

Association between sea surface temperature over the North Atlantic Ocean and the summertime convection over the South America

Rosane Rodrigues Chaves

Universidade Estadual do Norte Fluminense Darcy Ribeiro - UENF

Laboratório de Meteorologia - LAMET

Macaé - Rio de Janeiro - Brazil

rosane@lenep.uenf.br

1. Introduction

In contrast to the sea surface temperature (SST) over the South Atlantic Ocean (Robertson e Mechoso 2000, Chaves e Nobre 2004 and Chaves e Ambrizzi 2005), the influence of the SST over the North Atlantic Ocean in the summer convection over the South America (AS) does not have received attention from the research community. In this study was evaluated the association between the SST over the North Atlantic Ocean (Equador-40°N; hereafter referred as NA) and the summer convection over the SA through statistical methods as Principal Components Analysis (PCA) and numerical experiments with the CPTEC/COLA atmospheric general circulation model. The observational analysis used SST from COADS and Outgoing Longwave Radiation (OLR) from CDC/NOAA. Patterns of SST anomalies over the NA were determined through PCA to December-January-February (DJF) from 1979 to 2001. Association of these patterns with summertime convection over the SA was determined by linear correlation between the time series of these patterns and OLR anomalies over this continent. The CPTEC/COLA model was used to perform sensitivity experiments with prescribed boundary conditions over the NA in order to evaluate the association between SST over this ocean region and the summertime convection over the SA. Three numerical experiments were done from November 2000 to February 2001. A control run was carried out by using observed global SST from NCEP as surface ocean boundary condition. This experiment was referred as *CTR*. The others two experiments used a negative and a positive increment added over the NA, and observed global SST over the remaining oceans. These experiments were referred as *AFN* and *AQN*, respectively. The AGCM was integrated for 120 days, with 5 distinct initial conditions from NCEP operational analysis for 12:00 UTC on 1 November 1995, 1996, 1998, 1999 and 2000 for all experiments (*CTR*, *AFN* and *AQN*). The December 2000 to February 2001 ensemble averages for each experiment were analyzed.

2. Results

The spatial pattern associated with the first anomalies SST mode shows one monopolo pattern over the NA (not showed). The second pattern shows an out-of-phase relationship between SST anomalies over the tropical and subtropical regions (not showed). The third pattern shows three action centers over the NA, SST anomalies with same signal over equatorial and subtropical regions and different signal over intermediate region (Fig. 1a). The first and third patterns show greater interannual variability and the second pattern interdecadal variability. Only the third mode has influence over summertime convection on the SA. It explains 9.4% of the variance. This third pattern shows correlation significant with summertime convection only over the northernmost part of this continent (Fig. 1b). The convection in this region is associated with positive SST anomalies over equatorial and subtropical region and negative SST over the tropical part of the NA. Results from numerical experiments corroborate the

results of the observational analysis; indicate also that SST over the NA has influence only in the summertime convection over the northernmost part of the SA (Fig. 2a, b).

3. Conclusions

The results of the observational analysis and numerical experiments showed that the SST over the NA (Equator e 40°N) has influence only in the summer convection over the northernmost part of the SA, with warm SST anomalies there associated with the convection over this continental region. Thus, apparently, the SST over the NA was not important for the predictability of the summer convection over most of the SA, included the South Atlantic Convergence Zone, to DJF from 1979 to 2001. Results presented here were based on statistical methods with dataset from DJF 1979 to 2001 and CPTEC/COLA model simulations with prescribed boundary conditions. In order to evaluate the dependence of these results, they must be compared with others models and observational data.

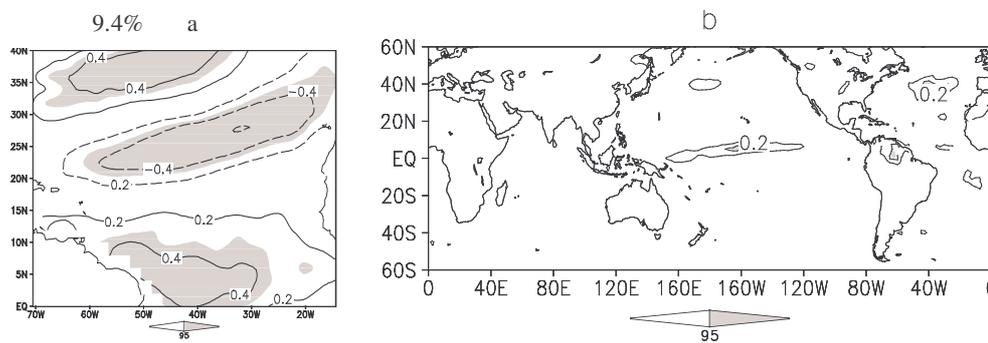


Figure 1 - Third EOF modes of the SST anomalies over the North Atlantic Ocean to DJF from 1979 to 2001 (a) and correlation field between time series of expansion coefficients of this EOF modes and OLR anomaly at that grid point between 60°S and 60°N from 1979 to 2001. The shaded areas represent statistical significance at the 95% confidence level

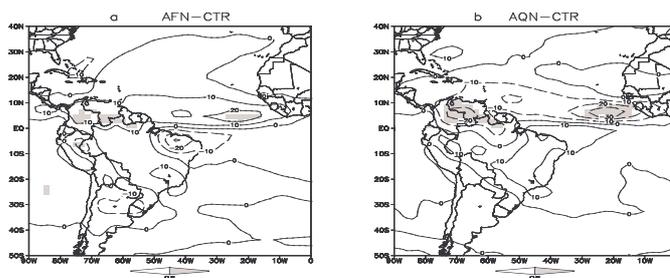


Figure 2 - OLR difference between AFN and CTR (a), AQN and CTR (b) experiments. The shaded areas represent statistical significance at the 95% confidence level.

4. References

- Chaves, R. R.; Nobre, P. Interactions between sea surface temperature over the South Atlantic Ocean and the South Atlantic Convergence Zone. *Geophys. Res. Lett.* 31:L03204, 2004.
- Chaves, R R.; Ambrizzi, T. Atmospheric response for two convections schemes in sensitivity experiments using SST anomalies over the South Atlantic Ocean. *CLIVAR Newsletter Exchanges Seasonal Predictability*, **33**, 2005.
- Robertson, A. W.; Mechoso, C. R. Interannual and Interdecadal Variability of the South Atlantic Convergence Zone. *Mon. Wea. Rev.*, **128**:2947-2957, 2005.