P4.17 RESOLUTION EXPERIMENTS WITH THE REGIONAL ETA MODEL FOR A FROST EVENT IN SOUTH AMERICA

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1. INTRODUCTION

Numerical experiments with increase of resolution have generally shown that higher resolution tend to improve the quality of the forecasts. The computational limitation favours the use of limited area models in high resolution experiments. The drawback is the care needed to treat the lateral boundary conditions which may introduce errors in the interior of the integration domain.

The purpose of this work is to evaluate the importance of the increase of resolution for the quality of the forecasts. A frost case which occurred in the South of Brazil was chosen to test the resolution dependence of resolution. In this event the orography and the surface conditions were important as snow was observed to fall over the high hills.

3. METHODOLOGY

The model used is the regional Eta model (Mesinger et al., 1988; Black, 1994). It is a grid-point model which uses the horizontal Arakawa E grid and eta vertical coordinate.

The operational Eta model, which is used at the Centro de Previsão de Tempo e Estudos Climáticos, is configured in a domain covering South America with 40km horizontal resolution and 38 eta layers in the vertical. Here the development of the high resolution is done in two steps. First, a 40-km version is configured over the southern part of Brazil, between 35°S and 16°S, and 62°W and 40°SW. Then, a 20-km resolution version was configured in the same small domain. Topography of the 40-km operational version was constructed from a 10' topography file. whereas the versions of reduced domain used a 30" topography file.

The initial and lateral boundary conditions in all three versions used the NCEP analyses at T062L28 resolution. The lateral boundary conditions were updated every 6 hours, and the tendencies distributed linearly in the time interval.

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3. SIMULATIONS

The results shown here refer to a cold event that occurred between 16 and 19 April 1999 over southern part of Brazil. The large scale pattern showed a cold front extending from the southern part of Amazonia toward the southeast of the continent. A cyclone in the rear of this main frontal band developed a secondary front over the southern part of Brazil. Cold air advection from the south caused temperatures to drop by about 16°C in one day in the South. Snowfall was recorded over the hills near São Joaquim, Santa Catarina, on 17 April 1999.

Figures 1.a, 1.b, and 1.c show 30-h forecast surface temperature veryfing on 17 April 1999, 06 UTC for the operational version (O40), reduced 40-km version (E40) and the reduced 20-km version (E20), respectively. The temperatures have not yet reached their minimum values at this time. The differences between the O40 and E40 are due to the different original topography data and the boundary conditions. The contours in the two runs are very close indicating reduced errors propagating from the boundaries of the small domain and giving confidence to the configuration of this version of the model. The higher resolution version, E20, follows nicely the temperature pattern of E40, but shows slightly lower values, especially over the hills. The shaded patches indicate the predicted snowfall, which was successfully predicted by the three versions, but better detailed in the higher resolution one.

Figures 2.a, 2.b, and 2.c show the 36-h predicted mean sea level pressure and 24-h accumulated precipitation veryfing on 17 April 1999, 12 UTC for the operational version (O40), reduced 40-km version (E40) and the reduced 20-km version (E20), respectively. The position of the low pressure over the coast of South Brazil is in agreement in the three versions. However, E20 shows a deeper low pressure system. Similarly, precipitation occurred over the same regions in the three versions of the model.

The agreement of the results from the three configurations of model give confidence to undertake further runs to evaluated the improvement of the simulations at higher resolutions.

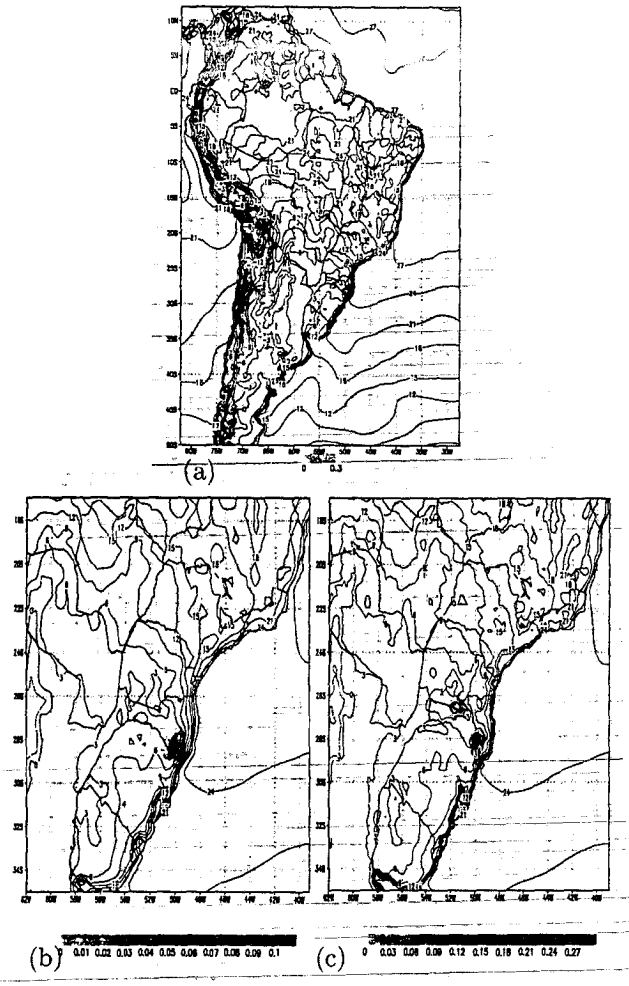

Figure 1: 30-hour predicted surface temperature (°C) (contours) and snow (mm) (shaded) from (a) O40, (b) E40 and (c) E20 runs.

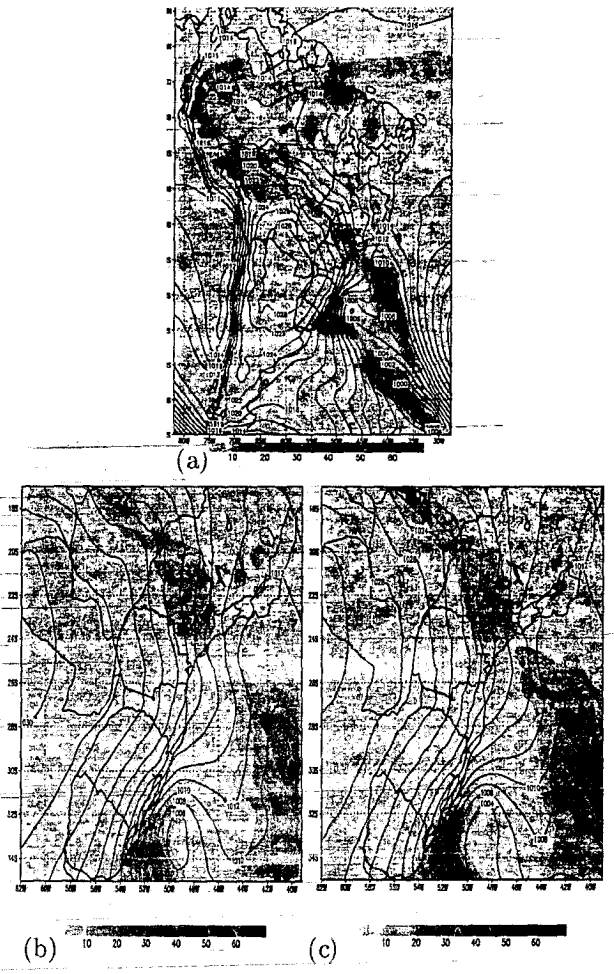

Figure 2: 36-hour predicted mean sea level pressure (hPa) (contours) and total precipitation (mm) (shaded) from (a) O40 (b) E40 and (c) E20 runs.

4. REFERENCES

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