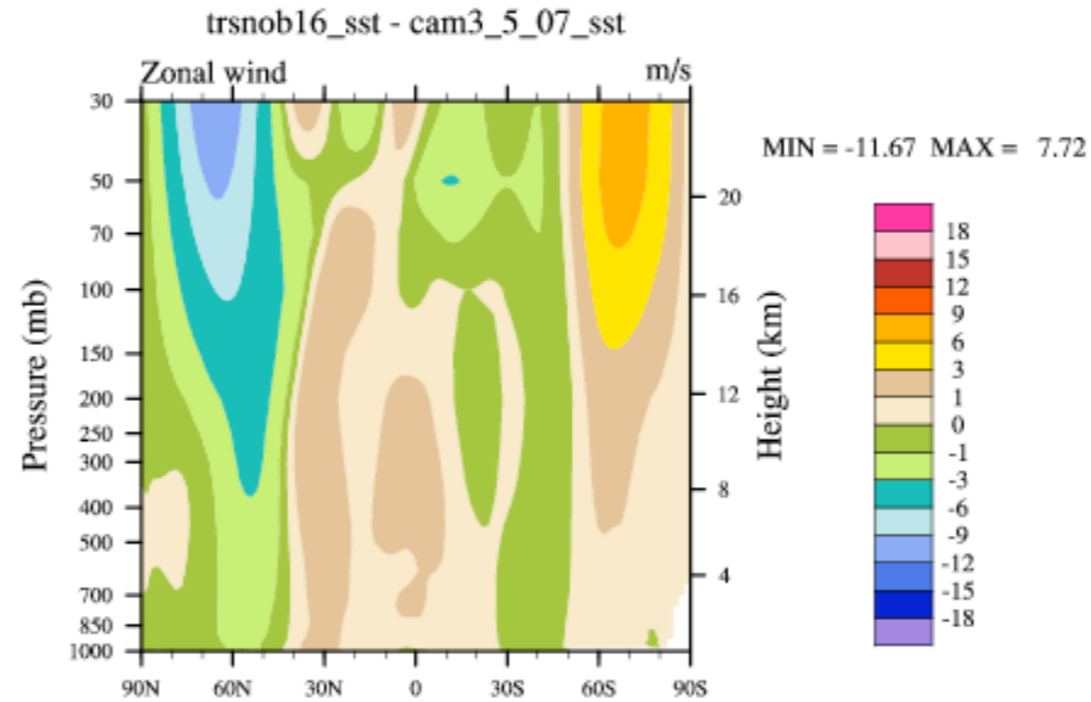
Min = -12.81 Max = 7.11



Surface Stress

PSL

WACCM - CAM



Created: Wed May 14 14:32:05 MDT 2008

DIAG Ver

Cause?

	CAM	WACCM
Model Top	~ 30 km	~ 150 km
Orographic GW:	Orographic GW: McFarlane (1981)	Orographic GW: McFarlane (1981)
Convective:	None	Convective: Beres et al (2004)
Frontal:	None	Richter, Sassi, Garcia based on Charron and Manzini (2002)

Cause?

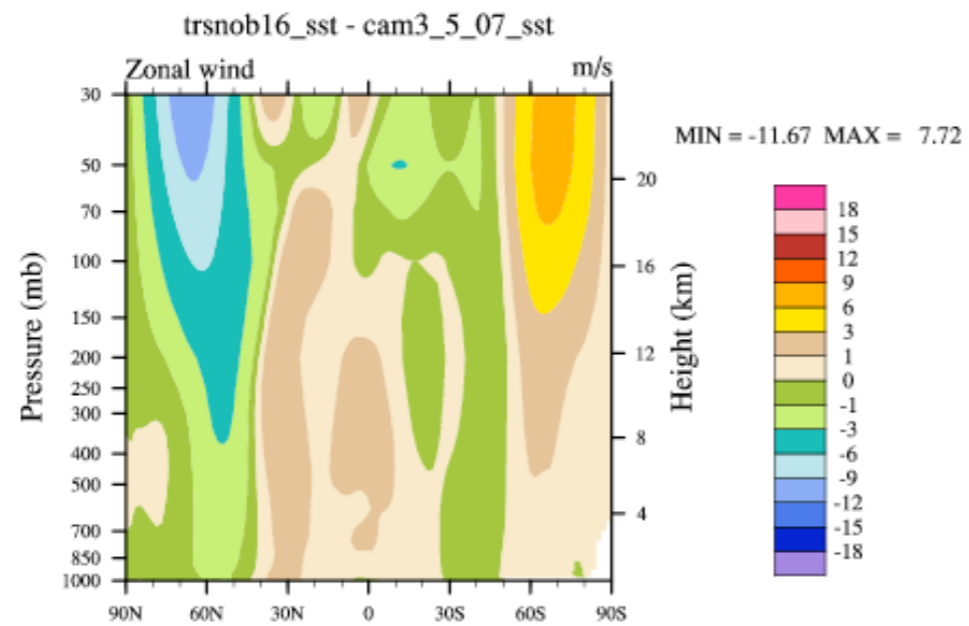
	CAM	WACCM
Model Top	~ 30 km	~ 150 km
Orographic GW:	Orographic GW: McFarlane (1981) $f_{crit2^*} = 0.5$	Orographic GW: McFarlane (1981) $f_{crit2^*} = 1.0$
Convective:	None	Convective: Beres et al (2004)
Frontal:	None	Richter, Sassi, Garcia based on Charron and Manzini (2002)

Simulations:

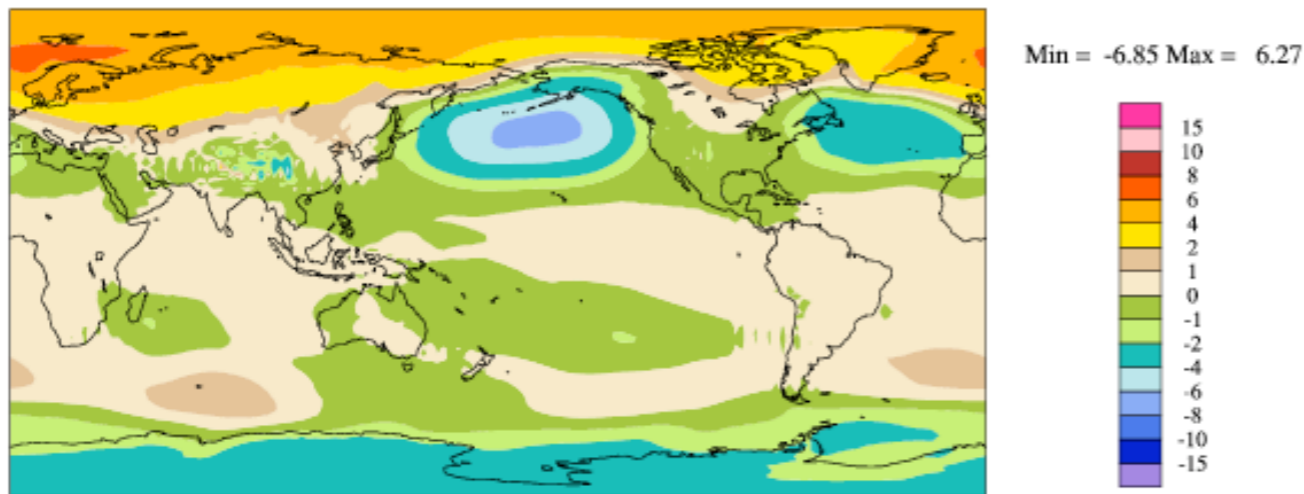
- 20 years, observed SSTs, 1980 - 2000

WACCM	WACCM based on cam357 + new GW param
CAM	cam357
CAM GW	cam357 + WACCM's GW param
CAM ORO	cam357 with fcrit2 = 1.0
CAM SPEC	cam357 with Beres et al (2004) and Frontal GW scheme

WACCM - CAM

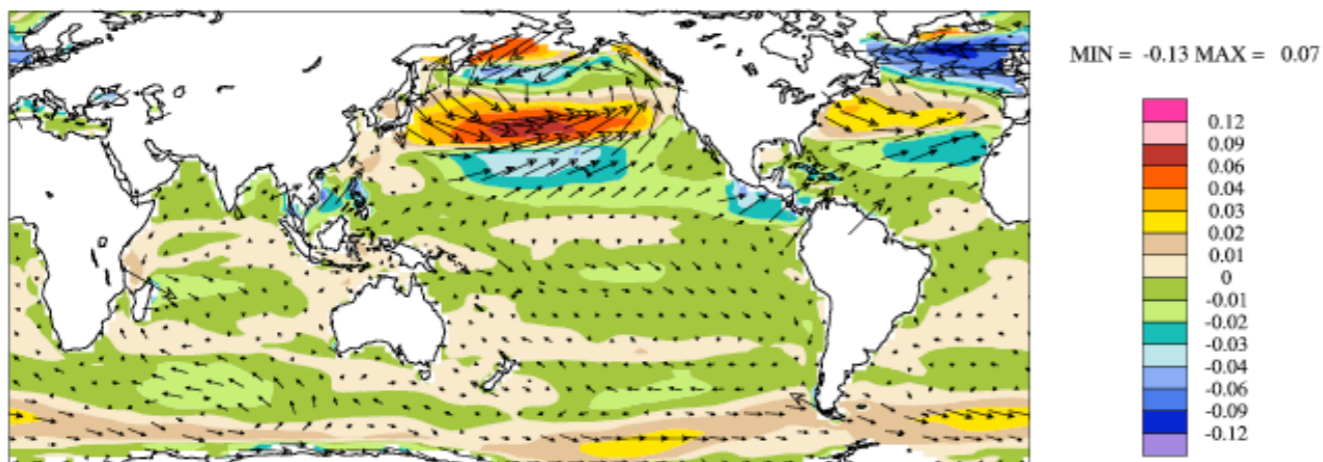


trsnob16_sst - cam3_5_07_sst
 mean = -0.01 rmse = 1.64 millibars

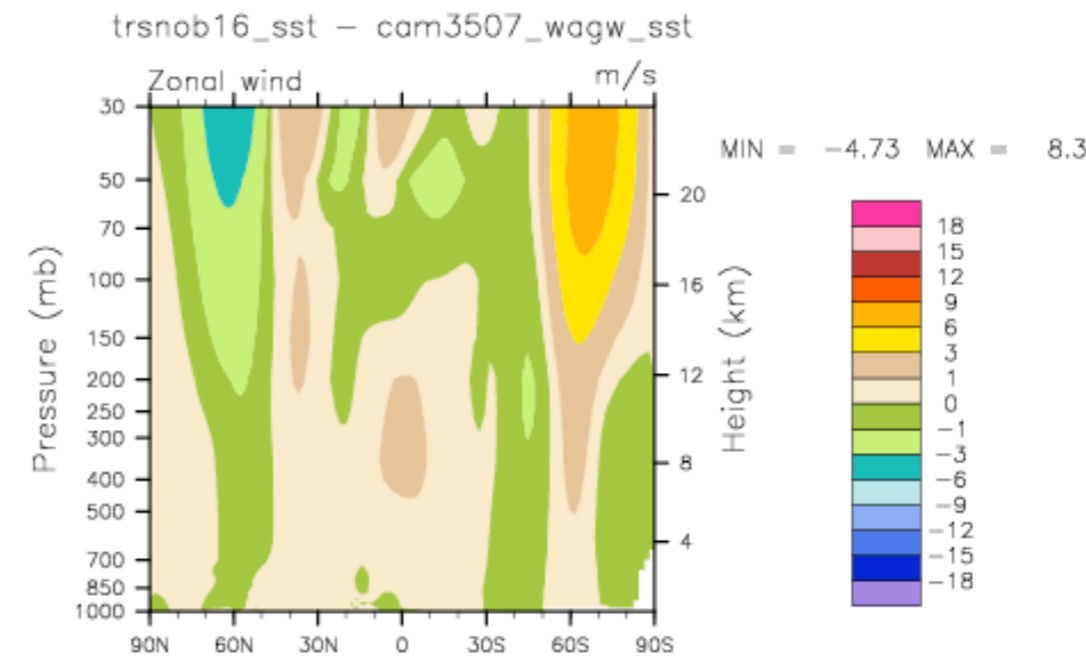


trsnob16_sst - cam3_5_07_sst

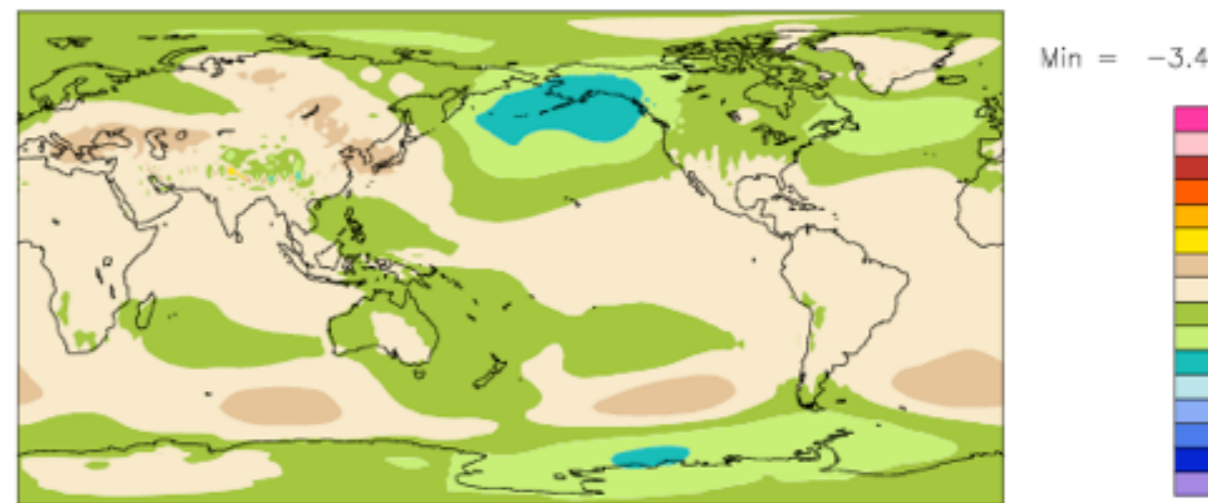
Surface stress mean = -0.00 N/m²



WACCM - CAM GW

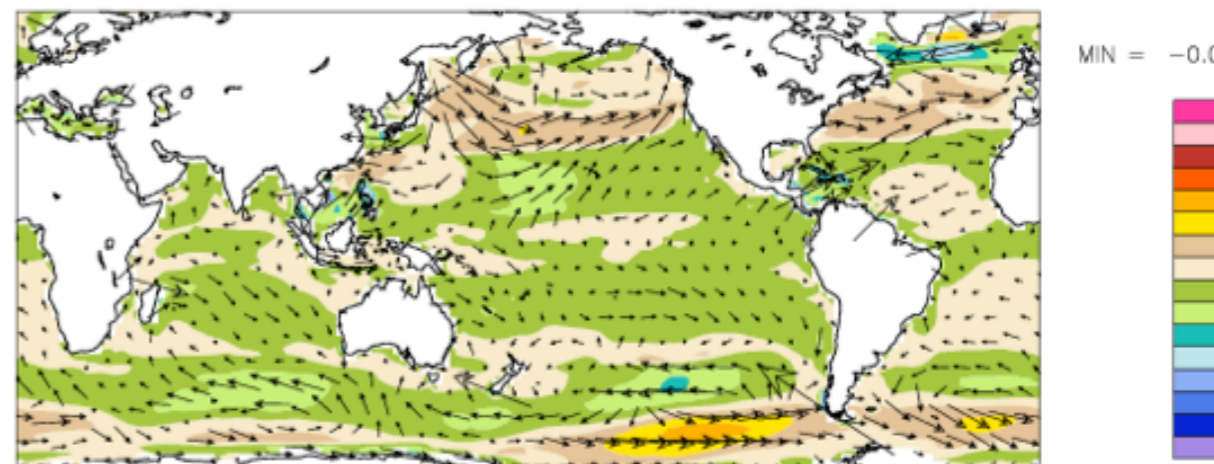


trsnob16_sst - cam3507_wagw_sst
 mean = -0.01 rmse = 0.69 millibars



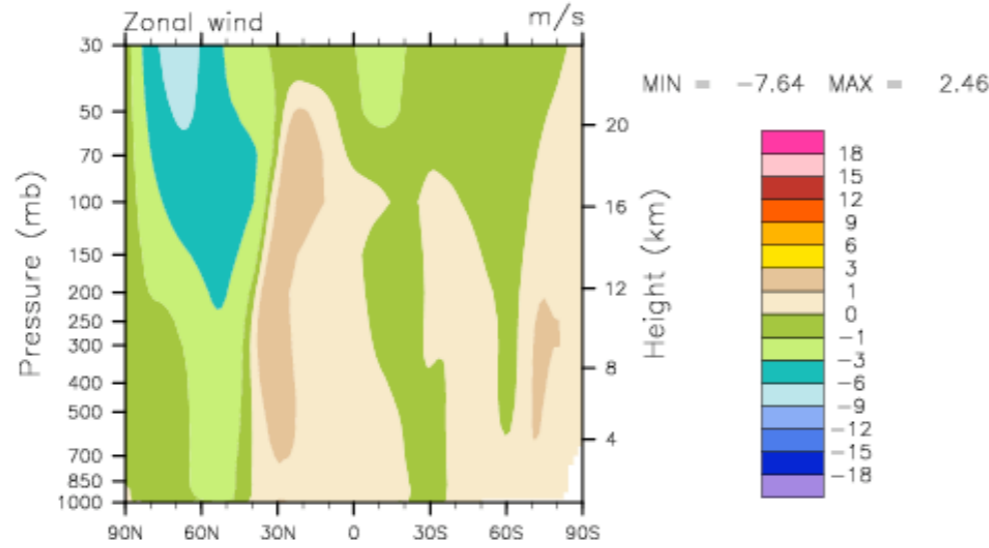
trsnob16_sst - cam3507_wagw_sst

Surface stress mean = -0.00 N/m²



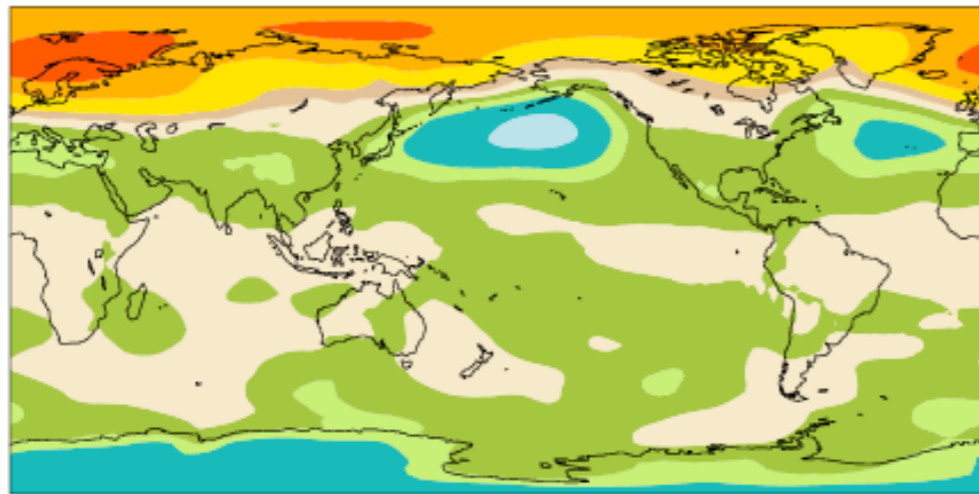
CAM GW - CAM

cam3507_wagw_sst - cam3_5_07_sst



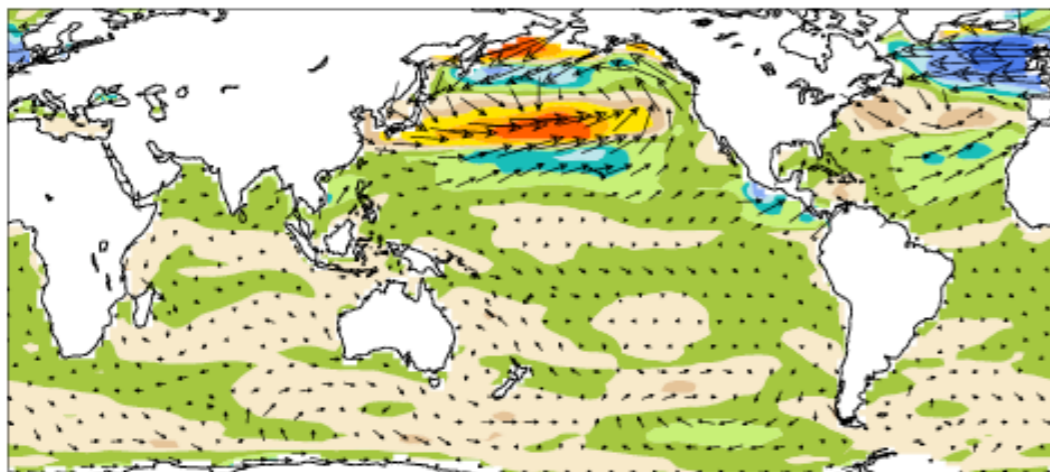
cam3507_wagw_sst - cam3_5_07_sst

mean = -0.00 rmse = 1.43 millibars



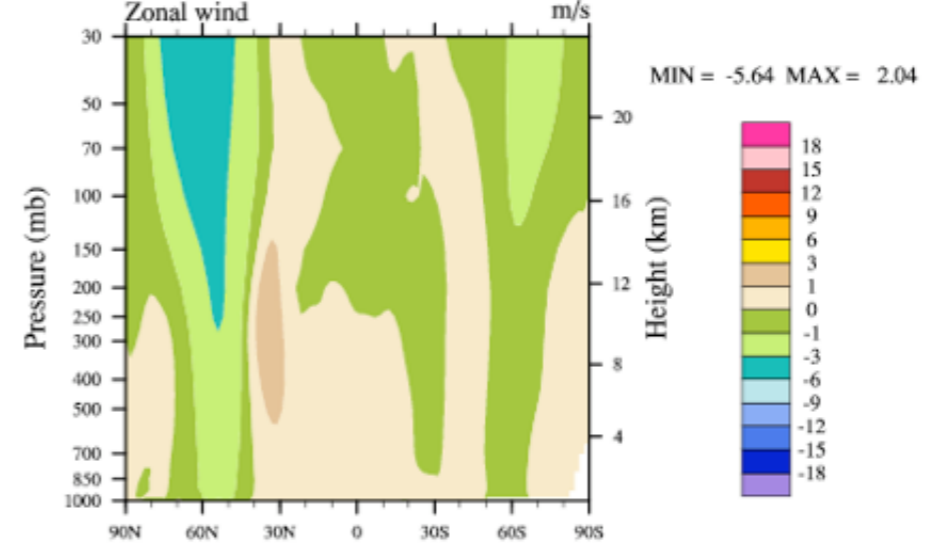
cam3507_wagw_sst - cam3_5_07_sst

Surface stress mean = -0.00 N/m²



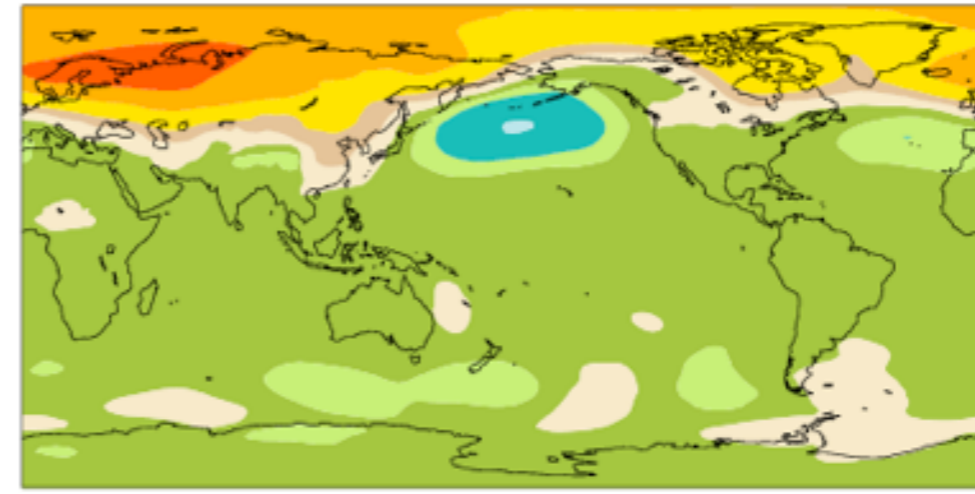
CAM ORO - CAM

cam3_5_07_sst_fcrit2 - cam3_5_07_sst



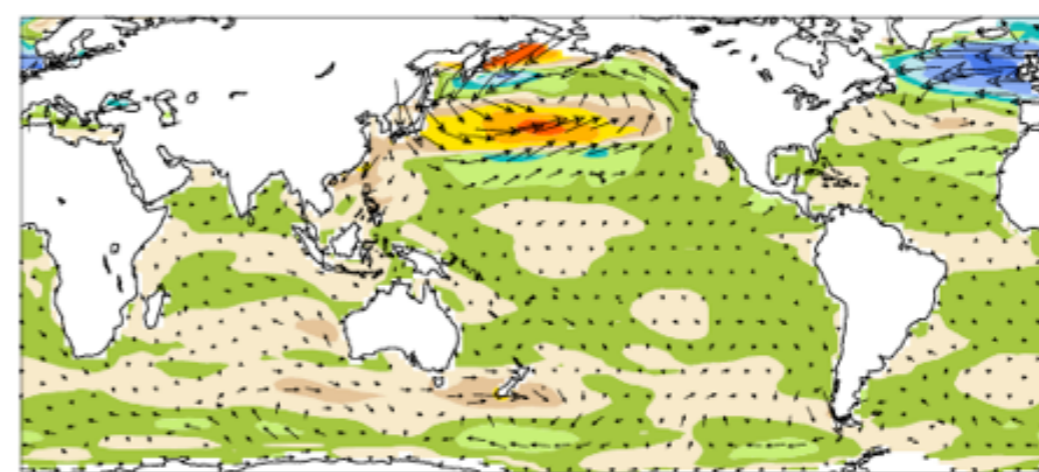
cam3_5_07_sst_fcrit2 - cam3_5_07_sst

mean = 0.01 rmse = 1.42 millibars



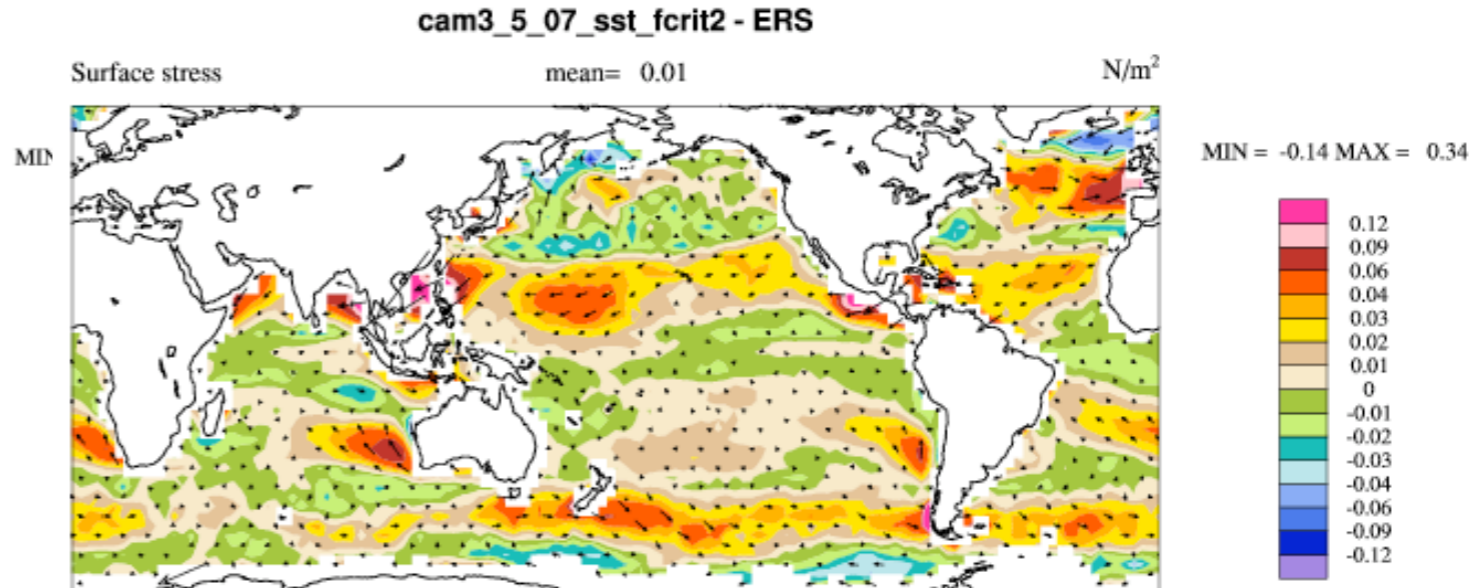
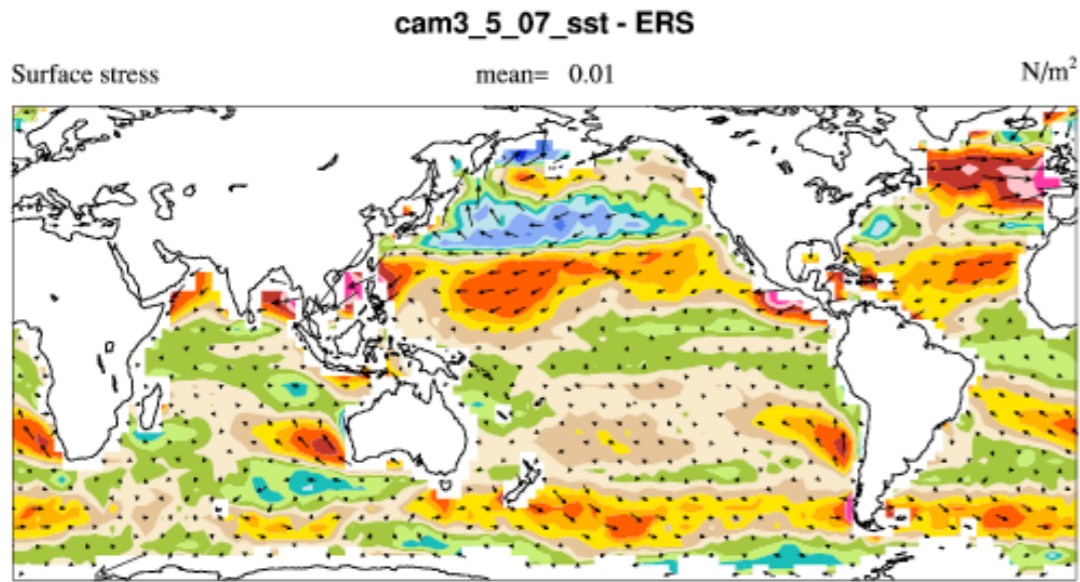
cam3_5_07_sst_fcrit2 - cam3_5_07_sst

Surface stress mean = -0.00 N/m²



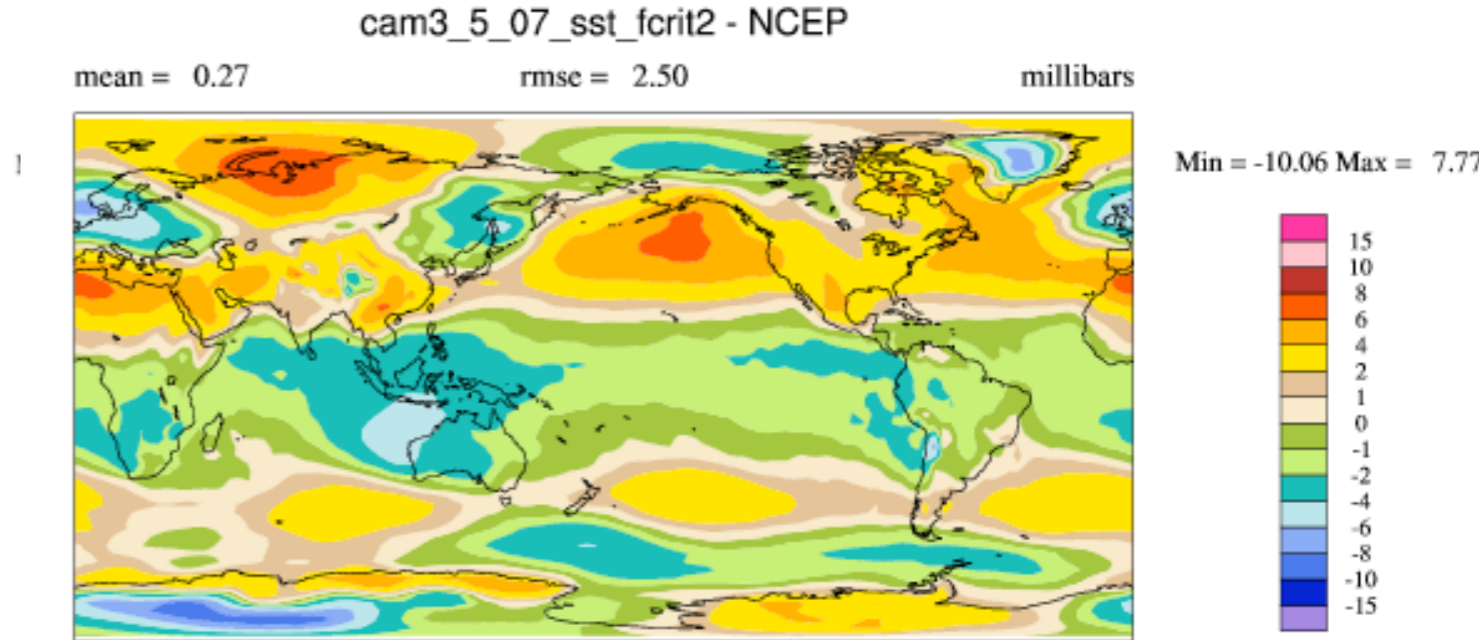
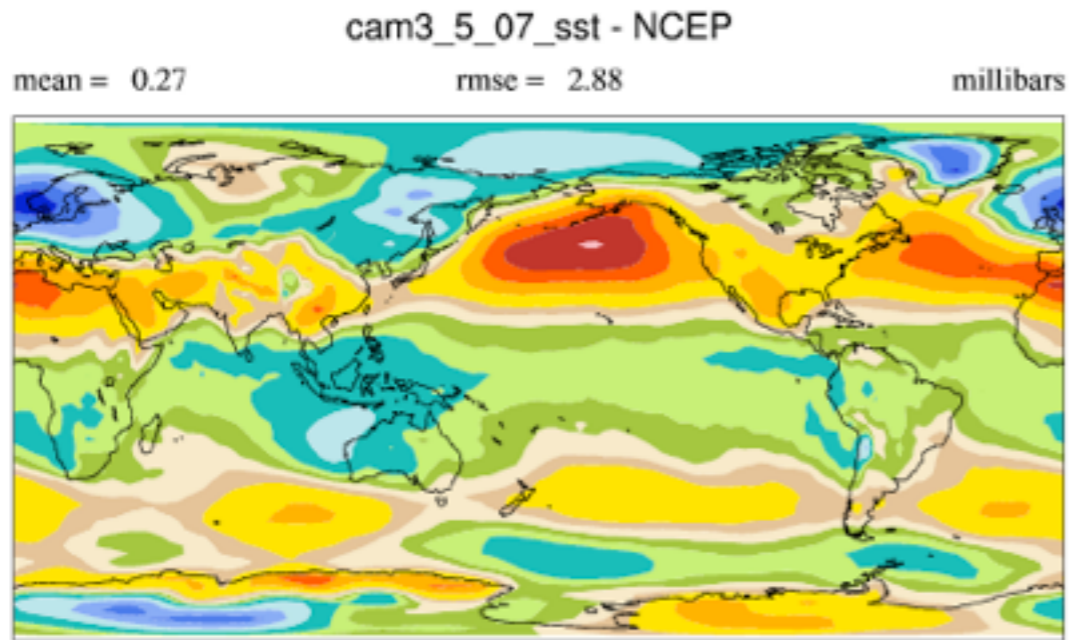
CAM - OBS

CAM ORO - OBS



Created: Thu Jun 12 14:37:38 MDT 2008

DIAG Version: 04081



Conclusions:

- Tropospheric/lower stratospheric winds, SLP in the Northern Pacific, surface stresses in the N. Pacific and in the SH can be improved by:
 - Changes in the orographic GW parameterization
 - Inclusion of non-orographic wave sources
 - Higher Model Lid

Concluding Remarks

- Change in `frcit2` to 1.0 should be considered for CAM 4:
No reason not to!
- Once the WACCM team has finalized the GW routine, this should be tested in CAM again and considered for inclusion in CAM4: **Single gw_drag.F90**
- Consistency between GWs in CAM and WACCM would enable conclusive examination the influence of the middle atmosphere on the troposphere

CAM SPEC - CAM

