FLASH FLOOD EVENT OVER CENTRAL ARGENTINA: A CASE STUDY.

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I. INTRODUCTION

Flash flood events occur within minutes or hours of excessive rainfall, this kind of events can destroy buildings and triggers catastrophic situations due to sudden water stream (Davis, 2001). The central region of Argentina presents a flat terrain with a weak slope to the Atlantic Ocean. March 26 to April 1, 2007 was a week characterized by a great number of mesoscale convective systems developed over the whole central region of this country generating strong rain rates. Santa Fe and Entre Rios (Fig. 1) province were principally affected by the presence of successive convective systems that generate strong rain rates flooding large areas and producing important damages in the area and lost of lives. A primary goal of the present work is to describe the synoptic and mesoscale characteristics of the environment associated to a flash flood over the central region of Argentina, that principally affect the cities of Rosario and Gualeguaychú.

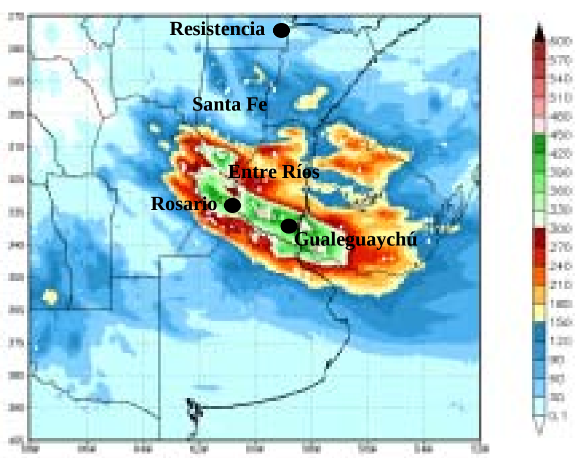


Figure 1: CMORPH precipitation estimation from March 26th at 13UTC to April 1st at 12 UTC. Geographical regions and cities mentioned in the text are shown.

II. METHODOLOGY

Global Assimilation data System (GDAS) with 1 degree horizontal and 6 hour resolution and upper-air soundings are considered to describe the evolution of the meteorological variables of the environment

In order to describe the evolution of the successive mesoscale convective systems that affect the area of interest and their impact on precipitation rain rates, satellite images every half hour with 4km resolution (Janowiak et al. 2001) and satellite estimation every one hour (CMORPH, Janowiak et al. 2005) are used. 24 hour accumulated precipitation is used to validate CMORPH data with a good performance over the area, but it is import to consider this kind of information due to the lack of hourly rain rate over the area. A clusterization and tracking technique called Forecasting and Tracking of Active Cloud Clusters (ForTraCC) are employed to determine the life-cycle of the systems (Machado and Laurent, 2004).

III. RESULTS AND CONCLUSIONS

III.1 Synoptic and Mesoscale features

The role of the large scale processes are essential in the development of deep moist convection, this situation is characterized by the presence of a strong trough centered on 75°W, the presence of this system generate an important advection of cyclonic vorticity over the central part of the country. This system remain stationary over the whole studied period. In addition, the jet stream at 200 hPa is located over 40°S and evolves to the east reaching the maximum intensity on March 30. A cold front associated with these large scale features advances to the north-east from 42°S and cross the studied area on April 1st.. These synoptic environmental features present the ideal conditions to the formation of convection, because they establish a favorable situation associated with large scale vertical ascent.

The thermodynamic environment is characterized by strong CAPE at Resistencia and the presence of a deep flow from the north that shows a low-level jet profile. On March 26 at 12UTC, CAPE presents a value of 3061 for the parcel from surface and 3260 from the parcel at 900 hPa. A strong low-level jet profile persist over the whole studied period, showing an extreme value of 45 knots at 850 hPa on March 28 at 12 UTC. This low level jet structure is possible to be detected also in GDAS data with extreme values of 18 ms^{-1} close to Resistencia, associated with an strong moisture flux from the north that persist over the whole period.

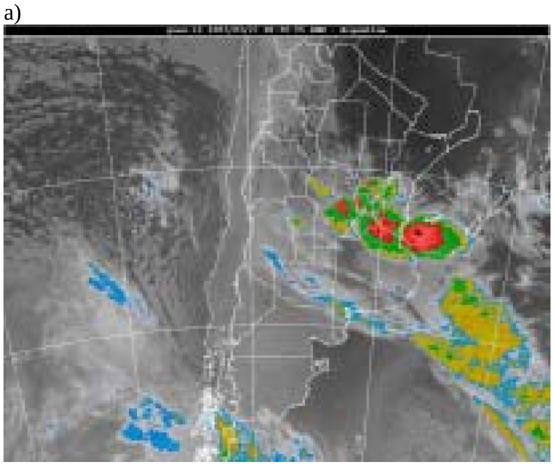
The thermodynamic and dynamic conditions present in this situations generate the lifting mechanisms that favor the development of convection in a restricted area of the country. These conditions favor the development of strong convection associated with strong rain rates that produce flooding areas all around the south of Entre Ríos and Santa Fe.

III.2 Convection Activity

The convection activity over southern region of

Entre Ríos and Santa Fe is characterized by the presence of six mesoscale convective systems that develop ahead of the cold front. They generate and decay over the same region and produce strong rain rates over the flooded area. ForTraCC analysis considering the IR brightness temperature threshold of 218 K shows that all systems tend to generate during the beginning of the night and decay during the day. The maximum extension of the systems varies from small systems to the bigger on March 29 at 8Z that cover all area. The most important estimated rain rate registered over the studied period over Rosario and Gualeguaychú occurs on March 27 at 8 and 4 UTC respectively associated with the evolution of different systems, but the most important rain rate estimations were close to 70 mm h^{-1} on March 29 close to the center of Santa Fe.

a)



b)

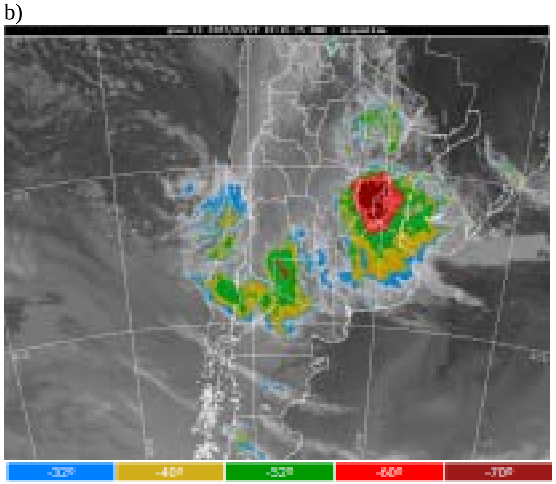


Figure 2: IR Brightness Temperature on a) March 27 at 4:30 UTC and b) March 29 at 8 UTC. (Figures where extracted from www.meteofa.mil.ar).

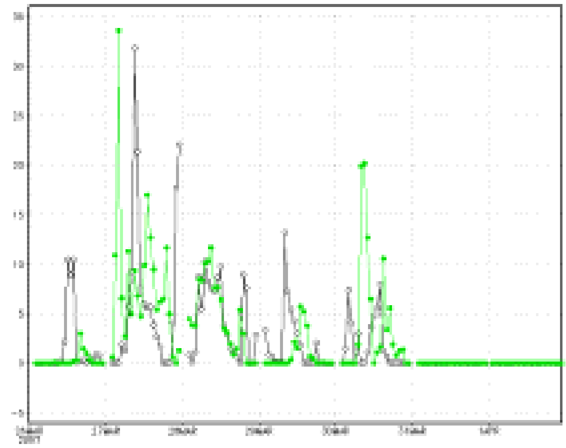


Figure 3: Hourly rain rate estimation from CMORPH at Rosario (Black) and Gualeguaychú (green) from March 26 at 0UTC to April 1 23 UTC.

IV. AKNOWLEDGMENTS

This research is supported by UBA grant X266, ANPCyT grant Nº PICT 07 – 14420 and CONICET PIP N° 5582.

V. REFERENCES

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