SENSITIVITY STUDY OF BRAMS FORECAST IN AN ORGANIZED MESOSCALE CONVECTIVE EVENT

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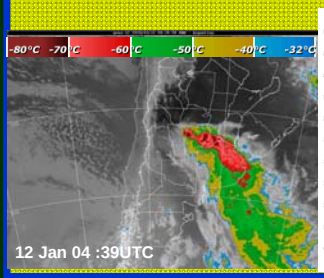
Motivation and Purpose

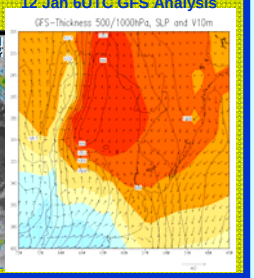
Heavy rainfall and other severe phenomena related to deep convection and their forecast is a major problem in different geographical regions. Southeastern South America is particularly affected by large and intense mesoscale convective systems within which severe events develop. The main objective of the present work is to study BRAMS forecast sensitivity to different initial conditions, vertical resolution and settings on cumulus parameterizations and on cloud microphysics scheme for a case study in order to progress in the forecast of these severe events .

Case study:

During early morning of January 12, 2010 an extended convective line developed in association with a cold front that propagated over the central and northern part of Buenos Aires Province, Argentina. Related storms produced severe winds (reported gusts exceeding 30 m/s) in different locations around the city of Buenos Aires.

✓Cold front close to northern Buenos Aires
✓Organized convective activity





Methodology:

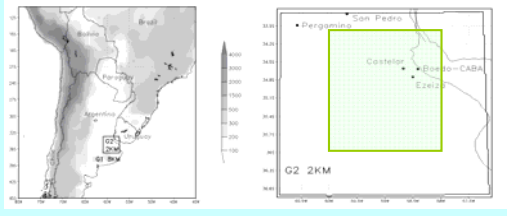
5 Numerical forecasts of the case study were performed using the Brazilian model Regional Atmospheric Modeling System (BRAMS).

CONTROL RUN features

- ❖Initial condition at 11 January 18UTC, 18 hours forecast
- ❖Initial and boundary conditions provided by BRAMS 20km horizontal resolution forecasts
- ❖Two-way nesting, two grid of 8 and 2 km horizontal resolution
- ❖Microphysics bulk water two moment, 8 water species
- ❖Shallow and deep convection parameterizations were not activated
- ❖Vertical resolution, DZ=10m, 65 vertical levels, 24 above 1500 m

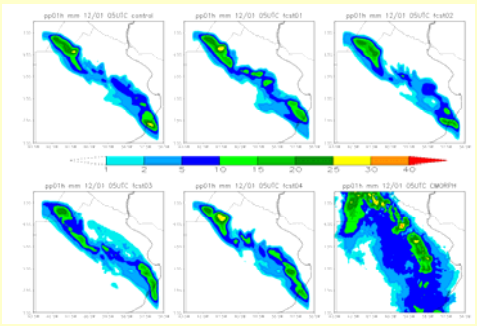
Sensitivity experiments characteristics Changes from CONTROL RUN

FCST01	Initial condition at 11 January 21UTC
FCST02	Microphysics bulk water one moment
FCST03	Grell and shallow cumulus parameterization activated at 8km horizontal resolution
FCST04	Coarse vertical resolution, DZ=20m, 50 vertical levels, 18 above 1500 m

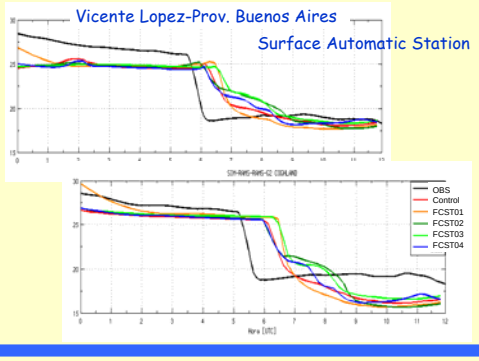


Model forecast performance was compared against measurements from radar, CMORPH estimations (8km-30min) and surface observations available in the region.

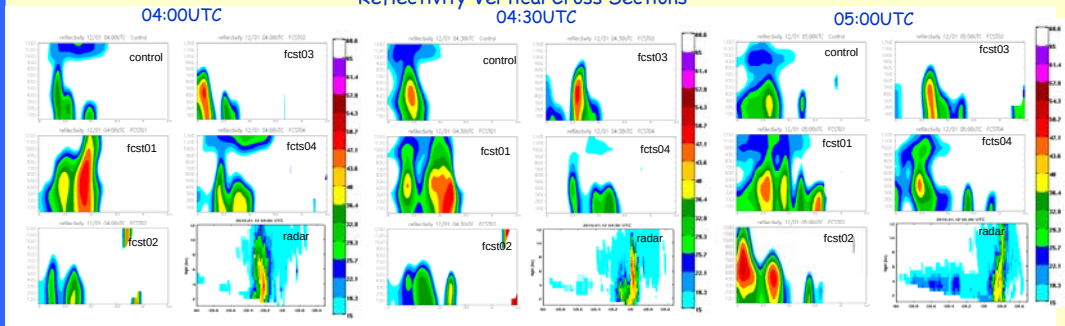
Accumulated precipitation between 4 and 5 UTC. Forecasts and CMORPH



Vicente Lopez-Prov. Buenos Aires
Surface Automatic Station



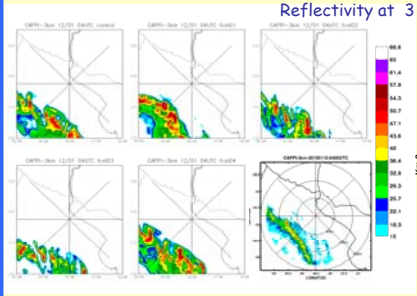
Reflectivity Vertical Cross Sections



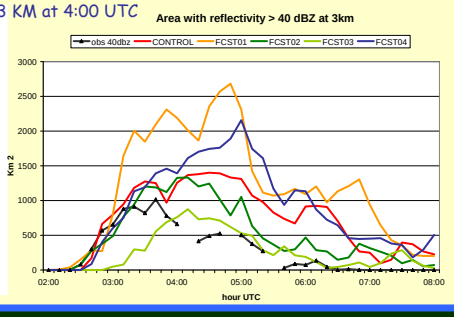
Conclusions and future-work

✓All forecasts succeed in reproducing a squall line reflectivity pattern similar to observations.
✓There is less than 1-hour delay in the progression of the predicted convective line respect to surface data and CMORPH pp estimations.
✓Sensitivity is more evident in the vertical reflectivity structure and in the time evolution of the area with large reflectivity.

Reflectivity at 3 KM at 4:00 UTC



Area with reflectivity > 40 dBZ at 3km



✓Weak sensitivity in Z structure pattern is found when vertical resolution is reduced to half of the control experiment whereas stronger sensitivity is attained when convective parameterization is activated and when initial conditions are changed.
✓ Z structure time evolution shows sensitivity to the microphysical scheme. Weaker 1-hour precipitation corresponds to 1-moment microphysical scheme.

Future work will advance on Radar calibration, will improve reflectivity estimation from forecast, including not only microphysics species but also their number concentration and will extend this kind of experiments to other convective events associated with severe weather.

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