Some aspects of seasonal climate variability over Southern-Central South America and opportunities for applications*

Guillermo J. Berri

Departamento de Ciencias de la Atmósfera y los Océanos, Univ. de Buenos Aires
Consejo Nacional de Investigaciones Científicas y Técnicas (Conicet-Argentina)

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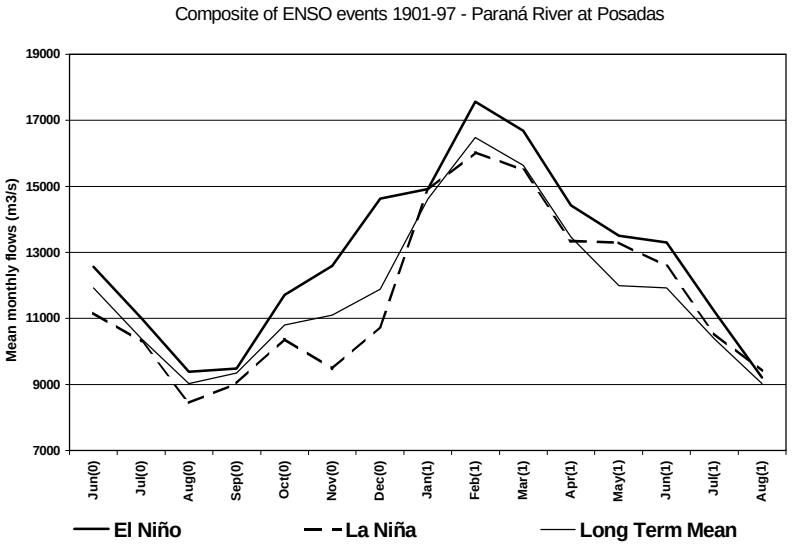
1. The influence of ENSO in the Paraná River flows

The Upper Paraná River is the main tributary of the La Plata River basin, the second largest in South America, contributing with an annual mean flow of 12,000 m^3/s to more than one half of the total water flowing in the La Plata River system. The Paraná River is very important in the region for transportation and hydroelectricity generation. This paper studies the influence of ENSO on the monthly flows measured at Posadas, Argentina during the period 1901-97. The original data is converted into standardized monthly anomalies and the annual cycle is removed. Two data subsets are generated, a first group includes the years of warm ENSO events or El Niño and the second group includes the years of cold ENSO events or La Niña. The elements of the subsets are composites of 24 consecutive months starting in January of the year when the ENSO event begins and ending in December of the following year.



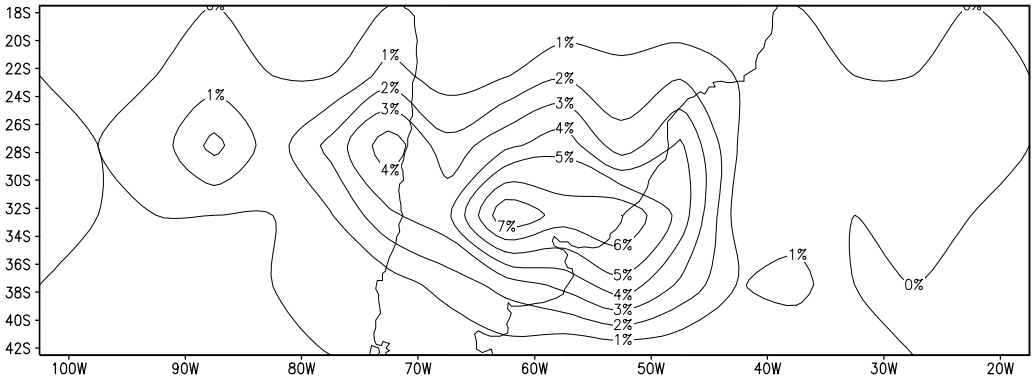
The results show that the averaged flows observed during El Niño events are always larger than those observed during La Niña events. The difference between the two groups peaks during November and December of year when the ENSO event starts. During the following year the difference reduces rapidly and by May both La Niña and El Niño flows are above the average. A categorical contingency analysis between Pacific Ocean sea surface temperatures (SST) in the Niño3 region and riverflow terciles during November-December of 1950-1997 shows a statistically significant relationship. The relationship is such that upper tercile (lower tercile) Niño3 SST coincide with upper tercile (lower tercile)

riverflows in 37.5% of the cases, while only 2% of the cases account for the opposed situation of the type above-below and below-above. Also, a statistically significant positive correlation between November-December mean riverflows and 2-month averaged Niño3 SST starts as early as March-April and so remains during the following months. Since the 1901-97 time series displays a variable long-term trend, a linear detrend is applied by means of a least-squares regression of the original monthly time series. Also, a piecewise linear detrend is applied for three different periods that were identified with relatively steady long-term trend, namely 1901-43, 1944-70 and 1971-97. The composite of ENSO events of the detrended time series shows no difference with the composite obtained with the original time series of monthly values. The conclusion is that the moderate trend observed in the Upper Paraná River flows over the past 100 years is not sufficient to modify the detected ENSO influence in the monthly mean flows.

2. The subtropical jet stream over South America

The subtropical jet stream is identified over South America from monthly mean wind fields during the period 1978-1999, from NCEP reanalysis. Monthly mean latitudinal vertical cross-sections of the zonal wind component are used to determine the intensity and latitudinal position. Also, monthly mean wind intensity at the 200-hPa level is used to identify the subtropical jet stream core.

Distribution of monthly mean STJ-cores, as percentage of months during 1978-1999



The monthly mean subtropical jet stream shows a maximum intensity of 35 m/s during winter and early spring, when it is located at its northernmost position of about 27ºS. In summer, it has a minimum intensity of 25 m/s, when it is located at its southernmost position of 35ºS. The position of the subtropical jet stream core at 200 hPa is studied over a box between the equator and 70ºS and between 15ºW and 105ºW. For each box of 5º in latitude per 5º in longitude, the number of individual monthly mean STJ cores was counted. Then the corresponding relative frequency was computed for each box. The highest frequency is located on middle-eastern Argentina (30°-35°S, 60°-65°W) and extends eastward over Uruguay. There is another frequency maximum west of Los Andes range in 25°-30°S, 70°-75°W that extends westward over the Pacific Ocean. South of 32°S and west of 82°W it is not possible to identify any STJ core, although the main frequency maximum is observed at the same latitude but east of Los Andes. In winter, a secondary maximum occurs on the Pacific Ocean off South America. During summer the subtropical

jet stream core locates preferably over the continent, while in winter its mean position shows a high dispersion in the west-east direction.

References

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