

ANALYSIS OF PRECIPITATION IN WRF OPERATIONAL SIMULATIONS IN CASE OF INTENSE CONVECTION OVER RIO GRANDE DO SUL STATE: DECEMBER, 11, 2012 CASE STUDY

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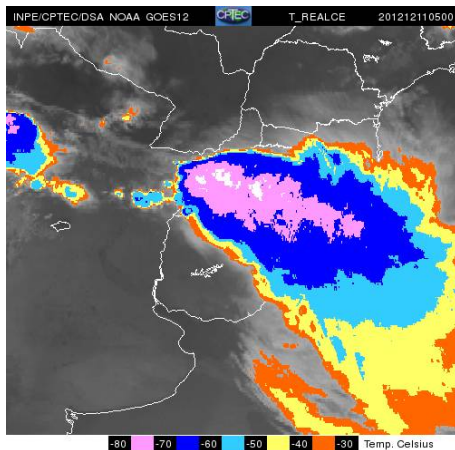
Universidade Federal de Santa Maria

May, 2013

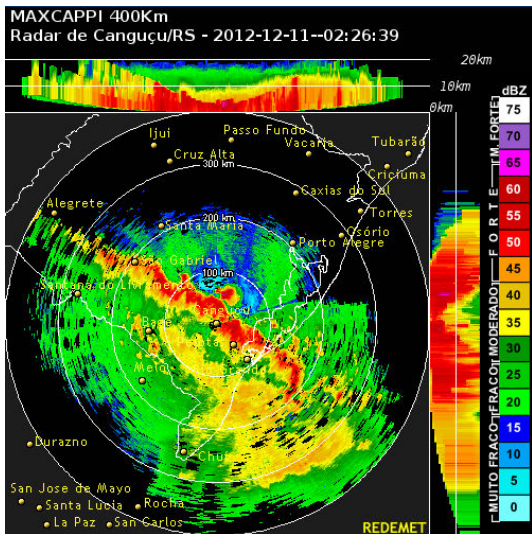
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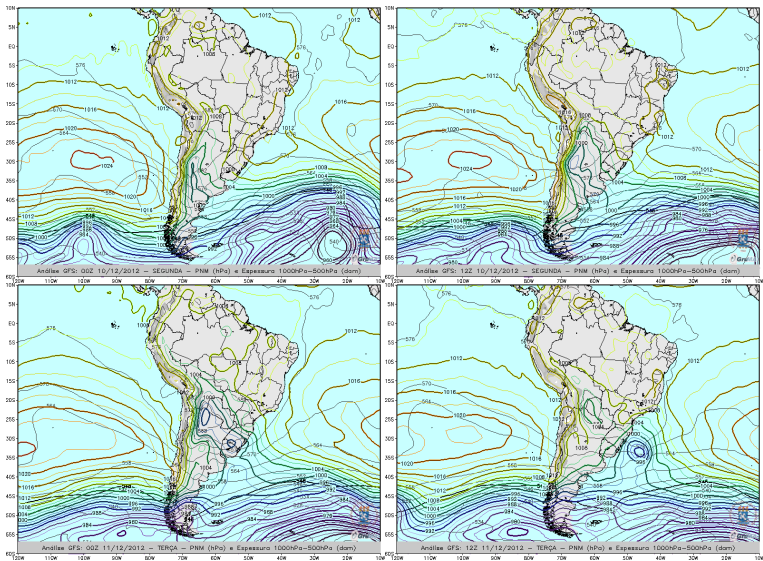
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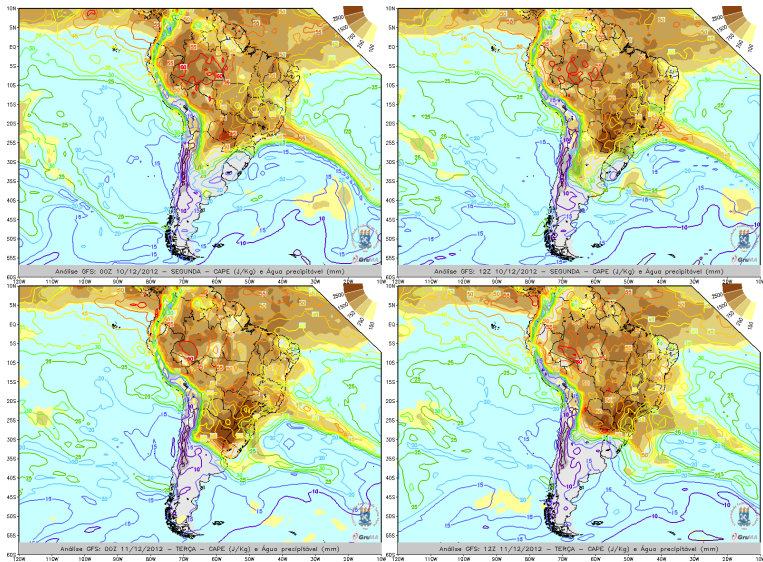
- In early morning December,11 a MCS passed over RS State;
- Causing many records of extreme rainfall and damages.



- A strong squall-line system.

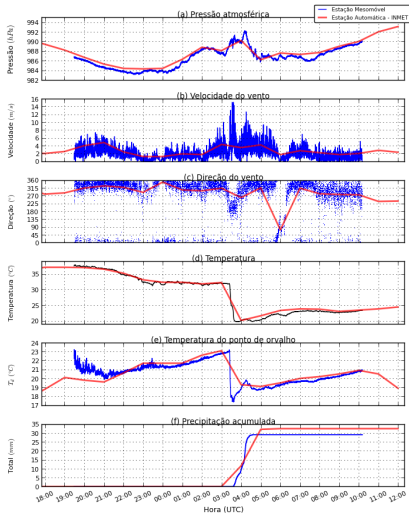






Over Santa Maria, the atmospheric conditions are:

Séries temporais - 10 e 11/12/2012



Objectives:

- Define the skill of the model to simulate operationally a strong convective system?
- What is the function of low resolution simulations to describe the mesoscale system?
- Over the entire RS do we have the same conditions?

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The Model:

WRF Model v.3.3

BC - GFS 1 degree each 6 hours.

Basic description:

- Two nesting grids (HR: 48 and 12km and 26 lvl.);
- With feedback between grids;
- Parameterizations Convection: Kain-Fritsch scheme
- PBL: YSU Scheme
- lw rad: RRTM Scheme
- sw rad: Dudhia Scheme
- Microphysics: Lin et al. Scheme

6 hours of accumulated rainfall (18Z 10/12 to 18Z 11/12) were analysed in two operational runnings and one final analysis runnings:

Operational:

- 36h previous: Dec, 9 initialized at 12Z - Op09
- 12h previous: Dec, 10 initialized at 12Z - Op10

Analysis:

- Started: Dec, 9/00Z - Control

Evaluating the differences between operational simulation and analysis simulation (control-C), using:

- Root Mean Squared Error (RMSE)

$$RMSE = \sqrt{\frac{1}{n} \sum_{i=1}^n (C - P)^2} \quad (1)$$

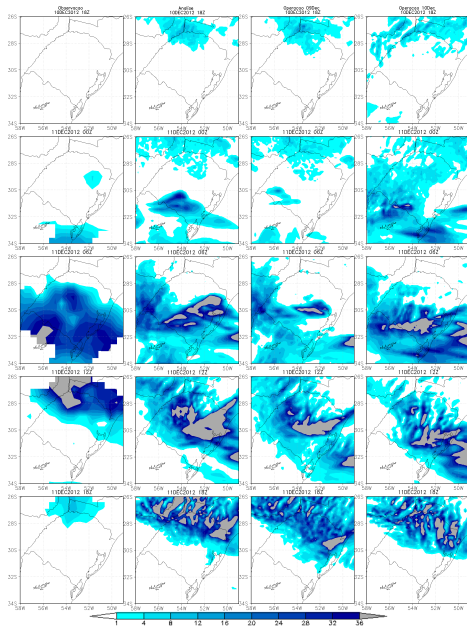
- HK score (Hanssen and Kuipers, 1965)

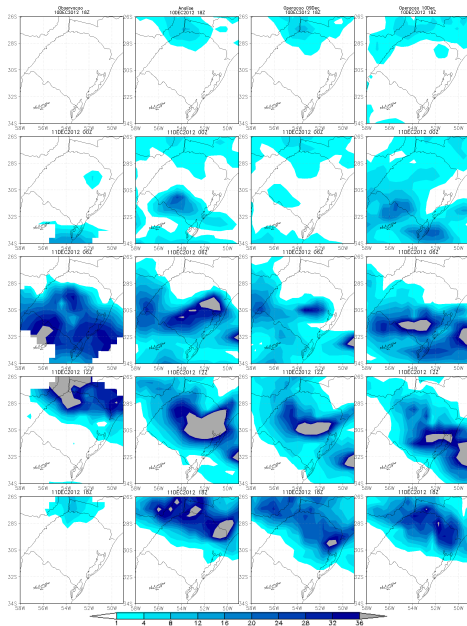
Forecast	Analysis	
	Yes	No
Yes	U11	U10
No	U01	U00

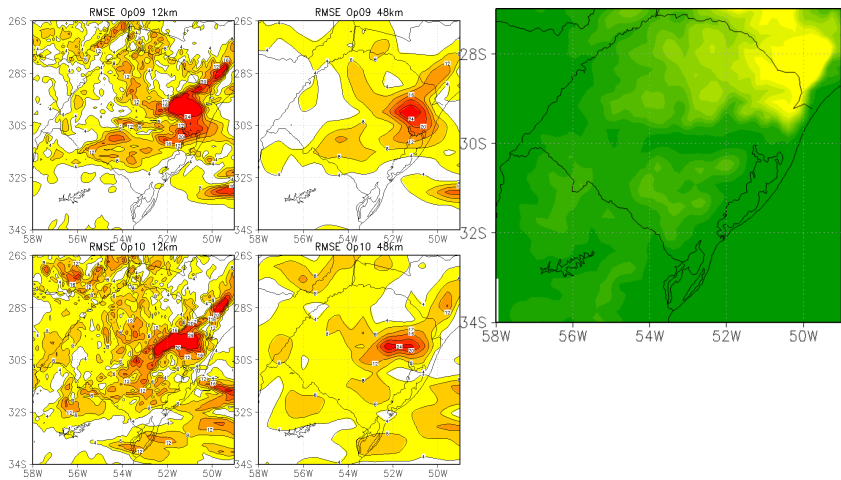
$$HK = \frac{(U11 * U00) - (U10 * U01)}{(U11 + U01) * (U10 + U00)} \quad (2)$$

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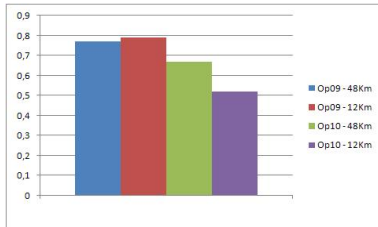
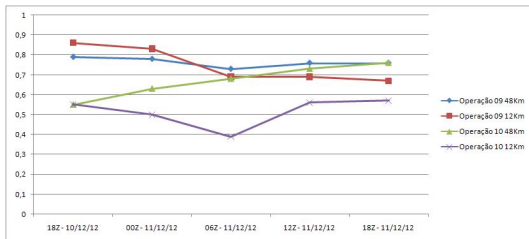






- The Op09 and Op10 shows the increase of RMSE in regions of high topography gradient;
- In the Op10, RMSE had a decrease of maximum magnitude error but with increase of coverage area with minimum of 4mm/6h.

HK Score



- The simulations with lower resolution (Op09 and Op10 with 48km) have a high skill during each individual analyzed time;
- In Op09 (36h before the system) the total skill is highest, especially in 12 km simulation.

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- The importance of the topography in rain simulations in RS, especially in regions of transitions, suggests the use of simulations with different or adaptative resolutions to each microarea.
- Also showing the applicability of low resolution simulations as a **qualitative** tool to evaluate rain occurrence additionally with high resolution simulations.

Thanks!
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