

Assessing the NCEP CFS Model Bias Associated with the Marine Stratus Clouds over SE Pacific

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Objectives:

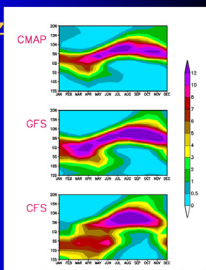
- ◆ To examine the CFS model bias associated with the insufficiently simulated marine stratus clouds over SE Pacific and SE Atlantic;
- ◆ To investigate the atmospheric circulation involving the formation and variations of the marine stratus clouds;

Two Sets of CFS Simulations Examined

- CFS AMIP Simulations [GFS]
 - ◆ The atmospheric component of the CFS model (v2.0.03) is forced by observed oceanic condition; 1979–2003;
- CFS CMIP Simulations [CFS]
 - ◆ The CFS model atmospheric model is fully coupled with an OGCM (OASU3.1);
 - ◆ 4 sets of CFS simulations for a 32-year period each;

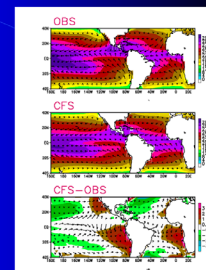
Annual Cycle of the Atlantic ITCZ

- GFS simulates annual cycle pretty well, with excessive precipitation;
- The Atlantic ITCZ located too south during DJF and MAM in the CFS simulation;



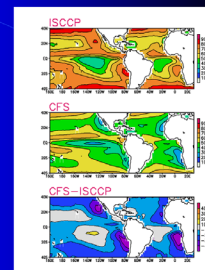
Annual Mean SST / Surf. Wind

- Warm SST bias in the CFS over the southeast Atlantic and southeast Pacific;
- Surface wind bias over the regions of warm SST bias.



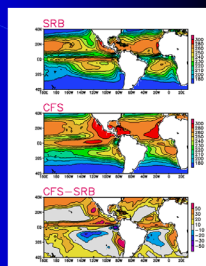
Annual Mean Total Cloud (%)

- In general, CFS cloud amount is smaller than that of observations almost everywhere;
- Insufficient amount of clouds simulated by the CFS over the regions with warm SST bias;



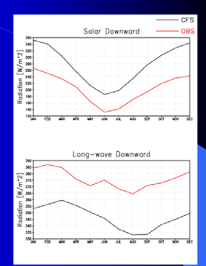
Annual Mean SW Radiation

- Excessive incoming solar radiation over both the SE Atlantic and SE Pacific;
- Differences of over 50W/m² over SE Pacific;



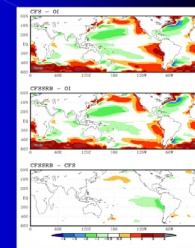
Comparison with EPIC Buoy Data at [20°S,85°W]

- Downward SW/LW radiation is too large/small in CFS compared to those based on EPIC buoy observations



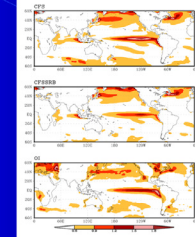
Impact of Insufficiently Simulated Stratus [1]

- CFS CMIP simulation is repeated with the incoming solar radiation over the SE Pacific stratus deck corrected using the SRB;
- The warm SST bias over the SEP is reduced by about half
- The radiation correction also nonlocal affects in the equatorial eastern Pacific



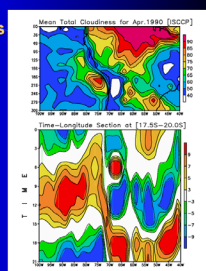
Impact of Insufficiently Simulated Stratus [2]

- Interannual standard deviation of monthly SST
- Tropical interannual variability is weakened with the reduction of the warm SST bias over SE Pacific

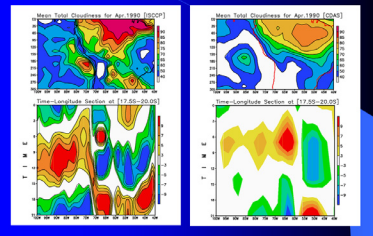


Diurnal Cycle in ISCCP cloudiness

- 24-hour mean cloudiness (top) shows a bi-polar structure over the dry zone and nearby continent, suggesting a diurnal cycle cell caused by sea breeze;
- 3-hourly ISCCP cloud data (bottom) presents distinct diurnal cycles of different phases over the dry zone and the land area;

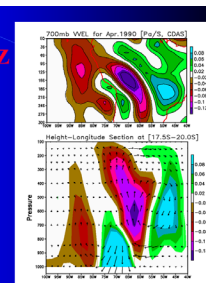


Diurnal Cycle in CDAS1 Cloudiness



Diurnal Cycle in circulation from CDAS1 06Z

- 24-hourly mean removed to examine the diurnal cycle;
- Cells of regional circulations involving land-sea contrasts;



Summary

- ◆ Overall good performance of CFS model in reproducing large-scale precipitation patterns;
- ◆ Meridional shifts of ITCZ over Eastern Pacific and Atlantic sectors;
- ◆ The displacements of the ITCZ closely related to the warm SST bias in the SE Atlantic and SE Pacific stratus deck regions;
- ◆ About half of the warm SST bias is attributable to the insufficiently simulated stratus clouds in the CFS; and
- ◆ Strong diurnal cycle in the stratus clouds generated by regional circulation caused by land-sea contrasts between the oceanic regions and their adjacent continents.