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INTRASEASONAL OSCILLATION IN THE SOUTH BRAZIL aDURING THE 2003-2005 DROUGHT

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1.INTRODUCTION

The intraseasonal oscillation (IO) here will be discussed in terms of being an oscillation in a season. In Brazil the IO has been studied by a number of authors (Ferraz, 2000, Schneider 2001, Vitorino 2002). The Madden-Julian oscillation (MJO), for example, is a global tropical intraseasonal oscillation that has impacts around the wolrd (Madden, R.A.; Julian, P.R., 1971, 1994).

Paegle and Mo (1996) discuss the alternating wet-dry regime in the South American, like a see-saw pattern.

Cavalcanti and Kousky (2001) investigated the 2001 drought period in Brazil and found remote influences over the affected region.

During the 2004-2005 years the Rio Grande do Sul State underwent a severe drought event that had strong influence on the development of the economical sector.

The goal of this work is to investigate the predominant atmospheric
oscillation scales as well as briefly discuss the circulation pattern associated with the recent drought in the south of Brazil, mainly in the 2003-2004 transition.

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2. DATA AND METHODOLOGY

The wavelet transform (WT) has been applied to a series of outgoing longwave radiation obtained from the reanalisys project (Kalnay, E. e colaboradores, 1996). An average in the region of 27,5°S – 32,5°S; 50°W- 55°W was performed, covering the most part of Rio Grande do Sul State (southern brazil).

The wavelet transform is a powerful tool that describes the evolution of an oscillation in the time-space domain.

The WT packet used here is adapted from the Torrence and Compo(1998).

In order to obtain the phase of the Role signal during the drought event it was also shown the real part of wavelet coefficients. A scale averaging was performed to clarify the influence of the respective phase on both the intraseasonal and semi-annual bands. We also calculated the energy of the meteorological signal (more details in Torrence and Compo (1998).

3. RESULTS AND DISCUSSIONS

3.1. A climatological view

The scale averaging graphic shows strong fluctuation in the 1986-1987, 1992, 1998 years (Figs. 1 and 2). It is interesting to note the energy in the semi-annual band (close to the 180 day oscillation). The scalogram reveals strong amplitude in 1982, 1986, 1990 and in the 2003-2005 period. The latter is the drought event in the southern Brazil.

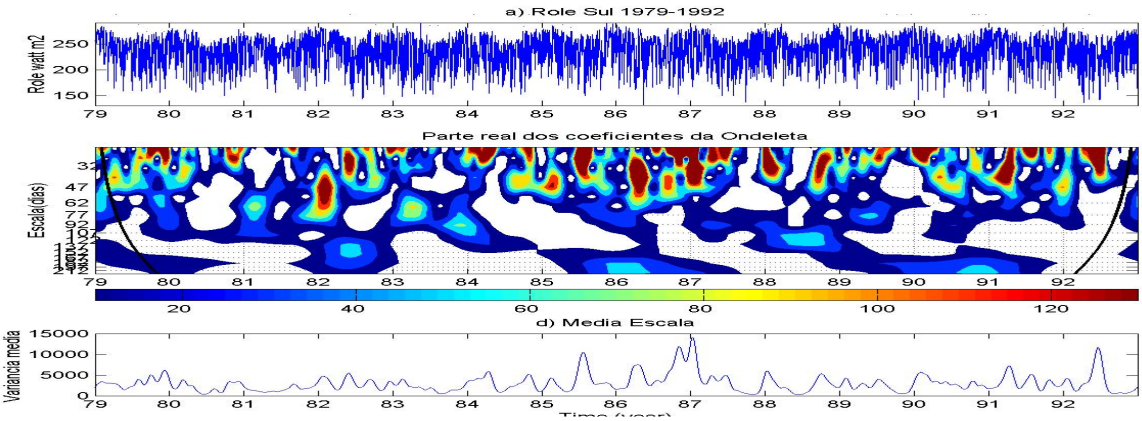

Fig.1. The (OLR) series (in watt m2 units), 1979 –1992 period (upper panel), the energy extracted by the wavelet transform (middle)-the influence cone appears in black line- and the 20-90 day energy scale averaging.

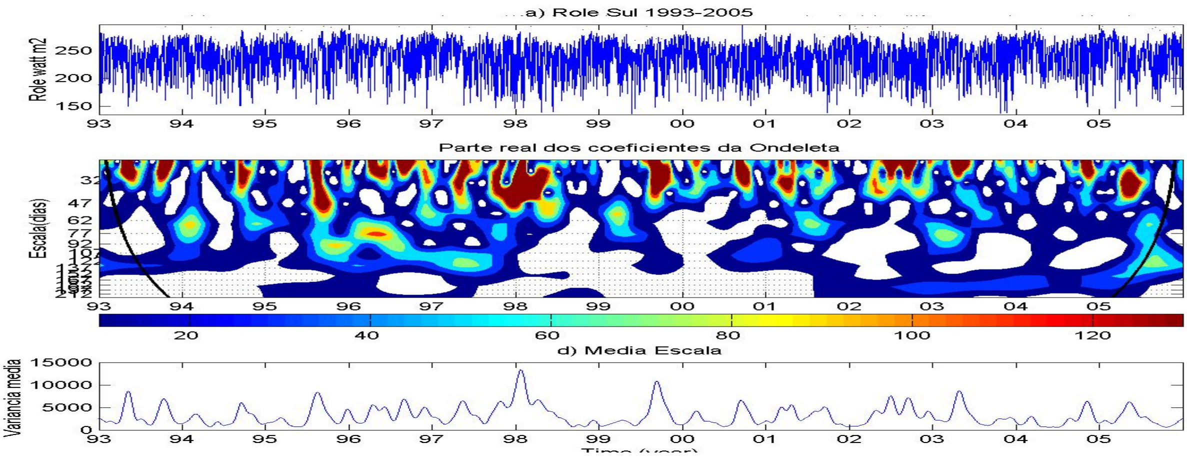

Fig.2 The same as fig.1, except for 1993-2005 period

3.2 The recent OLR phase evolution-oscillations associated with the drought event

The outgoing longwave radiation (OLR) series of 2000-2002 (upper part fig 1) shows an increase in the intraseasonal activity in the austral winter period of 2002. At this time, there is an enhancement in the amplitude of the real part of wavelet coefficients (middle) and in the semi-annual band. Thus, the 20-90 day scale averaging indicates (fig 1, lower panel) strong fluctuation.

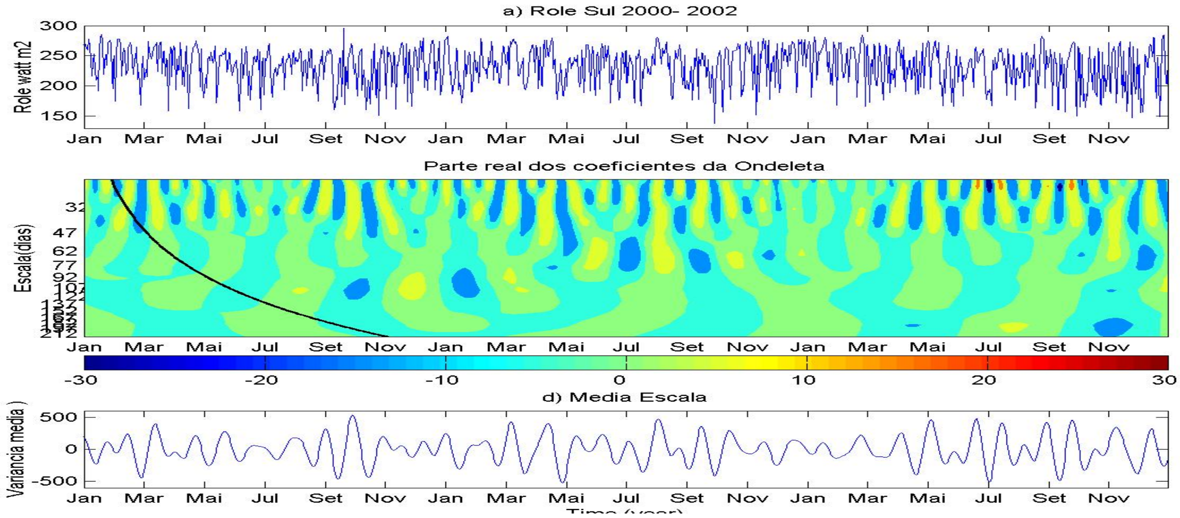

Fig. 3. The outgoing longwave radiation series (2000-2002) upper, wavelet transform of the real part of wavelet coefficients (middle) and the 20-90 day scale averaging (lower)

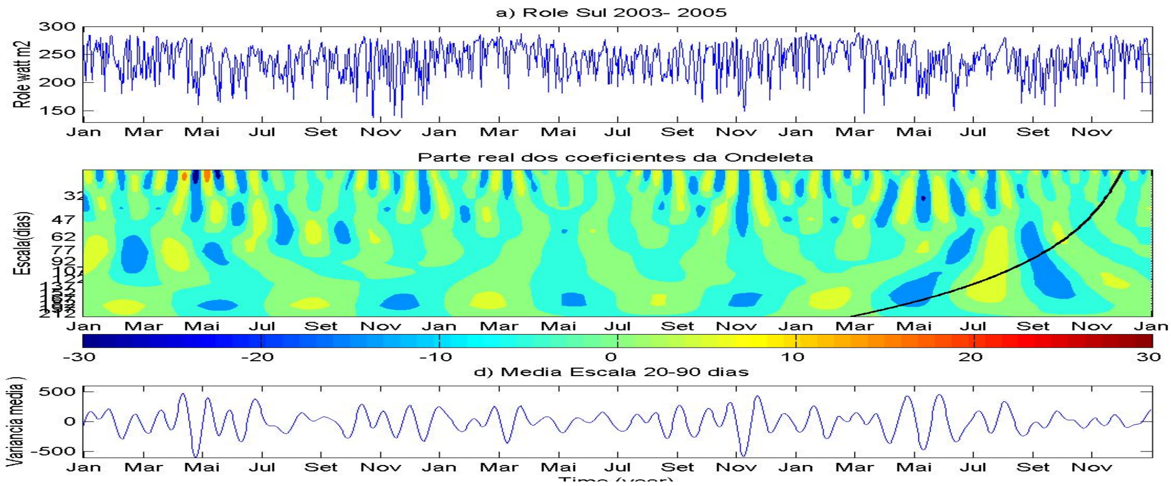

Fig.4 The same as Fig. 1, except for 2003-2005 period.

During the January-March months of 2003 to 2005 the drought phase of the semi-annual oscillation was responsible for the reinforcement of the drought scenario. This period has above normal evaporation conditions due to the high temperatures (austral summer) and the rain deficits.

There was a sharp transition between December 2003 and January 2004 due to the humid phase of 30 days (fig 4) and 180 days (fig 5). The strong active phase of the OMJ oscillation then ends in 2003 and the neutral conditions of Nino 1.2 area could be favorable to start and accentuate the drought.(the Pacific Convergence Zone shows a right displacement and create conditions higher than normal rain conditions in parts of southeast and northeast.

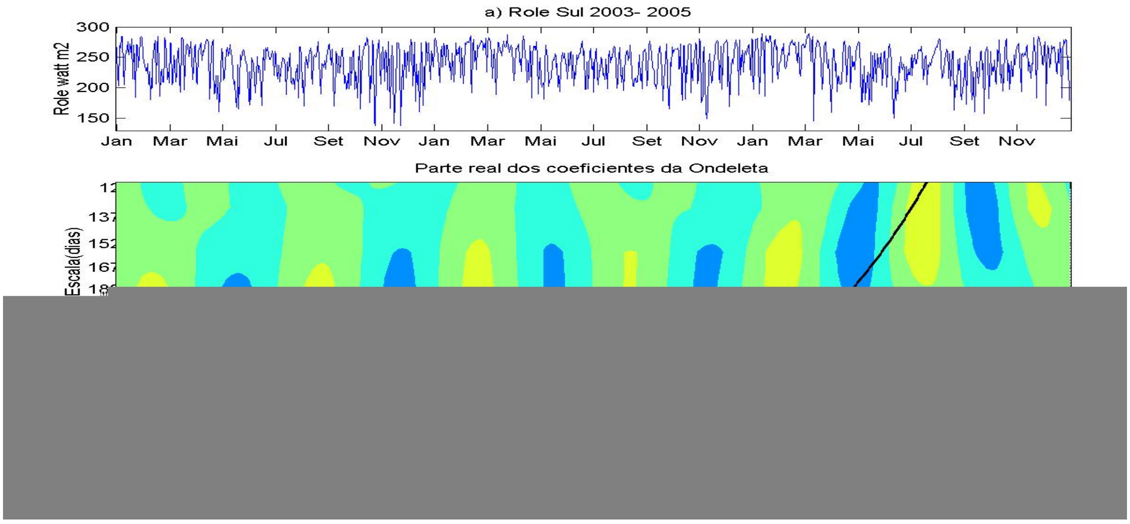

Fig.5. The same as Fig.2, except for a zoom in the 120-215 band.

4. Conclusions

Some predominant scales of oscillation in the 1979-2005 period have been identified. It was discussed with particular interest the 2003-2005 period, when it was observed a relative contribution of the semi-annual phase oscillation on the drought enhancement period, coinciding with a neutral Nino condition and a strong OMJ active period.

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