



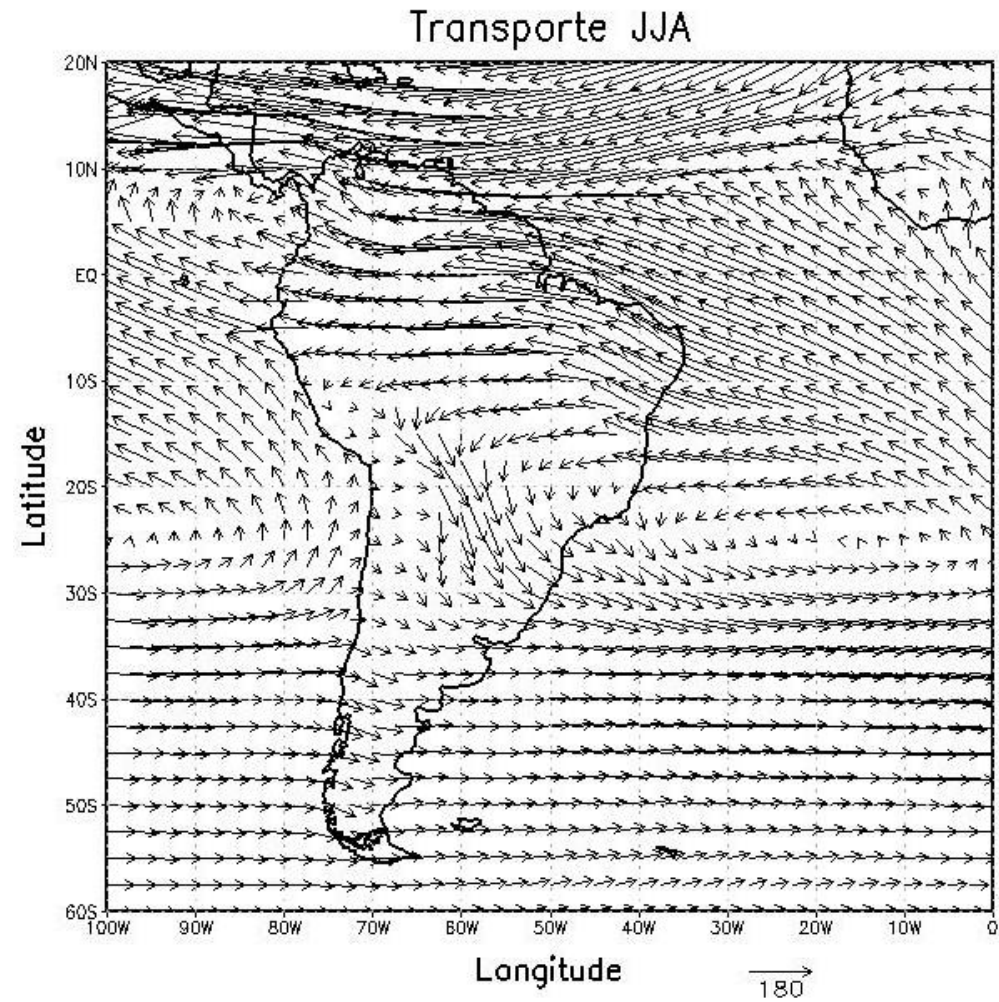
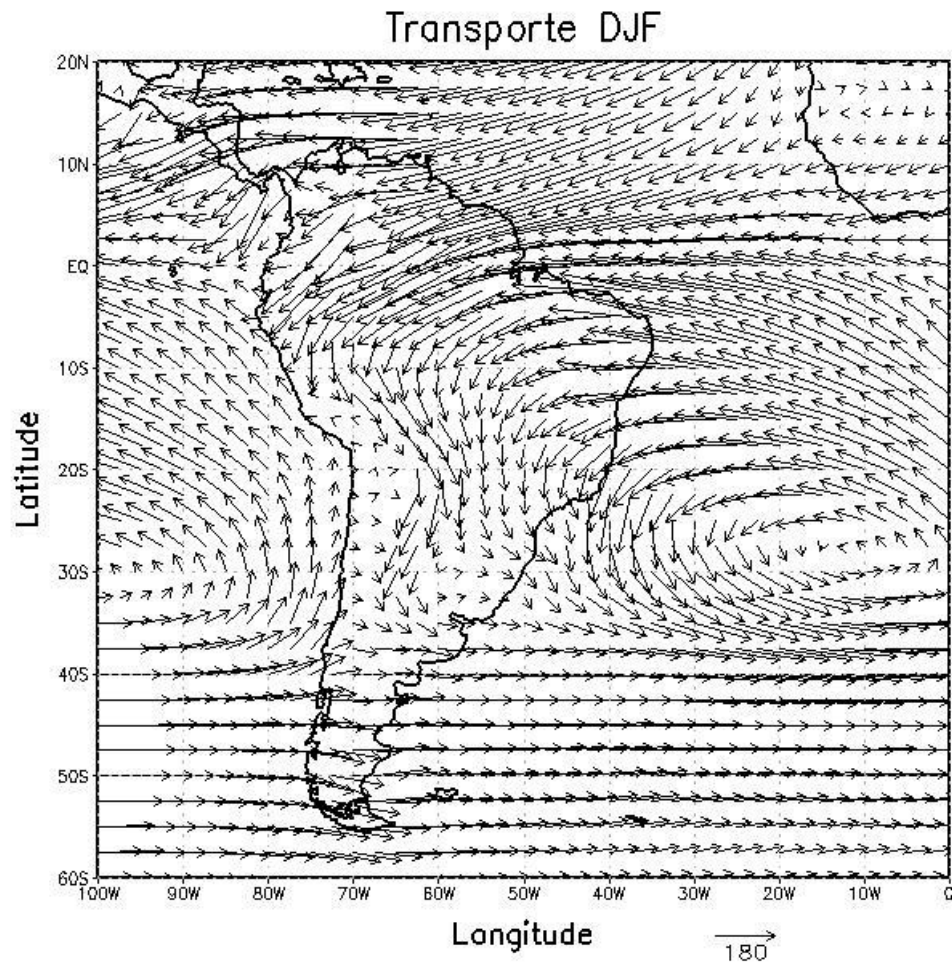
**Analysis of Moisture
Transport from Amazonia
to the Southeastern Brazil
During austral summer**



Introduction

- Characteristics of local meteorological dynamics;
 - Seasonal moisture transport;
 - Jet Stream
 - ZCAS
 - EL Niño
 - 500hPa

Moisture Transport



Goals

- To evaluate the average climatological transport (DJF) of the Amazon region towards the Southeast of Brazil;
- Check for possible anomalies of a physical nature;
- Observe the behavior of Vertical Integrated Moisture Flow in years of El Niño Southern Oscillation (ENSO);

Experiments

Equations used

Moisture Flow

$$\bullet Qu = \frac{1}{g} \int_{pt}^{p_0} qu dp$$

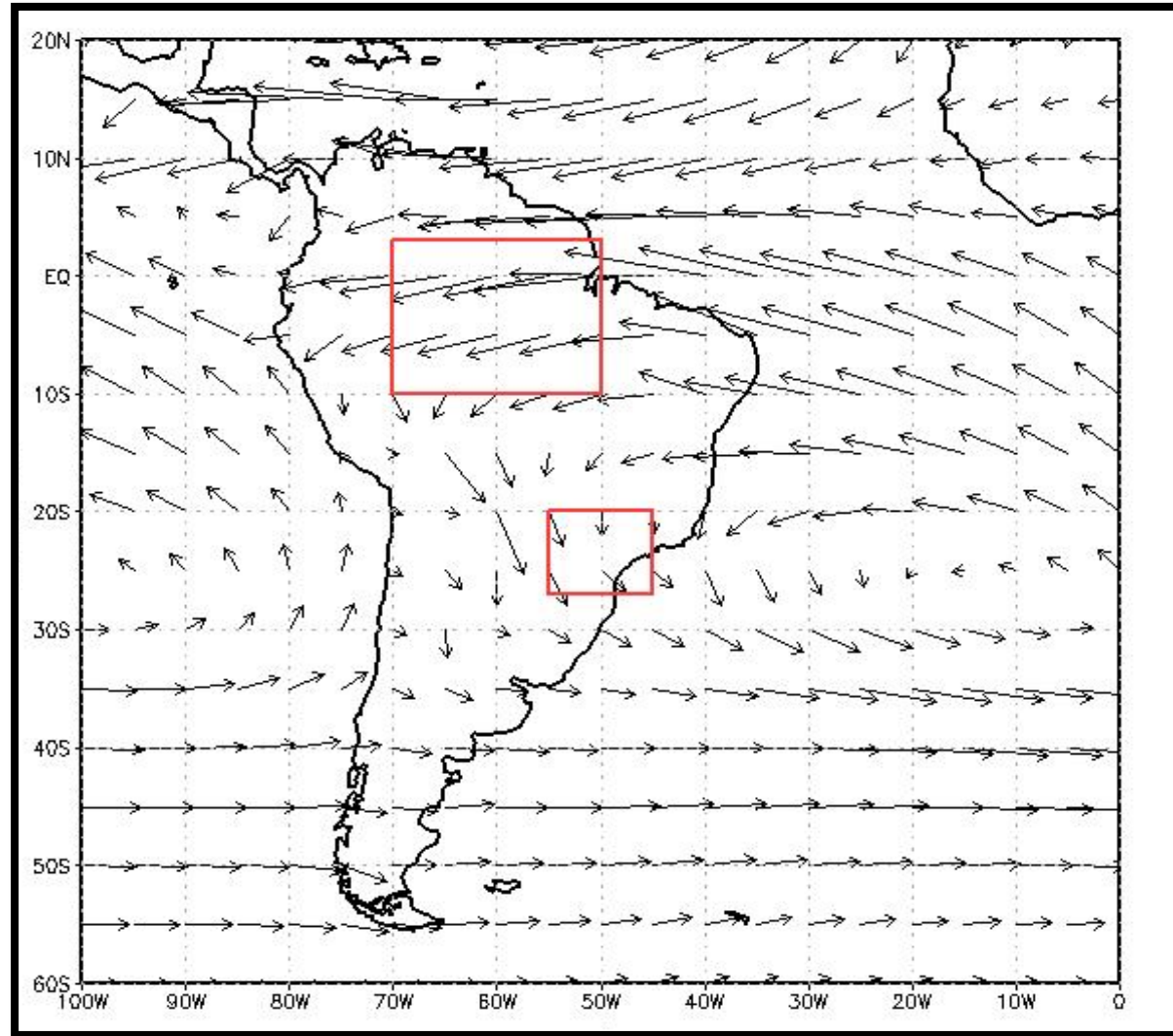
$$\bullet Qv = \frac{1}{g} \int_{pt}^{p_0} qv dp$$

Anomaly and Jet Stream

$$X' = Xi - \bar{X}$$

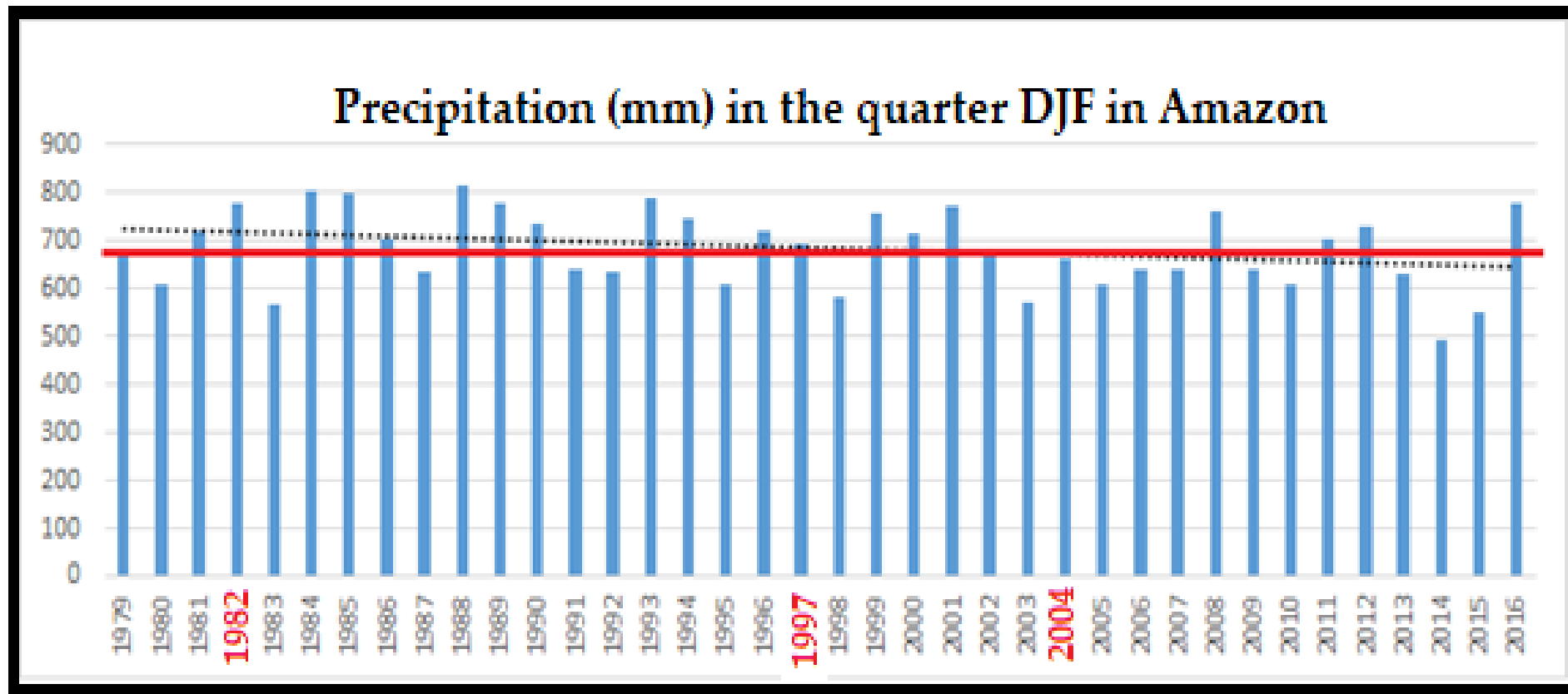
$$\sqrt{\mathbf{u} * \mathbf{u} + \mathbf{v} * \mathbf{v}}$$

Area Studied

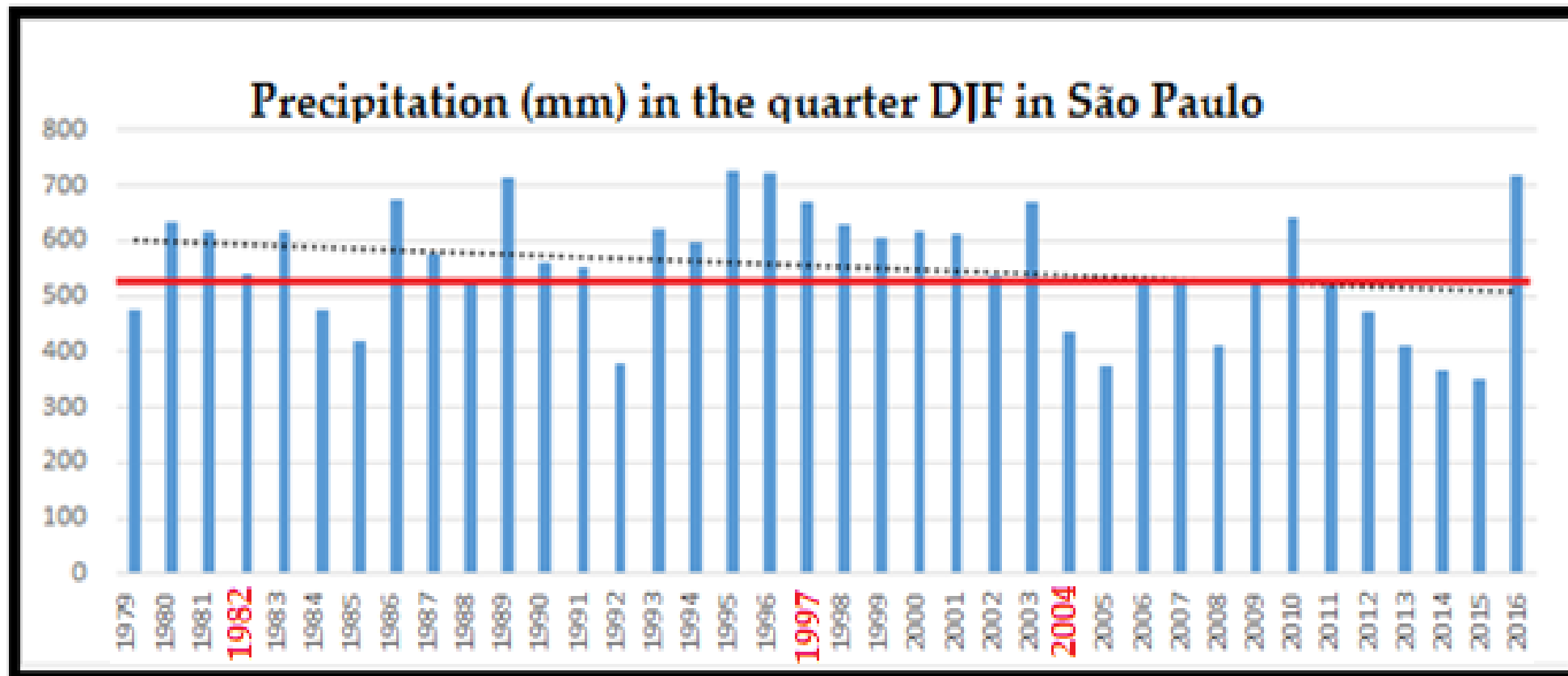


Results

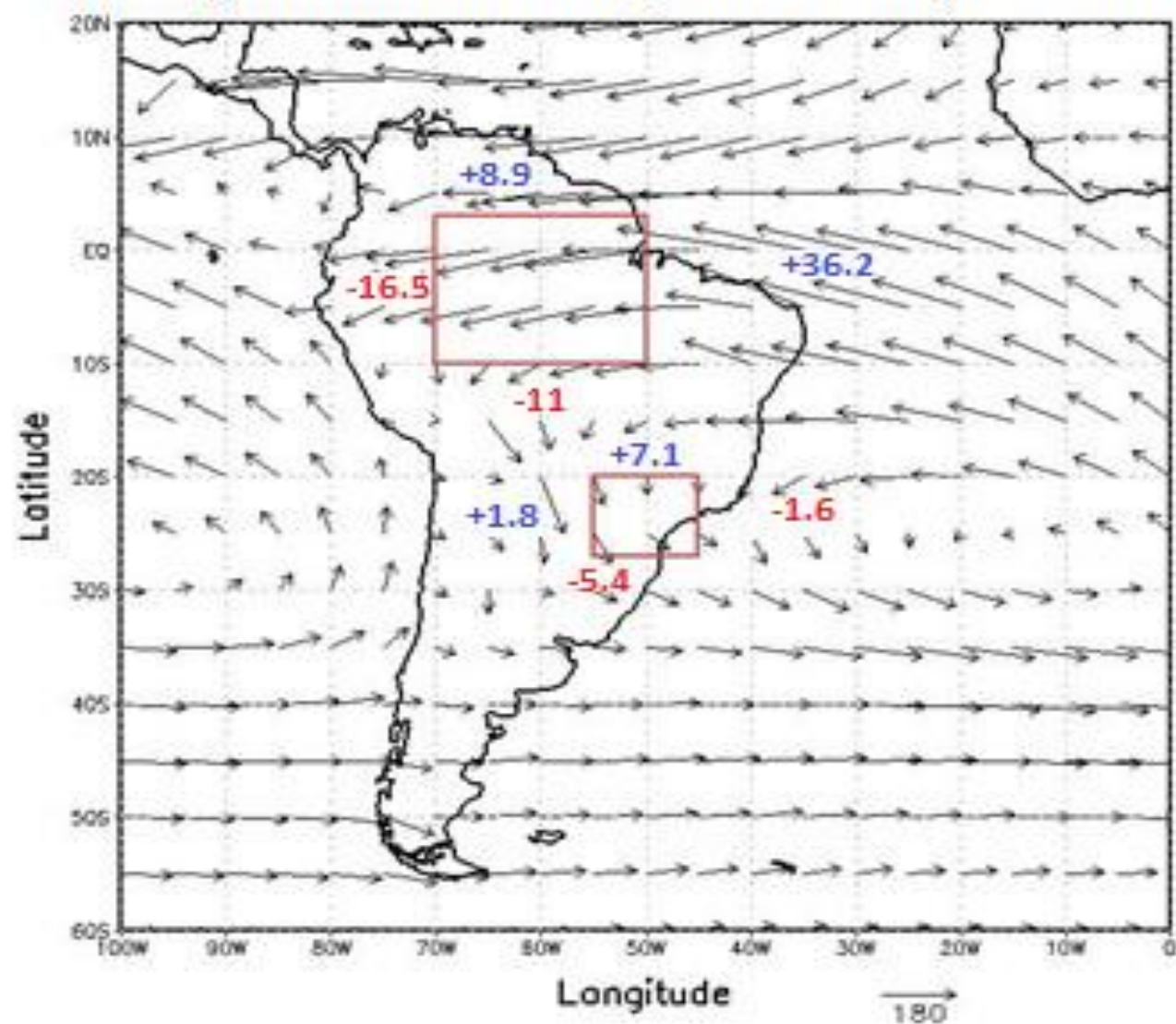
Time series of precipitation (mm) in the quarter DJF in the Amazon. ENSO years in red.



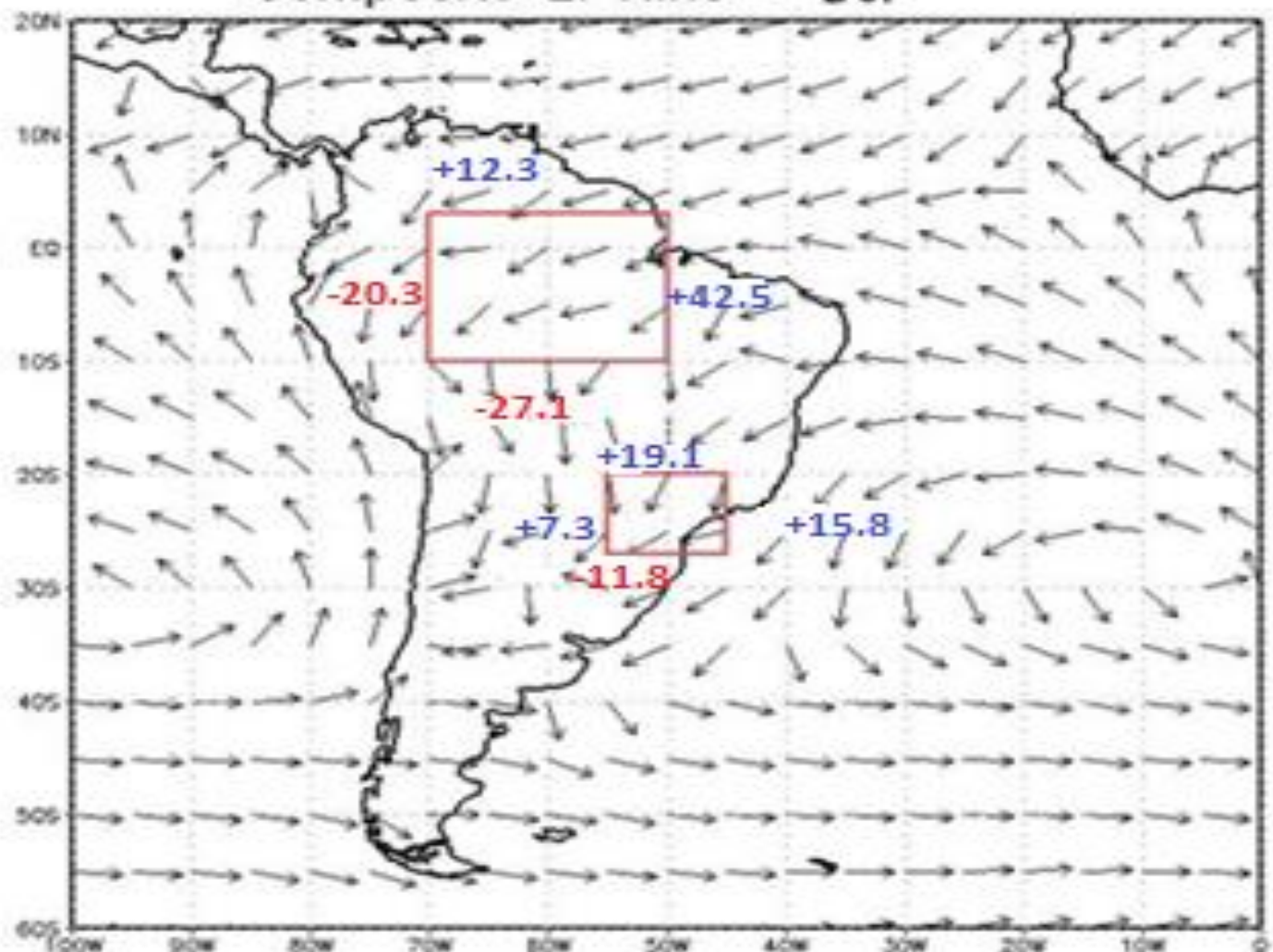
Time series of precipitation (mm) in the quarter DJF in São Paulo. ENSO years in red.



Avarage of Vertical Integrated Flow (1979 - 2015)



Composite El Nino - DJF



1982 1986 1991 1997

Longitude

180

Conclusions

- The detailed study of moisture transport in the DJF quarter, from the Amazon forest, to the Southeast region of Brazil, especially in São Paulo state, presented concrete data regarding the reduction of the integrated vertical moisture flow transport, which in the turn results in a decrease in precipitation. The years considered ENSO presented a difference of intensity when compared with neutral years, this means that the forest plays a fundamental role in the balance of these years, since in years of ENOS, the cold fronts can not advance to the southeast of Brazil.

References

- 1. ARRAUT, J. M. et al. Aerial Rivers and Lakers: Looking at Large-Scale Moisture Transport and Its Relation to Amazon and to Subtropical Rainfall in South America. *Journal of Climate*, v. **25**, n. 1, p. 543 - 556, Janeiro 2012. DOI 10.1175/2011JCLI4189.1.
- 2. ARRAUT, J. M.; SATYAMURTY, P. Precipitation and water vapor transport in the Southern Hemisphere with Emphasis on the South American Region. *Journal of Applied Meteorology and Climatology*, v. **48**, p. 1902-1912, Março 2009.
- 3. BORMA, L. D. S.; NOBRE, C. A. *Secas na Amazônia causas e consequências*. São Paulo: Oficina de Textos, 2013. 367 p.
- 4. CARVALHO, L. M. V.; JONES, C.; LIEBMANN, B. Extreme Precipitation Events in Southeastern South America and Large-Scale Convective Patterns in the South Atlantic Convergence Zone. *Journal of Climate*, v. **20**, p. 2377 - 2394, n. 15, 2002.
- 5. COELHO, C. A. S.; CARDOSO, D. H. F.; FIRPO, M. A. F. Precipitation diagnostics of an exceptionally dry event. *Theoretical Applied Climatology*, p. **16**, Junho 2015. DOI 10.1007/s00704-015-1540-9.
- 6. HERDIES, D. L.; DIAS, M. A. F. S.; FERREIRA, R. N. The moisture budget of the bimodal pattern of the summer circulation over South America. *Journal of Geophysical Research*, v. **107**, p. 42-4 42-10, 2002. DOI 10.1029/2001JD000997.
- 7. HOREL, J. D.; HAHMANN, A. N.; GEISLER, J. E. An investigation of the annual cycle of convective activity over the tropical Americas. *Journal of Climate*, v. **2**, n. 11, p. 1388 - 1403, 1989.
- 8. OBREGÓN, G. O.; MARENGO, J. A.; NOBRE, C. A. Rainfall and Climate Variability: longterm trends in the Metropolitan Area of São Paulo in the 20th century. *Climate Research*, v. **61**, n. 2, p. 93 - 107, 2014. DOI 10.335/cr01241.
- 9. SAMPAIO, G. D. O. *El Niño e você - o fenômeno climático*. 1. ed. São José dos Campos: Transtec Editorial, v. 1, 2001, 2001.
- 10. SILVA DIAS, M. A. F. et al. Changes in extreme daily rainfall for São Paulo, Brazil. *Climatic Change*, v. **116** (3-4), p. 705-722, 2012.
- 11. TEDESCHI, R. G.; GRIMM, A. M.; CAVALCANTI, I. F. A. Influence of Central and East ENOS on extreme events of precipitation in South America during austral spring and summer. *International Journal of Climatology*, v. **1**, n. 35, p. 2045 - 2064, July 2015. DOI 10.1002/joc.4106.