INVESTIGATION OF SEASONAL PREDICTION OF THE SOUTH AMERICAN REGIONAL CLIMATE USING THE NESTED MODEL SYSTEM

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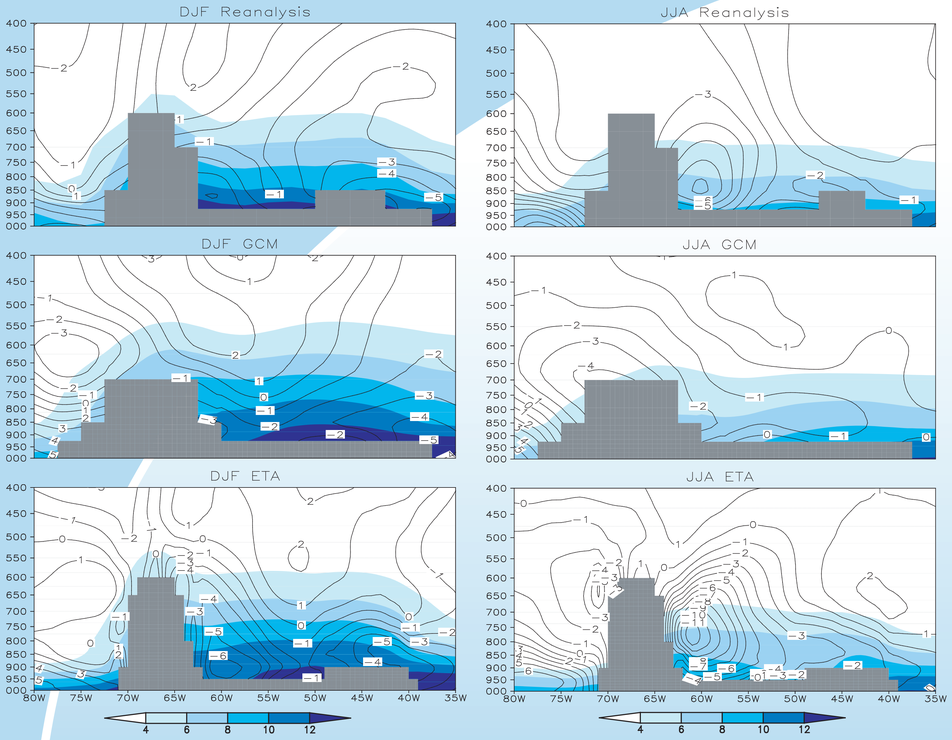
INTRODUCTION

- Trying to access the potential predictability of seasonal climate over South America has been of increasing concern in atmospheric sciences;
- Seasonal climate anomalies are forced by slowly varying conditions of SST, land surface conditions, and random internal atmospheric variability;
- El Niño: dry conditions found over northern South America and wet conditions over the subtropics including the La Plata River basin. The situation reverses during La Niña events ;
- The use of regional models in seasonal anomalies studies has been increasingly predominant due to their ability to allow better representation of topography and physical processes in the atmosphere than AGCMs .

METHODOLOGY

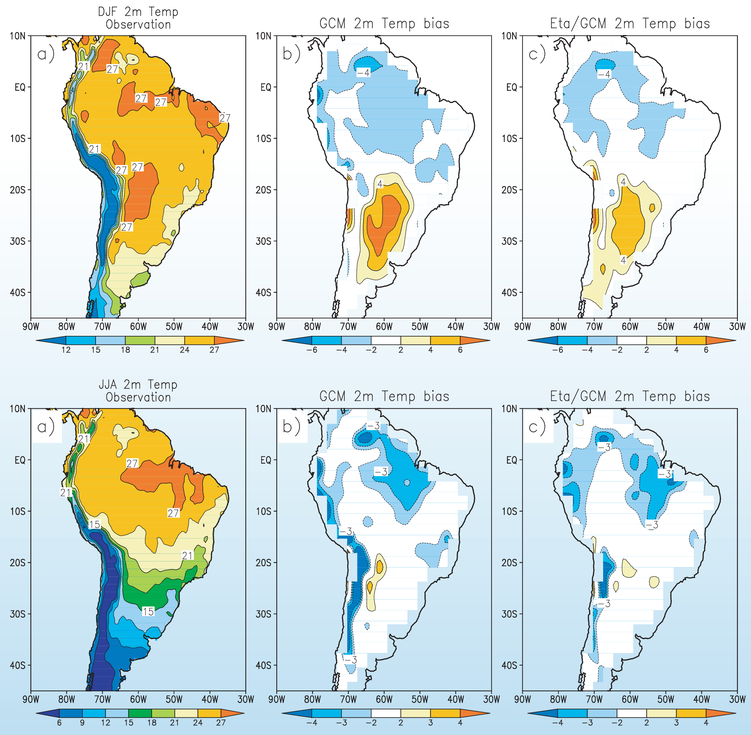
- NCEP 80-km Eta model was used in a series of seasonal integrations to investigate the predictability of seasonal climate over SA using the one-way nested model system;
- NCEP T42 AGCM integrations were used as lateral boundary conditions for the Eta simulations (dynamic downscaling);
- NCEP/NCAR reanalysis was used as the initial conditions for all simulations;
- Both summer (DJF) and winter (JJA) seasons of intense El Niño and La Niña years were simulated in this study

Low-level jet circulation



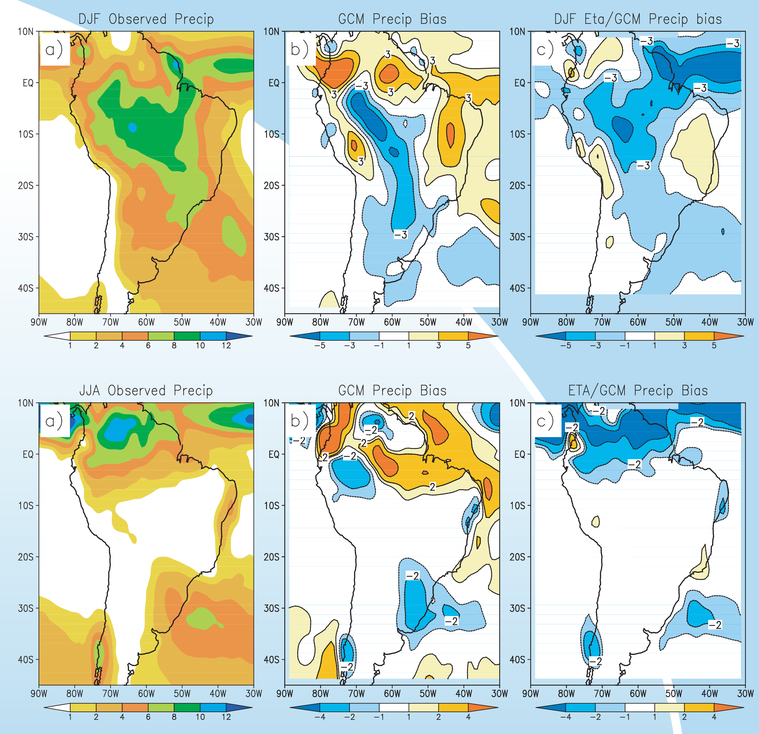
Cross sections of meridional wind speed (contour lines) and specific humidity (shading) along 20°S for summer and winter

Average Surface Temperature



Observed average 2-meter air temperature and model temperature biases for summer and winter

Average Precipitation



Observed average precipitation and model precipitation biases for summer and winter

Precipitation Time Series

Time series of 5-day mean precipitation for a) northwestern SA, b) Amazon river basin, c) northeastern Brazil, d) Altiplano Plateau, and e) La Plata river basin

Results

* The nested model system improved the simulation of the lower-level circulation, especially the South American low-level jet along the eastern slope of the Andes Mountain Range;
* The regional model's 2-m air temperature simulation also showed improvement during both seasons;
* The nested model reduced the excessive rainfall produced by the AGCM over northern and northeastern South America in the summer months. The nested model also produced better precipitation results in the subtropics as a result of enhanced southerly moisture flux associated with a stronger low-level jet;
* For the winter season, most of the precipitation improvement produced by the nested model system was located over the northeastern section of the domain and over southeastern South America, where the regional model eliminated the AGCM's dry bias;
* 5-day mean precipitation time series analysis showed that the 1-way nesting method can produced better precipitation temporal evolution for some areas of the continent. The nested model improved the rainfall time series in all the areas during both seasons, except over the Amazon Basin in the summer.
* The nested model exhibited a dry bias over the Amazon Basin and Atlantic ITCZ.
* Complete results in De Sales, F. and Y. Xue (2006) Investigation of seasonal prediction of the South American regional climate using the nested model system. *J. Geophys Res*. In press.

CONCLUSIONS

- This study investigated the 1-way nested model system over South America. The results indicated that this technique can improve the simulation of lower-level wind circulation, as well as surface temperature and precipitation over that continent during both summer and winter. The better simulation of the low-level jet, east of the Andes, by the nested model resulted in enhanced precipitation in the subtropics when compared to the AGCM.
- In the tropics, the nested model reduced the excessive rainfall produced by the AGCM to levels more comparable to the observation.
- The nested model also improved the precipitation temporal evolution for some areas examined in the study

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