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COUPLED CLIMATE SIMULATION OF THE SOUTH AMERICAN MEAN MONSOON CLIMATE

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1. Introduction

A newly developed coupled climate model at the Center for Ocean-Land-Atmosphere Studies (COLA) is examined here for its simulation of the South American monsoon mean climate. A systematic error in many of the coupled models including the COLA model is the dry bias over the Amazon region. Is this in any way related to drift in the coupled model or the coarse resolution of the AGCM in the coupled model? These questions are specifically addressed in this study.

2. Model Description

2aThe COLA AGCM

COLA AGCM V3.2 is now run at exactly the same resolution as the NCEP reanalysis (T62L28) with identical topography. The vertical co-ordinate system is the terrain following sigma co-ordinate. The dynamical core follows from CCM3.6.6 (Kiehl et al 1998). Here, all prognostic variables except the moisture variable are treated spectrally. Moisture is advected by Semi-Lagrangian scheme. The outline of the physics of the model is presented in Table 1. Additionally we have implemented a uniform calculation of saturation vapor pressure following Marx (2002) and variation of the latent heat of phase change with temperature following Bohren and Albrecht (1998).

	Feature	Reference	Source
1	PBL	Hong and Pan, 1996	NCEP
2	Shortwave	Collins et al. 2002	CAM2 .0
3	Longwave	Collins et al. 2002	CAM2 .0
4	Convection	Bacmeister et al. 2000	NSIPP
5	Horizontal diffusion		NCEP
6	Land surface	Dirmeyer and Zeng, 1997	COLA

Table1: Outline of the physics of COLA AGCM V3.2

2bThe Ocean model

The ocean model is version 3 of the Geophysical Fluid Dynamics Laboratory MOM (Pacanowski and Griffies, 1998). The domain is that of the world ocean between 74S and 65N. There are 25 vertical levels with the first 17 levels in the upper 450m. The zonal resolution is 1.5^0. The meridional grid spacing is between 0.5^00 between 10S and 10N, gradually increasing to 1.5^0at 30N and 30S and fixed at 1.5^0 in the extra-tropics.

3. Design of Experiments

A 95 year integration of the COLA coupled model (CONT) is made alongside 95 year integration of the COLA coupled model but with 64 levels in the AGCM (CONTL64) instead of the 28 levels. However, while showing the results from these integrations only the last 70 years of the model run are used to account for the spin-up issues. Besides, 1 year integrations starting with real initial conditions of atmosphere and ocean are made with the COLA coupled model (DSP) starting from 1 Dec of 1982, 1988, 1997, and 1998 with 10 ensemble members each. The ensemble members are generated from perturbing the atmospheric initial conditions only, keeping the initial condition of the ocean state identical for all the ensemble members of a season. A similar set of 1 year integrations for the same years, starting at the same time and with equal number of ensemble members (10) are made with 64 levels in the AGCM of the COLA coupled model (DSPL64). Finally a set of 1 year integrations with the same specifications as before are made with the AGCM horizontal resolution changed to T159 from T62 (keeping 28 vertical levels) in the COLA coupled model.

4. Results

The precipitation errors shown in Fig.1 is revealing in the sense that the neither the climate drift nor the vertical resolution of the AGCM seems to have a significant impact on the dry bias of the climatological mean DJF precipitation over continental South America. Although, the precipitation errors and the SST errors (not shown) have significantly changed in the neighboring tropical Pacific Ocean (appreciably less in the tropical Atlantic Ocean) in the DSP runs relative to the long integrations of the coupled model there is no relative large changes in the mean precipitation over the continental South America.

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5. Conclusions

It is seen that the climate drift in the coupled model is necessarily not the reason for the dry bias in the mean DJF precipitation over continental South America. The increase in the vertical resolution of the AGCM also had very little impact on this dry bias. The results from the T159L28 AGCM coupled to MOM3 will be discussed at the venue of the meeting.

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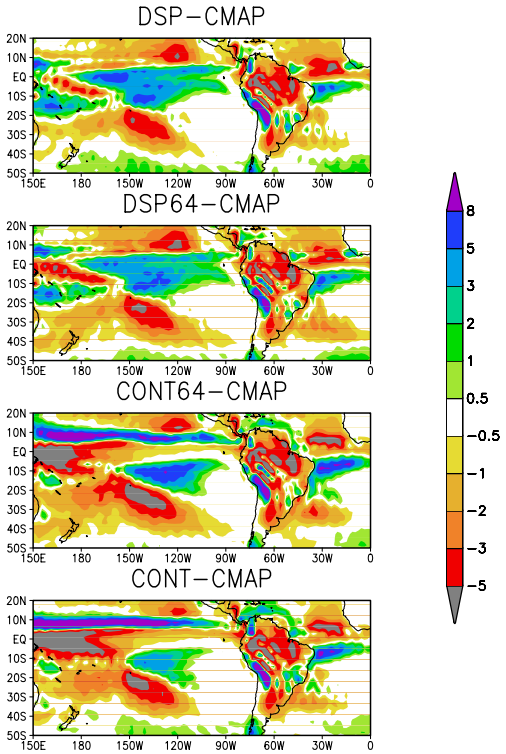

Figure 1: Climatological mean DJF Precipitation errors in mm/day