Eastern Tropical Oceans Synthesis Working Group
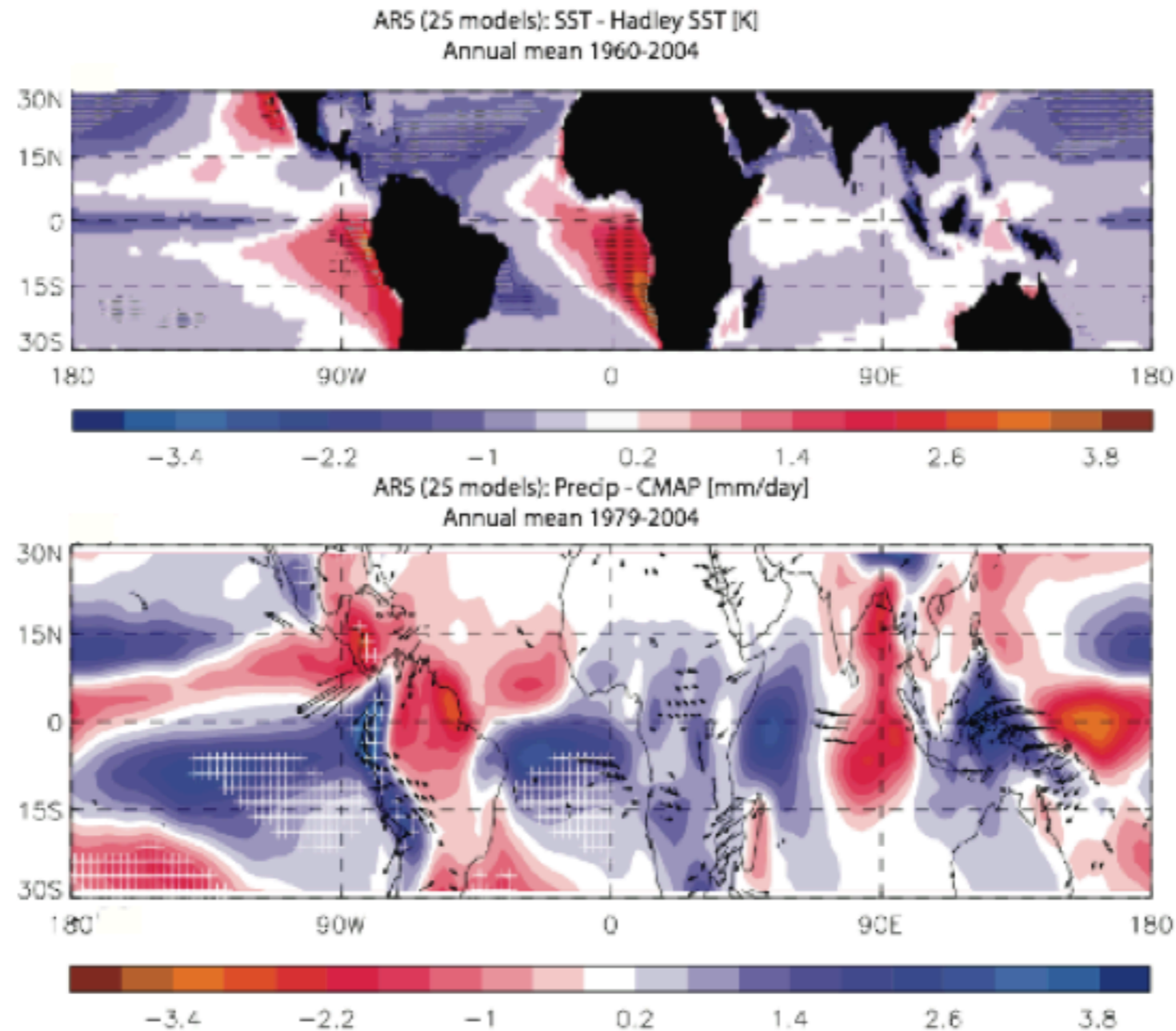
Co-chairs: Paquita Zuidema, Simon deSzoeke, Rob Wood, Roberto Mechoso

Motivation

ARS (25 models): SST - Hadley SST [K]
Annual mean 1960-2004

ARS (25 models): Precip - CMAP [mm/day]
Annual mean 1979-2004

T. Toniazzo

Top: mean SST error in the historical integrations of 25 coupled GCMs in the CMIP5 ensemble. Bottom: mean precipitation (colors) errors in same 25 models relative to CMAP data and mean wind (arrows) errors in in 22 models relative to ERA-Interim reanalysis 10-m winds. arrows plotted only where all individual model wind errors fall within 90 degrees from the mean. White hatching denotes areas where the sign of the error agrees in all models; black dots where all but one (CSIRO-Mk3.6.0) agree. Similar to that shown in Toniazzo and Woolnough (2013).

WG Objectives

- Promote collaboration between observationalists and modelers, and atmospheric scientists and oceanographers, active in the southeast oceanic basins.

- Coordinate a model assessment of surface flux errors for the equatorial Atlantic, mining all available observations.

- Identify recent model improvements and common and persistent model errors both, CMIP5 and higher-resolution coupled models.

- Provide recommendations of cases for community simulation and evaluation using eddy-permitting ocean models, sharing specified model conditions and output datasets.

Promote collaboration between observationalists and modelers, and atmospheric scientists and oceanographers, active in the southeast oceanic basins.

ETOS WG encompass all these and includes wide international participation

active members: Peter Brandt, Ping Chang, Simon de Szoeke*, Takeshi Doi, Tom Farrar, Carmen Grados, Noel Keenlyside, Ben Kirtman, Alban Lazar, Roberto Mechoso*, Brian Medeiros, Ingo Richter, Mathieu Rouault, Ed Schneider, Thomas Toniazzo, Rob Wood*, Paquita Zuidema*

*co-chairs

activities:

telecons, *dedicated websites:*
Google site (members contribute content)
US CLIVAR web site (public, moderated)
http://www.usclivar.org/working-groups/etos

AGU fall meeting 2012 session + in person WG meeting
(national and international representation)

in person meeting May 2014 (smaller, national scientists only)
this meeting finalized a figure set for white paper/
manuscript

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# SEP and SEA CMIP5 flux biases differ:

SEP biases dominated by shortwave (too little cloud) whereas
in the SEA, the bias structure is dominated more by the turbulent fluxes.
Net biases are also more pronounced in SEA than in SEP
=> oceanic contribution to the net cooling is more
pronounced in the SEA than SEP.

Z. Xu/P. Chang
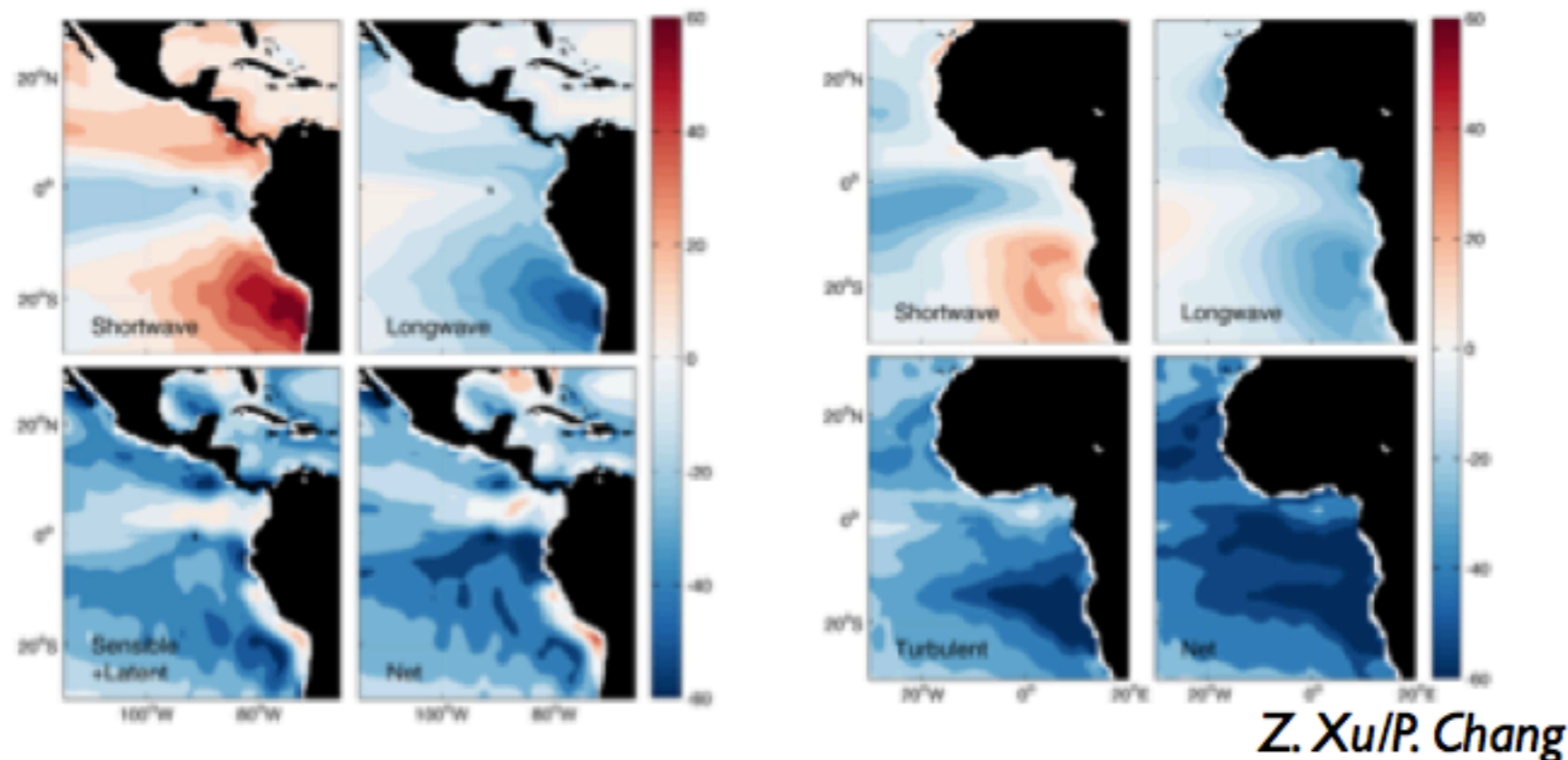
CMIP5 biases relative to OAFLUX, 1984-2004

assessing errors in gridded flux datasets at two 'full-flux' buoy sites:
85W, 20S (WHOI Stratus buoy)
10W, 10S (PIRATA buoy, in trade-wind cumulus regime)
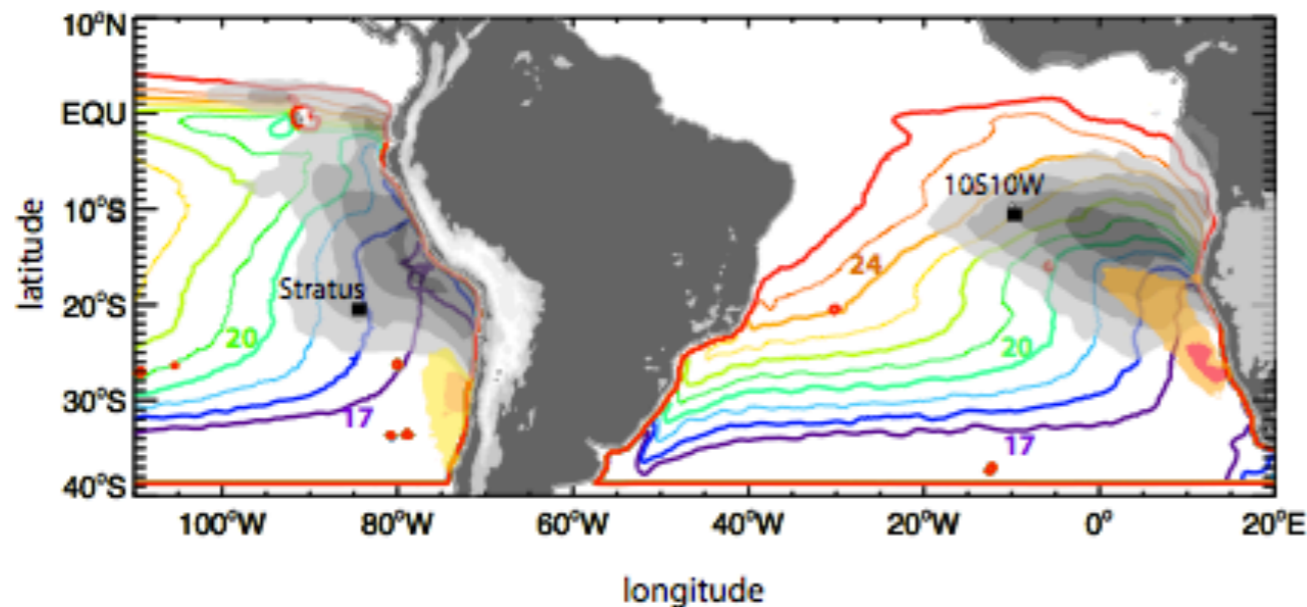
color contours - SST; filled grey contours - MODIS cloud fraction 0.6-0.9;
filled color contours - coastal surface wind jets 7-9 m/s

85W, 20S

10W, 10S
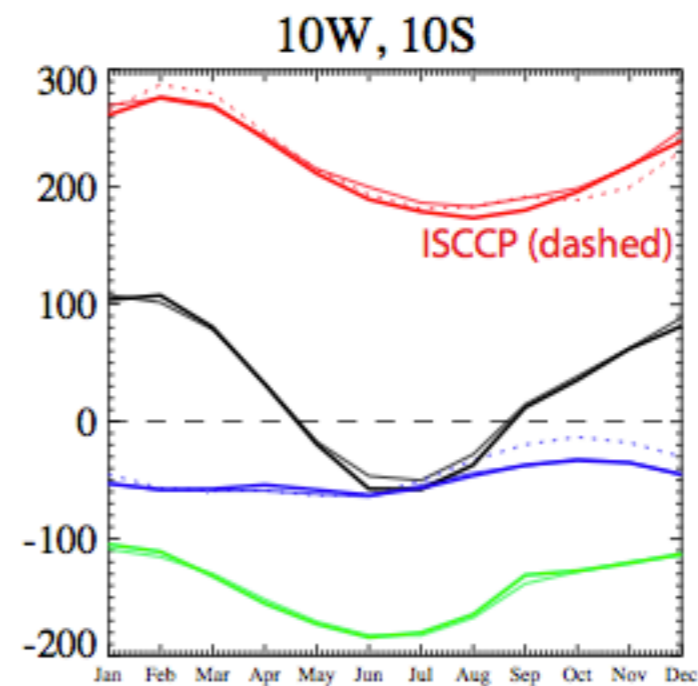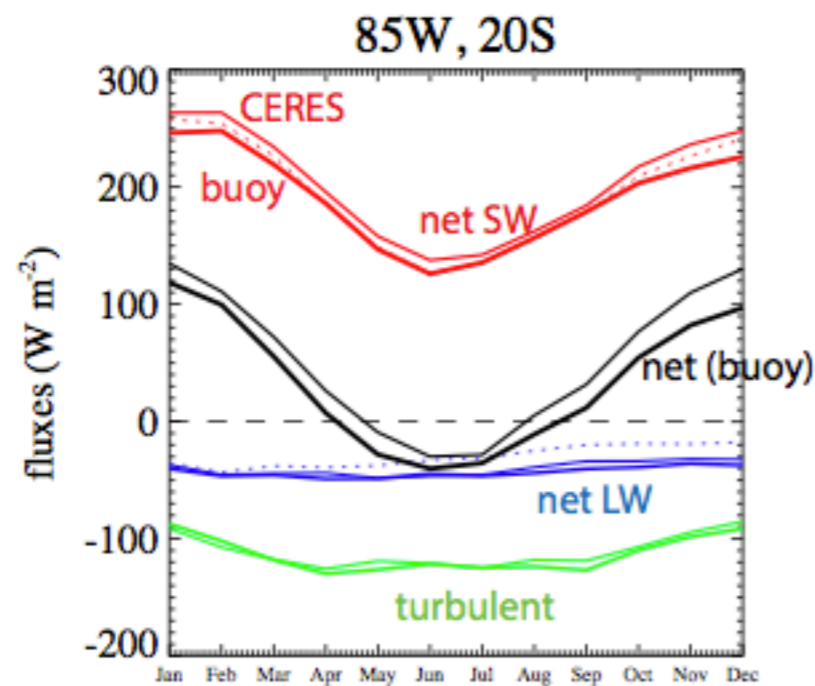
thick lines - buoy data   thin red+blue - CERES   dashed&thin green - OAFLUX (ISCCP)

preliminary assessment suggests CERES overestimates net solar flux into the ocean in cloudy conditions. matches net long wave better than ISCCP. buoy+OAFLUX turbulent fluxes match well, make use of same bulk flux coefficients

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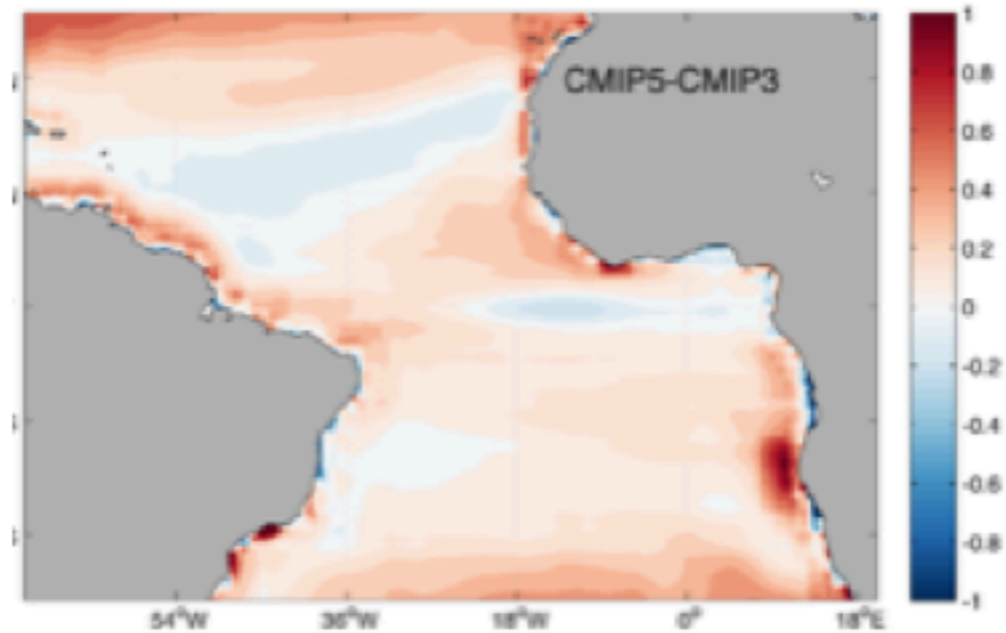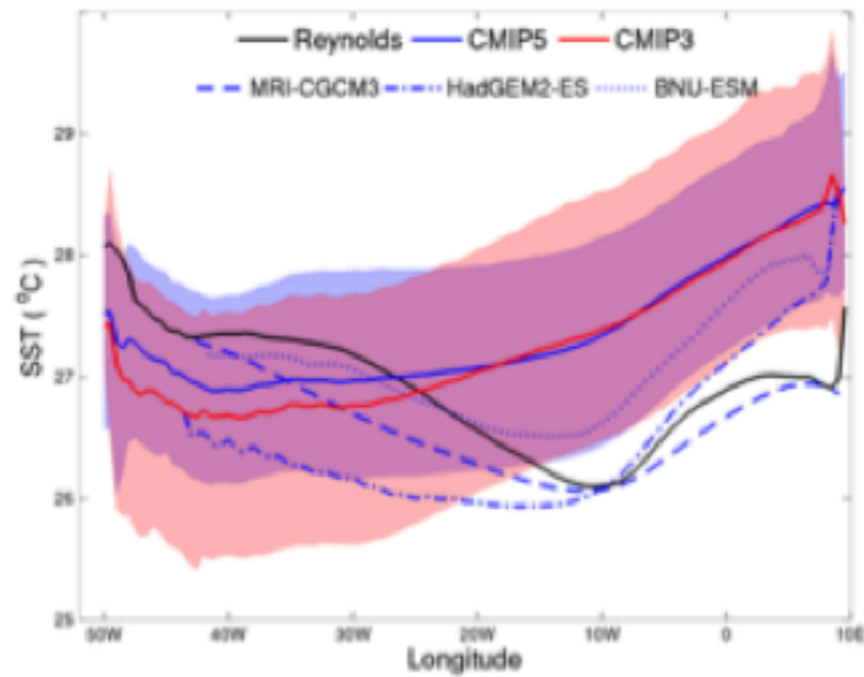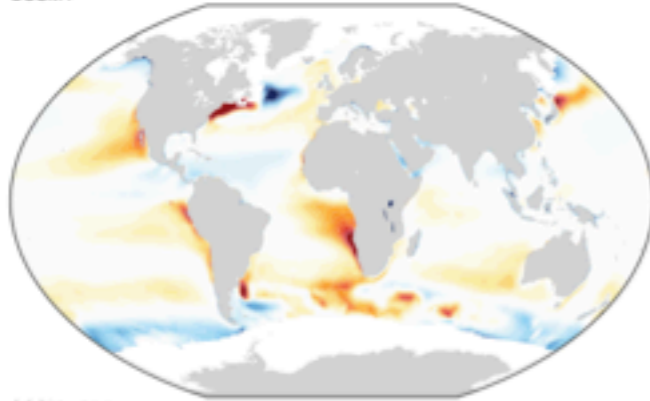
Z. Xu/Ping Chang

Atlantic equatorial zonal SST gradient still reversed in most CMIP5models as compared to observations

Only incremental improvement in CMIP5 models from CMIP3

some reduction in SST biases as model parameterizations (NCAR) improve; higher resolution may reduce SEA SST bias for the wrong reason (too strong wind stress+numerical diffusion)
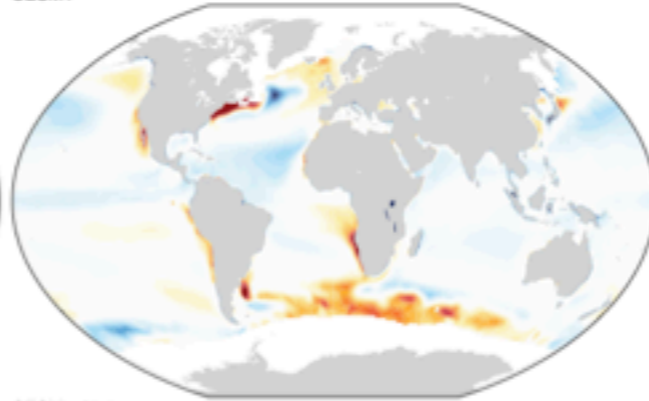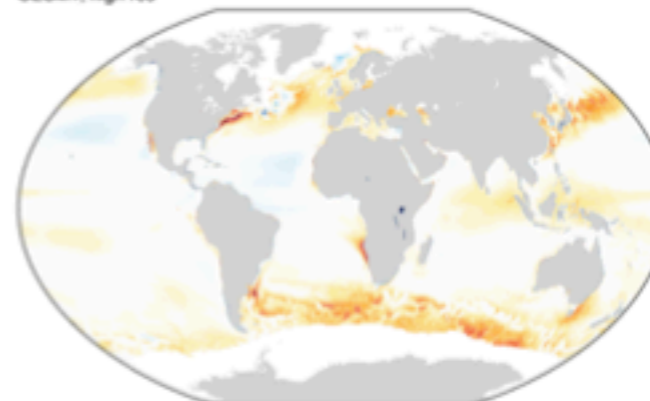
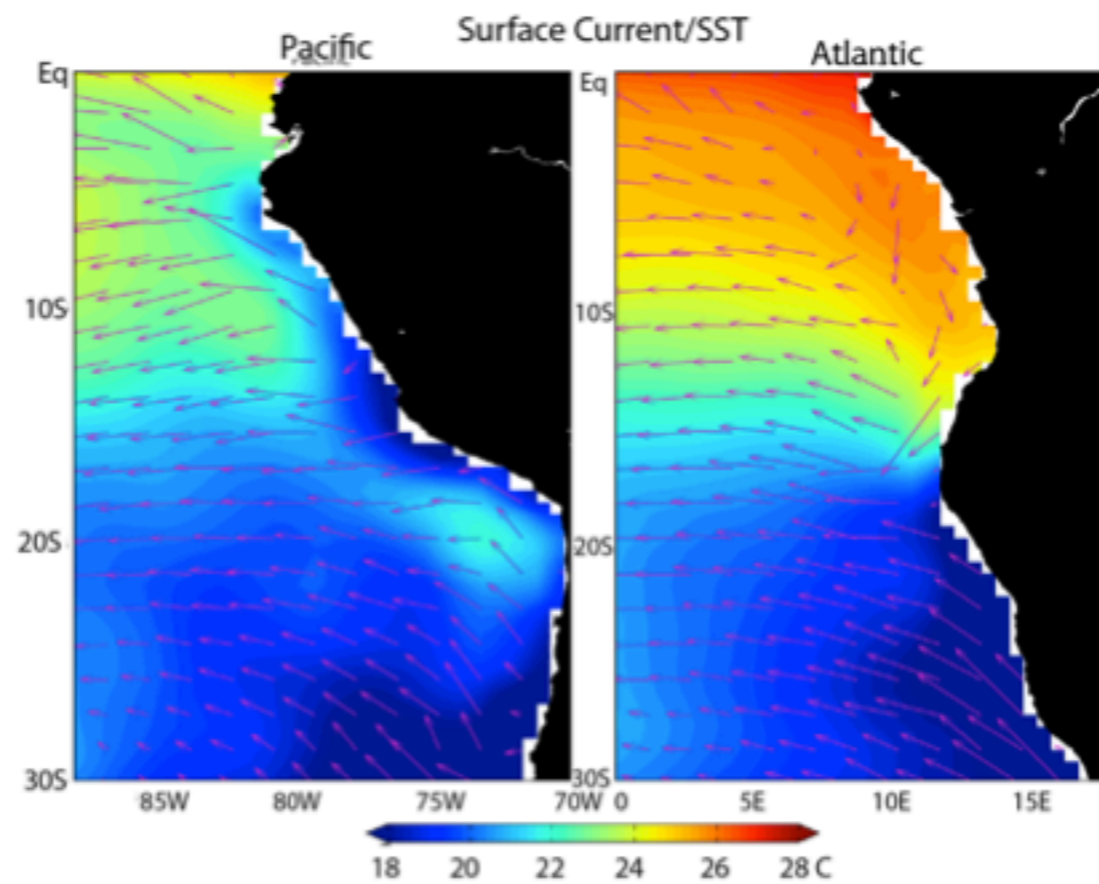CCSM4   CESM1   CESM1, high-res

SST biases in CCSM4, CESM1, CESM1-high resolution

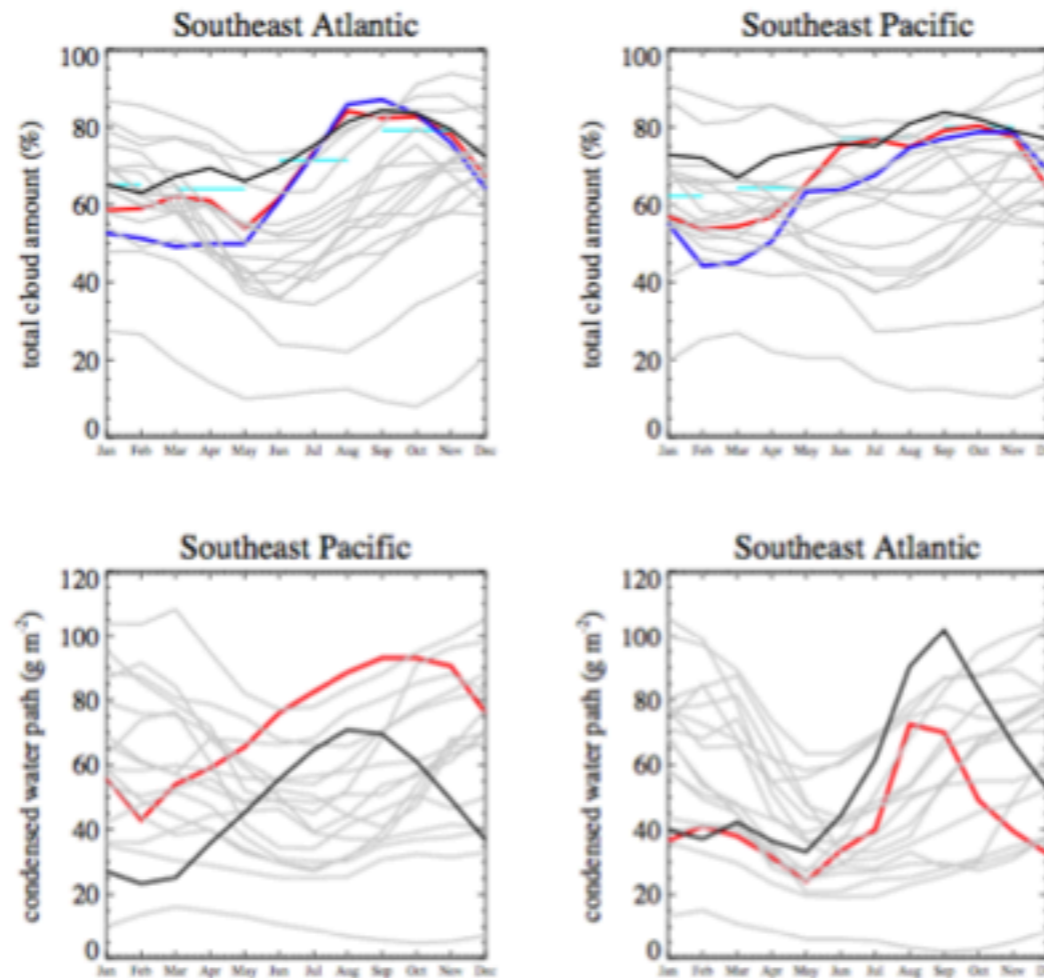-5 -4.5 -4 -3.5 -3 -2.5 -2 -1.5 -1 -0.5 0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5

B. Medeiros

WG recommendation to focus on improving SEA oceanography (location of the Angola-Benguela front) as well as clouds

Surface Current/SST

stratocumulus clouds in many CMIP5 models do not even have the correct seasonal cycle
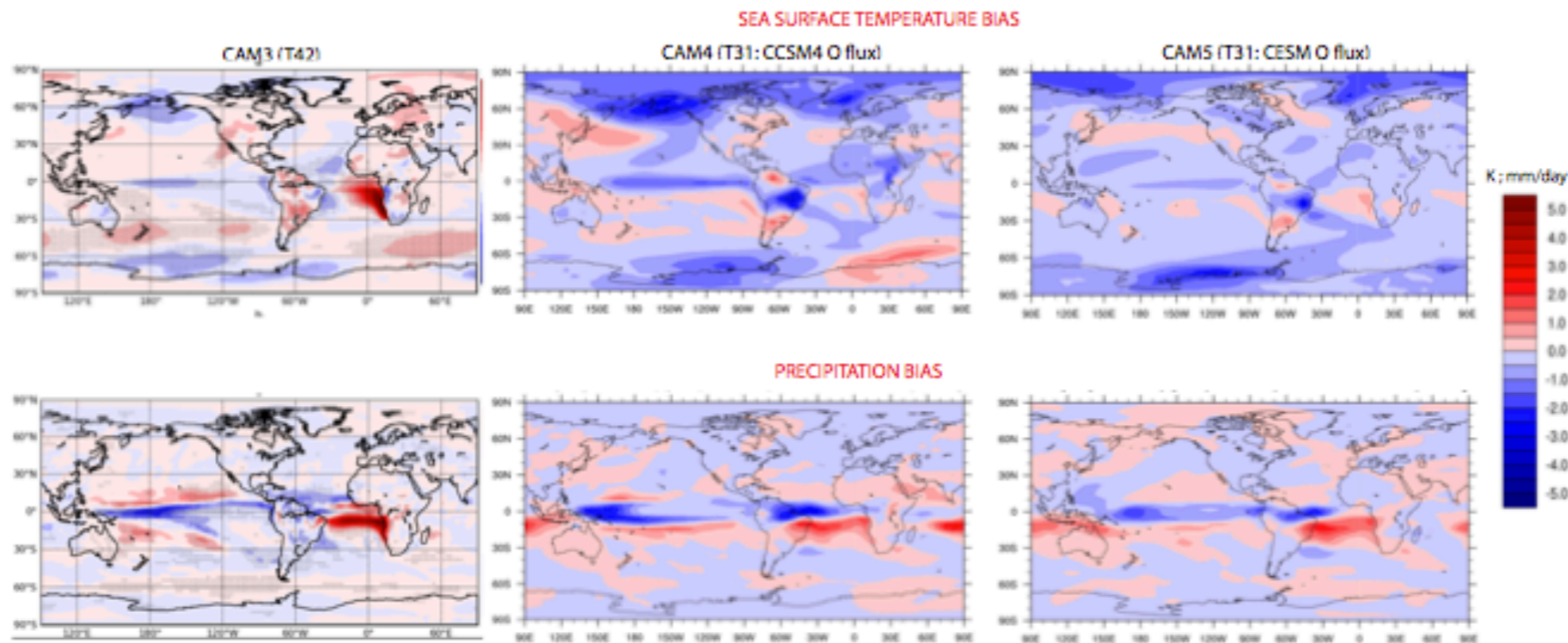

blue& red - MODIS&ISCCP cloud fraction; red - AMSR-E liquid water path
black - NCAR CESM/CAM5 has highest correlation to observed seasonal cycle
of any model

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do the SEP and SEA SST biases have a global impact?
- coordinated effort to examine as many models as possible

SEA SURFACE TEMPERATURE BIAS

CAM3 (T42)   CAM4 (T31: CCSM4 O flux)   CAM5 (T31: CESM O flux)

PRECIPITATION BIAS

Z. Xu/ P. Chang/ E. Schneider

atmospheric model coupled to slab ocean. first, a control simulation with internal ocean heat fluxes calculated to produce observed SST. then internal heat flux set to zero within the SEA region (5-30S, 15E-50W). SST & precip difference plots shown

southerly shift to Atlantic ITCZ. change in Pacific more ambiguous

do eddies contribute to net offshore transport of cooler waters?

still unresolved.

ETOS WG will perform one additional test of assessing difference in ocean heat budget between high-res and low-res models

Summary

ETOS WG Objectives on way to being met; white paper/manuscript completion by end of year (or earlier)