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Preliminary study of a MCS on the La Plata Basin Using Numerical Simulation and Reanalysis Data

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I- INTRODUCTION

An intense Mesoscale Convective System (MCS) that occurred in Southern South America between November 29th to 30th 2009 was analyzed in this study. This system had been associated with severe weather conditions. In some areas of the state of Rio Grande do Sul, Brazil, the winds of the order of 100 km/h and precipitation higher than 50 mm in 24 hours were observed, causing serious damages in several cities.

II-DATA AND METHODOLOGY

➢ ERA-Interim reanalysis, with spatial resolution of 1.5 ° x1, 5 ° lat/lon: it was used to generate meteorological fields in order to analyze the synoptic situation associated with the formation of the MCS.

➢The MCS was simulated using the Brazilian Developments on the Regional Atmospheric Modeling System (BRAMS) with spatial resolution of 15 km and 38 vertical levels, and outputs each 1h from November 28th 2009, 12UTC, during 24h, and the initial and boundary conditions from 12UC.

➢Precipitation observed data: to analyze the simulated precipitation fields, we used a precipitation field from raingauge network from several Brazilian institutions (http://clima1.cptec.inpe.br)

➢ A technique called MERGE, used to combine Tropical Rainfall Measuring Mission (TRMM) satellite precipitation estimates with surface observations over the South American, (Rozante et al., 2010) was used to compare the precipitation simulations of the model BRAMS and the precipitation of the reanalysis

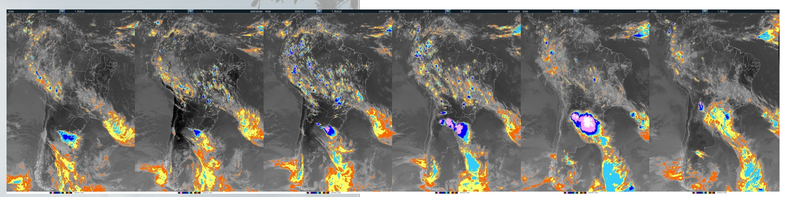

Figure 1. Sequence of satellite images related to the enhanced infrared SCM on 11/29/2009 at 12, 18 and 21 UTC and at 00, 06 and 12 UTC on 11/30/2009. From DSA/CPTEC/INPE

III-RESULTS

According to data from the reanalysis and satellite imagery, the MCS was associated with a cold front. We observed the presence of a low pressure center in northwest Argentina located at west of the MCS. Moreover, it was found that the system formed downstream of a Low Level Jet (LLJ) east of the Andes mointain. Strong warm and moist advection in the layer between the surface and 850 hPa, associated with the dowstream LLJ, toward the western region of Rio Grande do Sul was found, where we observed the occurrence of maximum precipitation.

In upper levels, the presence of the jet stream contributed to the formation/intensification of MSC, since this system was observed at the entrance of the equatorial jet stream at high levels. The BRAMS simulated the major features observed in synoptic fields generated with the reanalysis. However, it was found that the axis of LLJ was shifted to the northwest, over the eastern region of Paraguay. Thus, the downstream LLJ was verified over state of Parana. When we compared the simulation of accumulated precipitation and observed precipitation, it was found that the model shifted the maximum rainfall occurred west of Rio Grande do Sul to Paraguay, possibly due to the displacement of the LLJ for this region.

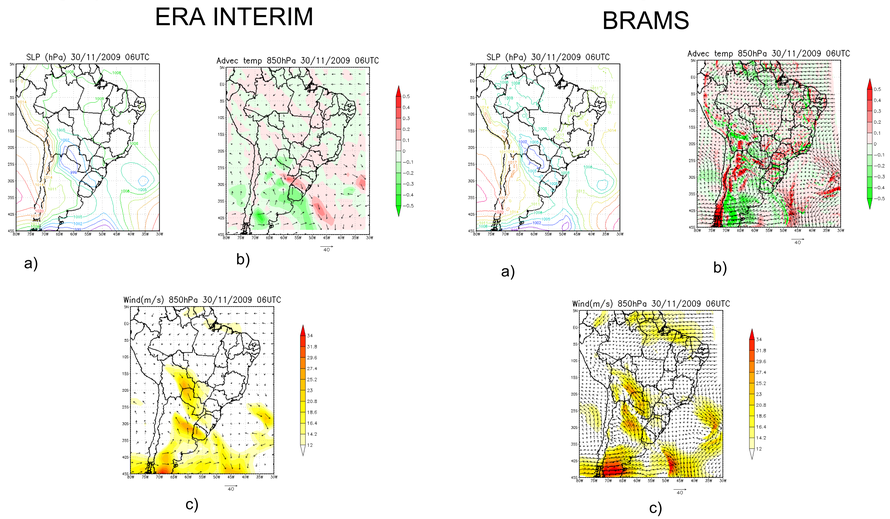

Figure 2. a) Sea level pressure, b) temperature advection and c) wind in850 hPa, in the left panel, ERA INTERIM and in the right panel, from BRAMS data.

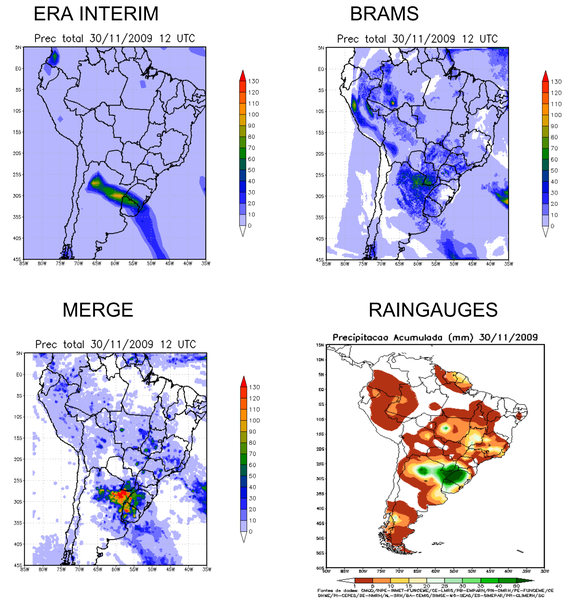

Figure 3. a) Total precipitation (mm) on 11/30/2009 from a) ERA INTERIM, b) model BRAMS, c) MERGE, d) CPTEC/INMET raingauge.

IV-CONCLUSION

The model BRAMS simulated satisfactorily the main features associated with the life cycle of the MCS when compared with the reanalysis field. The simulation for this MCS event described the spatial distribution of precipitation shifted slightly westward, thus not affecting the regions where the observed accumulated rainfall were higher.

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