5A.4 CLIMATOLOGICAL STUDIES OF THE INFLUENCES OF EL NIÑO SOUTHERN OSCILATION EVENTS IN THE PRECIPITATION PATTERN OVER SOUTH AMERICA DURING AUSTRAL SUMMER

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1. INTRODUCTION

Many studies have already indicated that the precipitation pattern over South America, in particular over some regions in Brazil, is strongly influenced by the extremes of the Southern Oscillation (SO) (Ropelewski e Halpert, 1987; and Rao e Hada, 1990).

Coelho et al. (1999), using datasets from 206 meteorological stations over Brazil, have developed a seasonal climatological precipitation study for El Niño/La Niña episodes, classifying them as strong/moderate or weak. For each season, different characteristics of the precipitation pattern were found. These results are in agreement with the present one.

Using seasonal and monthly rainfall anomalies and Outgoing Longwave Radiation (OLR) data for the austral summer (December-January-February) during the El Niño events of 1982/83, 1986/87 and 1991/92, and the La Niña events of 1984/85, 1985/86 and 1988/89, and analysis of the lower and upper level circulation, the associated convection and rainfall features were made. We will show here seasonal anomalies composites of these ENSO events.

Rainfall observations from 2138 meteorological stations over South America are used, with few of them going back in time from 1853 to 1996. The precipitation dataset implemented by Xie and Arkin (1996) for the period 1979 to 1995 is also used in this study, together with the NOAA OLR, and the (NCEP/NCAR) Reanalisys data, for the period 1968 - 1996.

2. RESULTS AND DISCUSSION

The quality and reliability of the precipitation dataset implemented by Xie and Arkin was tested through comparison between the monthly and seasonal mean precipitation anomalies over South America, obtained from meteorological stations, and the OLR dataset. A good agreement between the precipitation from the Xie and Arkin datset (Figure 1) and the meteorological stations (Figure 3) was found. The precipitation and OLR anomalies are also well correlated (not shown).

Preliminary results indicate that the atmospheric response and consequently the summertime precipitation pattern over South America during the El Niño events of 1982/83, 1986/87 and 1991/92, shows large variability from one event to another: The central part of the South America indicates enhanced precipitation while the southern section did not have significant changes in rainfall. On the other hand, in the north it was observed large negative anomalies during these events, which are related to changes in the position of the descending branch of the Walker cell in this region (Figure 2).

However, for the La Niña composites, the variability over the southern part of South America was less significant. The rainfall distribution pattern in the north of South America contrasts with El Niño, with enhanced rainfall over this area (Figure 3).

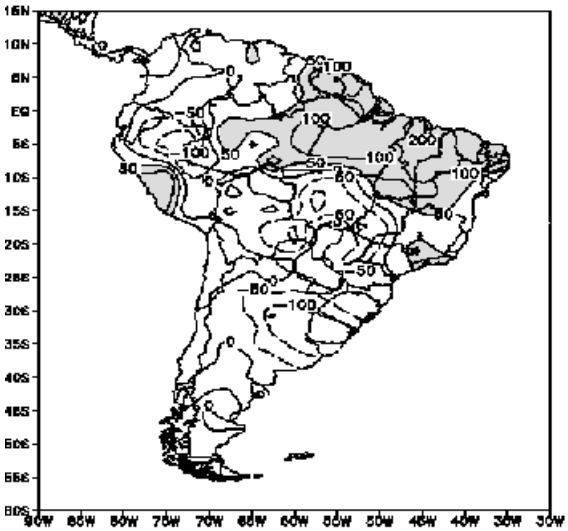

Figure 1. Composite of seasonal precipitation anomalies during Dec-Jan-Feb (1984/85, 1985/86 and 1988/89) using data from Xie and Arkin dataset. Contour intervals are 50 mm. Solid (dashed) lines refers to positive (negative) anomalies. Values greater than 50 mm are shaded.

The low level circulation pattern in the central and southern part of the South America for the El Niño composites shows an anomalous anticyclone in the west side of the central South America, over Bolivia, an anomalous cyclone in the eastern region, over Paraguai and south of Brazil, and an anomalous anticyclonic circulation in the south (Figure 4). The low level circulation pattern for the La Niña composites also indicate a similar configuration. However, we observe here two cyclonic anomalies, one over the west of the northern region of Brazil and the other over the southeast. An anticyclonic anomaly in the

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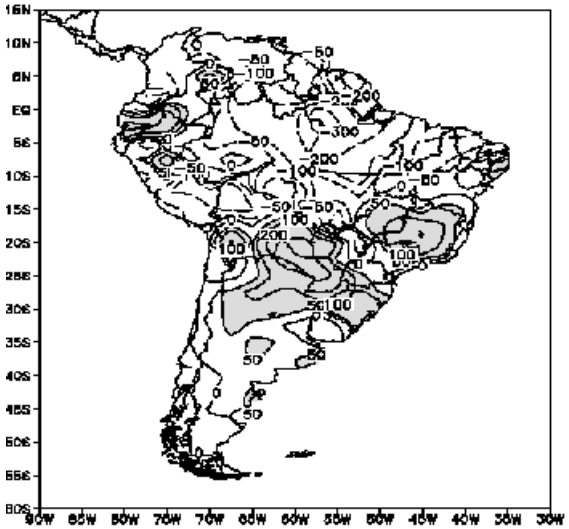

Figure 2. As Figure 1 during Dec-Jan-Feb (1982/83, 1986/87 and 1991/92) from meteorological stations.

south is also evident (not shown). The position of these anomalous centers are associated with enhancement or suppression of the rainfall over central and southern part of South America.

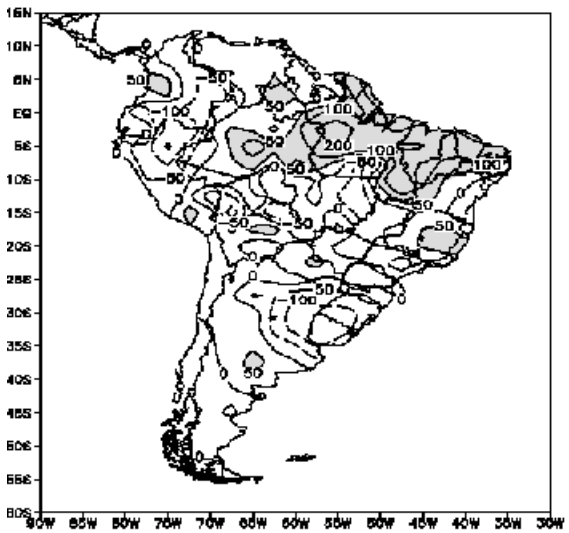

Figure 3. As Figure 1 during Dec-Jan-Feb (1984/85, 1985/86 and 1988/89) from meteorological stations.

The three typical characteristics observed during the warm ENSO episodes are: The subtropical jet stream over South America displaced northward of its climatological position, the great variability of the Bolivian High, and the presence of a high level trough over the Atlantic ocean to the east of the northeast region of Brazil. With the subtropical jet stream displaced northward, frontal systems and convective complexes, which normally reach the central part of South America, are blocked. This could explain why this region has enhanced precipitation during austral summer. On the other hand, in the northern part of the South America, the variability of the precipitation pattern is due to changes in the zonal thermal Walker circulation in the equatorial region. The displacement of the low level convergence zone from the center of Amazon to the west coast of Peru, leads to an inversion in the zonal circulation cell, with subsidence over Amazon and northeast region of Brazil and ascending vertical motion over north Peru and Equador (Figure 2).

There are evidences that the precipitation pattern over northern part of South America in the austral summer, during La Niña events, can also be modulated by changes in the zonal Walker circulation (Figure 3). The position of the subtropical jet stream during these events is also important to influence the precipitation pattern.

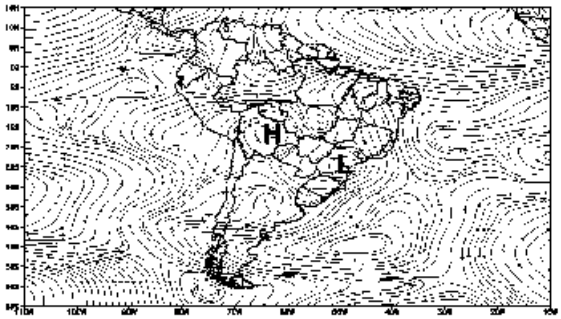

Figure 4. Composite of seasonal 850 hPa stream line anomalies during Dec-Jan-Feb (1982/83, 1986/87 and 1991/92) from NCEP/NCAR Reanalisys dataset.(H = anticyclonic anomaly; L = cyclonic anomaly)

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3. REFERENCES

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