REPORT OF THE SECOND PROSUL MEETING IN ASSUNÇÃO

"Simulations and experiments using CPTEC/COLA AGCM to analyse precipitation anomalies over Southern/Southeastern South America"

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Several studies on the PROSUL/IAI project performed and in development were shown in my presentation. All these studies show results of the CPTEC/COLA AGCM with emphasis to the Southern/Southeastern Region-SSA (La Plata River Basin). Two of them were presented in the Argentina Meteorological Congress, "Seasonal precipitation anomalies in El Nino 82/83 and La Nina 88/89 simulated by the CPTEC/COLA AGCM "**,** by IFA Cavalcanti; A Grimm; VBarros, and "Extreme cases of seasonal precipitation anomalies over SSA and the prediction by the CPTEC/COLA AGCM", by IFA Cavalcanti, JA Marengo, CA Nobre, M Nunez.

These two studies show anomalies of precipitation over SSA, simulated and predicted by the model and compared to observed data. Anomalies in El Nino and La Nina years are very well simulated by the model, when the observed SSTs are used as boundary conditions. In the prediction cases, the anomalies present the same signal as the observations, in large areas of the SSA, in several seasons of the period 1998-2000.

Other studies in development, were presented : "Hydrological balance and sources of humidity for the SSA as simulated by the CPTEC/COLA AGCM ", by D.A Rodriguez, I.FA Cavalcanti, C.S.Chan.

This study is part of a Master thesis at INPE. From the AGCM results it is seen that analysis of balance for the southern South America need to be performed considering the two sectors north and south separatelly. Eventhough the La Plata river basin extends from the northern to the southern sectors, it is seen that the components of the water balance have a different behaviour. These differences are enhanced when cases of extreme precipitation anomalies are analysed, as in 82/83 and 88/89.

Fig.1 show moisture flux in the summer of 82/83 and 88/89. During the spring and summer of 82/83, precipitation was higher than during the same period of 88/89 in the southern sector. The differences between the two opposite cases were detected in the low level wind flow, humidity and moisture flux. In the first case, there was flow at low levels from the tropical Atlantic towards the continent and from the Amazonia region southwards to the region of intense precipitation. In the other case the flow at low levels was weaker from the tropical Atlantic Ocean to the continent and the flow was directed from Amazonia to the northern sector of the region. The differences of moisture flux between the two years enhance the meridional component directed southwards.

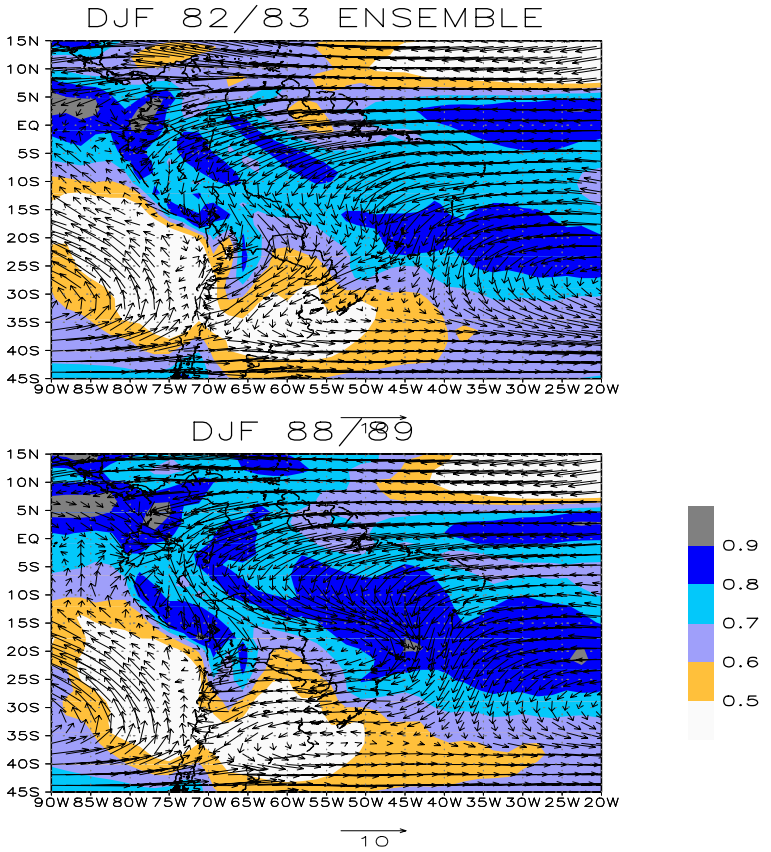


Fig.1- Moisture flux at 850 hPa, in DJF 82/83 and DJF 88/89 from the CPTEC/COLA AGCM simulation

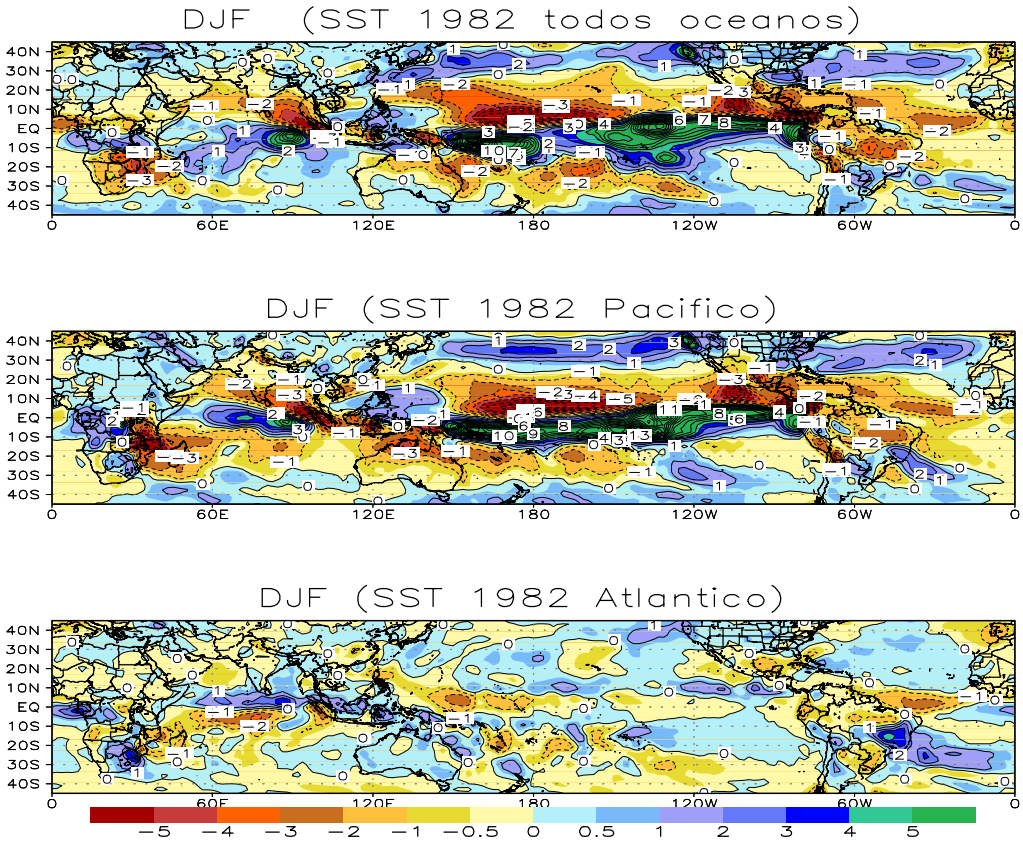
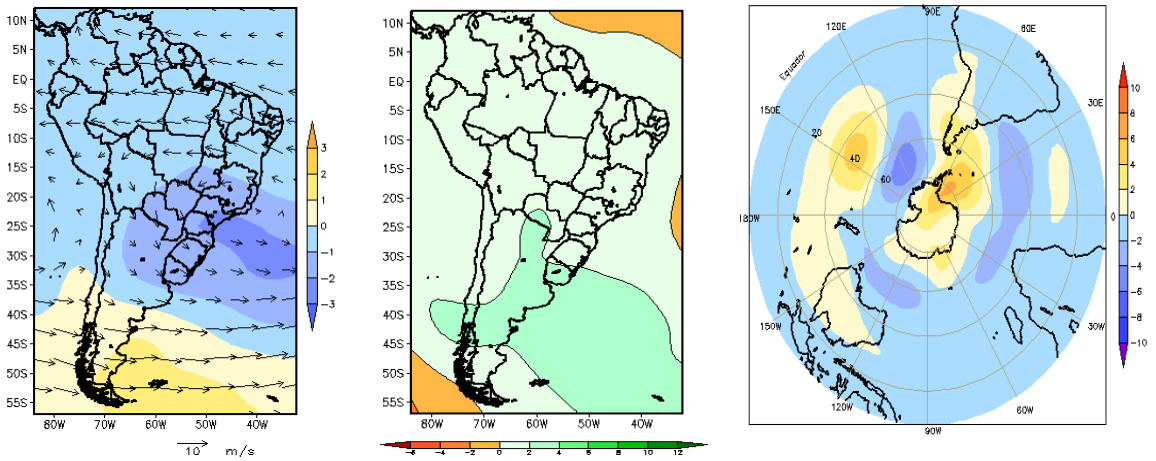


Fig.2- Precipitation anomalies from 3 simulations considering (a) SST of all oceans, (b) SST only in the tropical Pacific, (c) SST only in the Atlantic Ocean.

Other study that has the colaboration of other groups of PROSUL, is:" Influence of the Pacific and Atlantic Oceans on the La Plata river basin precipitation", by IFA Cavalcanti, A Grimm, P.L.Silva Dias, C.C.Castro, A Cardoso.

Fig. 2 shows the influence of the Pacific and Atlantic Oceans on the precipitation of SSA. It is seen that the precipitation anomaly over SSA is influenced by the Pacific Ocean , and that the influence of Atlantic Ocean is opposite to the observations and when all oceans are applied. The Atlantic Ocean tends to form an enhanced SACZ, and then, induces subsidence over SSA and deficit of precipitation.

Two more studies which are part of the research activities of PROSUL and have the colaboration of Cleber A Souza who has a schollarship of PROSUL/IAI, are :"Monthly atmospheric characteristics associated with cold air over SSA", by IFA Cavalcanti, CA Souza, which was presented in the workshop " *Extreme climatic events in South America: tropics-extratropics,Links during modern and past times"*, December 3rd and 4th 2001.
Monthly temperature anomalies (reanalysis NCEP/NCAR) at 1000 hPa were averaged over two areas of Southern South America and timeseries were constructed to analyse the extreme anomalous cold months. The study shows the composites of temperature at 1000 hPa, wind field at 850 hPa, geopotential at 500 hPa and wind field at 200 hPa of negative anomalous months from april to august, considering Area 1 (48W-60W;25S-40S) and Area 2 (40W-53W; 15S-25S). The results show that the monthly characteristics are similar to daily characteristics found in previous studies**.** The same analysis is being developed with daily model results. **Fig.3 shows the main features : the negative temperature anomalies extending in a large area of southern South America and sea surface high pressure over southern South America. Another common feature is the low geopotential center over southeasthern South America and high geopotential over the southern tip of South America and Southeast Pacific. These are characteristics found in daily analysis of frost occurrences in Brazil, and it is seen that they are also associated with cases of colder than normal months over the two analysed regions.**



(a)

Fig.3-Example of average fields in cases of july (1979-1997) extreme low temperature in area (40^0W-53^0W; 15^0S-25^0S). (a) Wind flow at 850 hPa, (b) Sea surface pressure anomaly, (c) geopotential height anomaly at 500 hPa.

Another study, with collaboration of Cleber A Souza is "The low level jet east of Andes in the NCEP/NCAR reanalysis and CPTEC/COLA AGCM simulations, by IFA Cavalcanti , CA Souza and V.Kousky, apresentado na Conferência on South American Low-Level Jet, 5-7 fevereiro, 2002, Bolívia.
Several features related to the LLJ occurrence were identified in the seasonal climatology analysis, and the model could simulated these features, as the maximum at 850 hPa, low geopotencial over southern South America, and precipitation over SSA associated with the

LLJ. The model could not get many cases in the summer, likely related to the enhancement of the SACZ during this season.

Conclusion

The model is able to simulate/predict extreme seasonal precipitation anomalies associated with ENSO, over SSA.
The model simulates the differences of moisture flux from the Atlantic Ocean and Amazonia in the wet and dry cases over SSA.
Experiments show the Atlantic and Pacific Ocean influences on precipitation over SSA.
Extreme cold months over SSA have a well defined monthly atmospheric characteristic.
The model can reproduce the main features associated with the occurrence of the LLJ.

Planned activities in the project are being developed in colaboration with other co-Pis. Argentina (CIMA,UBA) and Brazil (USP, UPR)