RESEARCH ON THE LOW-LEVEL JET JUST TO THE EAST OF THE ANDES (SALLJ), SOME RESULTS AND STUDIES IN PROGRESS

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1. Research aspects related to the low-level jet just to the east of the Andes (SALLJ) (Collaborators: Celeste Saulo, Paola Salio, J. Carlos Torres and Graciela Ulke)

- Characterization of low-level mean wind fields and water vapor fluxes over South America during summer. Investigation of the relationship between extreme precipitation in subtropical latitudes and the occurrence of SALLJ. (4 hours, 1.125 resolution 1979-1993 reanalyses (ERA) and precipitation data). (Salio et al., 2000).
- Model characterization of the low-level circulation and moisture transport during the 1997-1998 spring-summer season, from high-resolution ETA operative products. Low-level jet identification, moisture budget estimation in a region that contains La Plata basin (**in collaboration with CPTEC, Brazil**). (Saulo et al., 2000).
- Characterization of synoptic conditions related to Chaco SALLJ cases (extended to the south) during summer 1979-1993 (ERA data) and during 1997-1998 warm season (ETA products and NCEP reanalyses). Relationship between Chaco jet cases and precipitation.
- MCSs and its life cycle environmental conditions characterization (5 years data: ISCCP, precipitation and ERA) over Argentina and its relation to SALLJ (Torres and Nicolini, 1999).
- Simulation of strong jet events and related precipitating systems. Develop and validate theories on LLJ generation, variability and jet-convection relationship.

2. Main results from a model characterization of the South American low-level flow during the 1997-1998 spring-summer season (Saulo et al., 2000)

- ETA model confirms the existence of a northerly current to the east of the Andes and progresses in characterizing its mean scale (around 300 km cross stream), structure and intensity and its nature as a moisture conveyor from the Amazon Basin to subtropical latitudes in South America. Summer 97-98 mean vertically integrated moisture flux field (**Q**) reveals a northerly and dominant stationary component evident just to the east of the Andes (Fig. 1b).
- The model identifies the SALLJ cases and characterizes its vertical structure at individual grid points. The satisfactory performance of the model to determine the frequency of occurrence of SALLJ events (comparison with pilot balloon soundings, PACS/SONET, (Douglas et al, 1999) at Santa Cruz, Bolivia) gives confidence on its ability to describe average conditions of LLJ cases.
- An estimation of water vapor budget with the inclusion of both observed and model precipitation accomplished over a region encompassing the La Plata Basin characterized this area as a net atmospheric moisture sink during this warm season. Two major sources of moisture have been identified at low levels. The dominant one is represented by the southward flux through the northern boundary originated in tropical South America and the secondary contribution is given by the northeasterly component from the South Atlantic Anticyclone.

- The particular characteristics of this warm season have become evident in the strong signal of the low-level jet apparent even in the mean monthly wind field and could be related to this El Niño episode.

3. Preliminary results of the investigation of the relationship between extreme precipitation in subtropical latitudes and the occurrence of SALLJs.

Low-level wind and precipitation anomalies during two extreme January precipitation regimes over a particular South American region (see Fig. 2) have been explored to address the hypothesis of the existence of a relationship between these two anomalies in the presence of SALLJ events (Salio et al., 2000). Figure 2.a (2.b) displays a divergent (convergent) zone in the vertically integrated moisture flux (**Q**) for the year 1985 (1988) associated with a negative (positive) precipitation anomaly over the continental subregion depicted as a box. Also included is the net **Q** divergence in low-levels as well as the mean areal precipitation anomaly within the selected region. **Q** convergence for January 1988 is mainly accounted for by the contribution from low levels water vapor flux through the northern border of this box. An opposite behavior in the northern and eastern borders and low-level net divergence is evident during January 1985. A comparison shows a higher number of SALLJ cases during 1988 occurring over northern Argentina and southern Brazil.

This relationship is further hypothesized to be primarily dependent on the incidence of events that penetrate farther to the south from the mean maximum near Santa Cruz, Bolivia. The motivation is based on the potential implications in the occurrence of enhanced precipitation in continental latitudes between 25 and 40ºS. Accordingly, a subensamble of SALLJ cases denoted as Chaco jets has been identified during the spring-summer 1997-1998 season using ETA forecast products and an analysis of both the intensity and characteristics of circulation, related moisture meridional transport, thermodynamical anomalies and contribution of Chaco cases to the seasonal accumulated precipitation are in progress (Nicolini and Saulo, 2000). Comparison of mean vertically integrated moisture flux field (**Q**) for the mean Chaco composite summer cases and the mean respectively (Fig 1a and 1b) show a maximum intensification for Chaco cases near the northern Argentina border. Also, signals like a baroclinic wave pattern and mechanisms leading to a deepened northern Argentina thermal low are investigated to understand the development of these synoptic scale events (Saulo and Nicolini, 2000). These preliminary results have been used in the design of the VAMOS/CLIVAR SALLJ field Argentina component.

4. References

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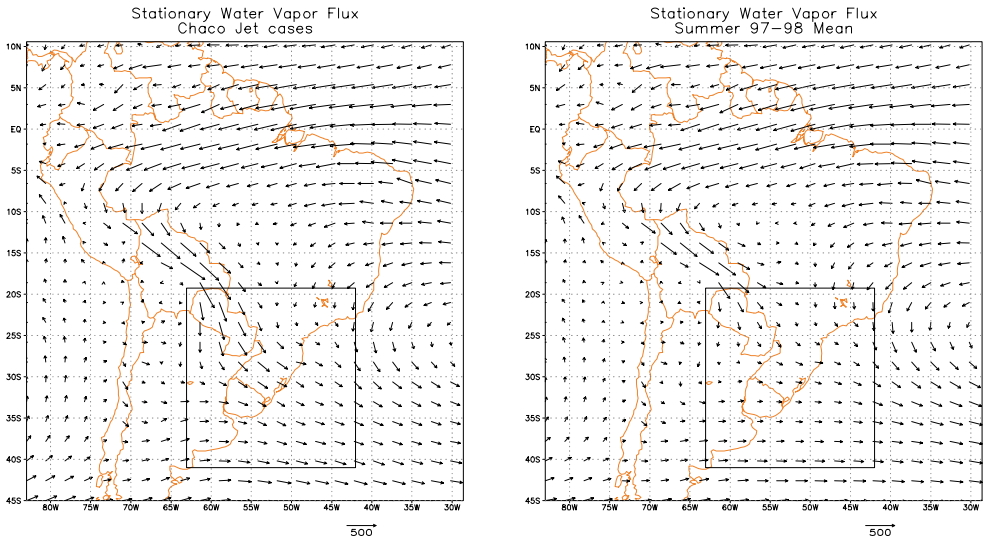

Figura 1: Vertically integrated stationary component of the water vapor flux field, a) mean for composite Chaco jet cases, b) mean summer

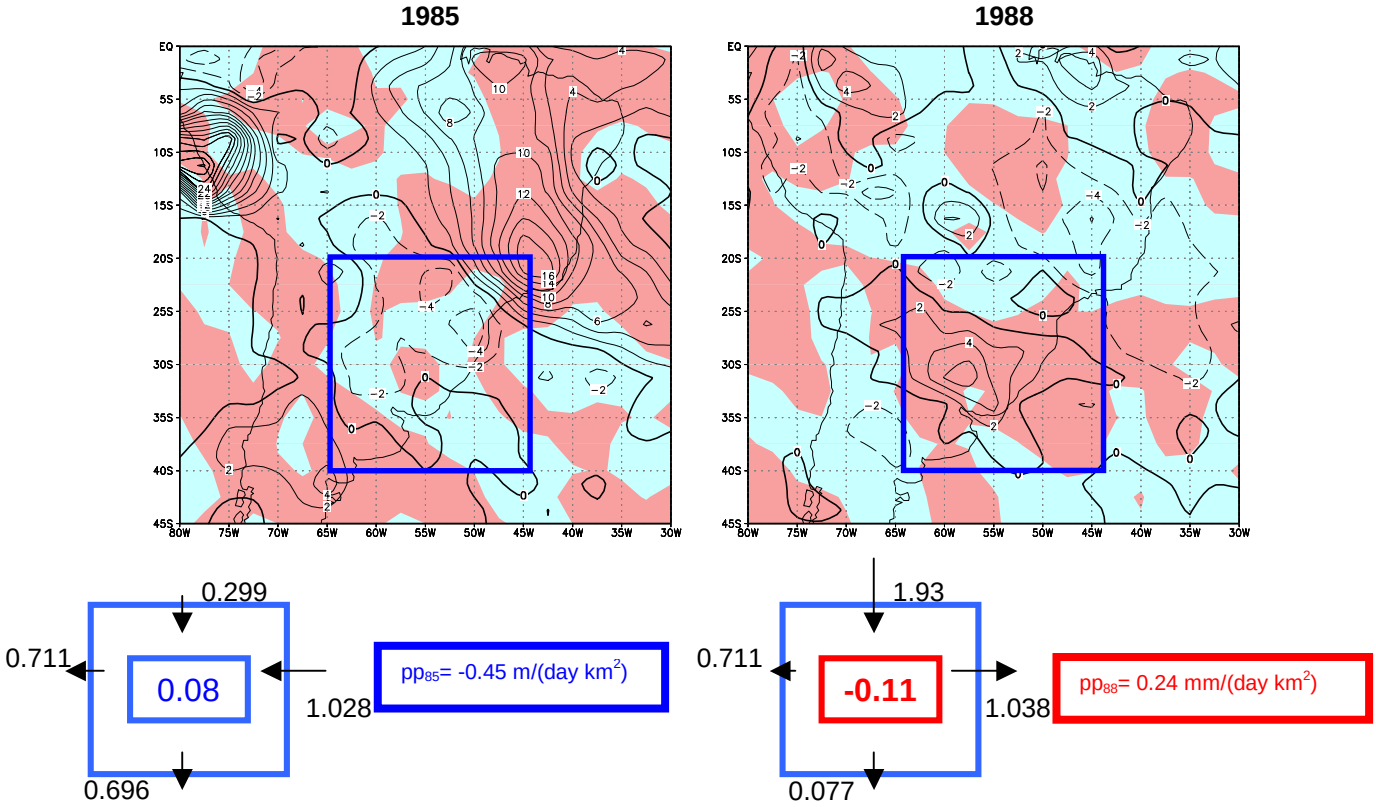

Figura 2: a) Xie and Arkin precipitation anomaly every 2 mm/day (contours) and divergence of vertically integrated moisture flux anomaly (red corresponds to positive values and blue to negative ones) in January 1985; b) idem a) but in January 1988.