Different Aspects of WRF-ARW applications at the National Meteorological Service – and Naval Hydrographic Service of Argentina.

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INTRODUCTION

This is a report of activities of the diverse applications of the numerical weather prediction (NWP) model WRF-ARW implementations developed under a collaborative project between the National Meteorological Service (NMS) and the Naval Hydrographic Service (NHS) of Argentina.

A system composed by WPS, WRF-ARW, ARWpost and WPPV3 is running at the NMS on daily basis for the 00 UTC cycle, on a cluster of 5 ML350 HP Proliant nodes. This version is Open MP and distributed implementation. The model's domain covers South America and the surrounding oceans, with 24 km of spatial resolution and provides 72-hours forecast fields every 3 hs. of precipitation and sea level pressure, maximum CAPE and CIN, RH and TD at 2 m. In addition, 10-meters winds over selected regions of the Argentine coasts and nearby South Atlantic Ocean are produced. Recently, and focused over Argentina, fields such as 700hPa omega and geopotential height, cloud base and 0°C isotherm geopotential height, PBL height and friction velocity, surface visibility, among others, were included for the same cycle. Besides that, there is a broad range of studies underway with the main object of improve the NWP forecasts over the region.

RESEARCH ACTIVITIES

Sensitivity studies of soil moisture initialization

One of the research topics in which we are applying WRF-ARW is to investigate the model sensitivity to the lower boundary condition given by the soil moisture fields, both in its diagnosis as well its short and medium range predictions. To meet this goal, several experiments are carried out by changing the initial soil moisture content.

The impact in the precipitation predictions and over other key variables, are studied using soil moisture data from uncoupled soil global models from the Global Land Data Assimilation System (GLDAS) and the CPTEC (Centro de Previsão de Tempo e Estudos Climáticos) soil model. Normalization procedures to avoid inconsistencies are applied. Preliminary evaluations of the superficial soil moisture fields with passive radiometer AMSR-E, and of the precipitation resulting fields with NMS meteorological stations measurements and CMORPH and TRMM estimations, are in progress. Preliminary results (*Fig. 1*) show the sensitivity of the model to the different lower boundary conditions used, and its influence on the precipitation fields as stated by a number of authors (*Collini et al. 2010, Ferreira et al. 2011*).

Forecast Verification

The validation of weather forecasts consists of comparing the forecast events to the corresponding observed events, in order to establish the quality of the forecast. Different verification attempts focalized on extreme temperatures at the surface and temperature in the whole atmosphere, were made.

Verification of extreme surface temperatures forecasts of the WRF – ARW with the observations from 19 selected Argentine meteorological stations was made on operational basis, following the analysis performed for March, April and May (Southern Hemisphere autumn) of 2010 by *Dillon et al. 2010*, where the basic statistical BIAS and RMSE were utilized. These results were compared with those of the ETA/NMS operational model. Generally, these models showed lower thermal amplitude than the observed. Differences between the models results were mainly due to the parameterizations, since both models use the GFS fields for the initialization and boundary conditions. Additionally, the first stages in the application of Model Evaluation Tool (MET) was carried out to validate temperature forecasted by the model, compared with the 12Z upper air soundings observations from Córdoba, Resistencia and Ezeiza argentine weather stations (*Martin and Collini, 2010*).

Forecast of ash dispersion and deposition.

With the aim to improve forecasts of volcanic ash dispersion and deposition over Argentina, a number of experiments were made running the FALL3D dispersion model coupled with the WRF-ARW model for the 2008 Chaitén eruption, Chile. The model results include time-dependent 2D and 3D variables like airborne ash

concentration at selected flight levels, cloud column load and deposit thickness among others, and its tracking at selected locations. This work constitutes a preliminary assessment of the application of FALL3D coupled with WRF-ARW at the NMS as a test case, and constitutes a starting point for the application of this modeling strategy to other volcanoes of the region (*Folch et al., 2011*).

CONCLUSIONS

This project contemplates various numerical modeling issues and, hopefully, its results will be used not only for operational purposes but also as a framework for future developments focused on the Argentine weather and climatic system.

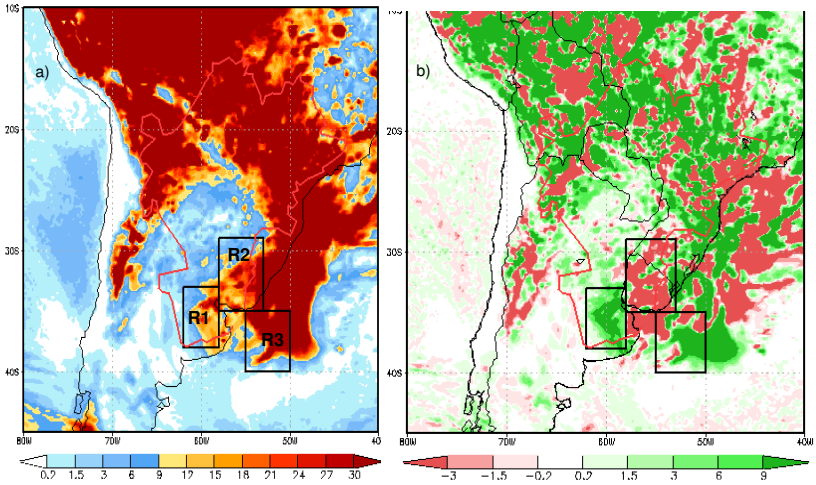

Fig 1. 120 hs accumulated precipitation (mm) forecasted by WRF-CTRL model (left) and its difference respect to WRF-CPTEC model (right). The squares show studied subregions.

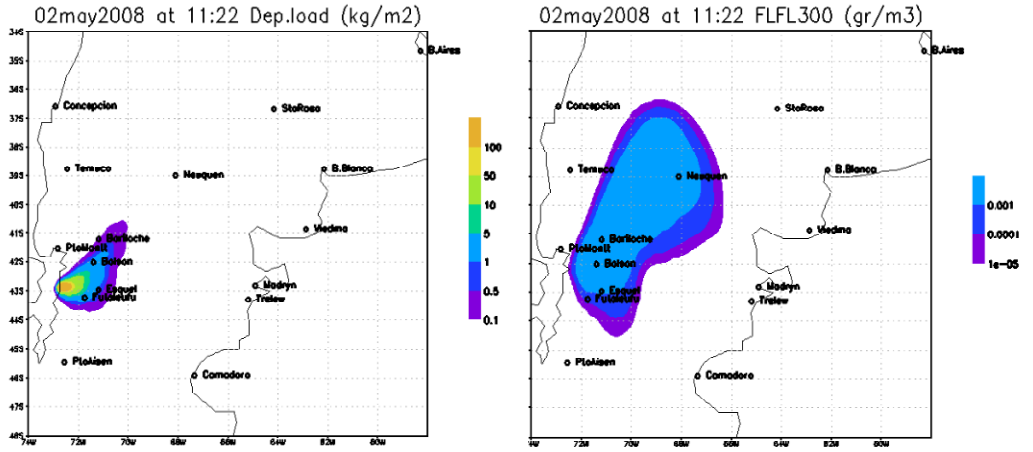

Fig 2. Deposit charge forecast (kg/m2) (left) and concentration forecast in gr/m3 for the 300 flight level (right), for 11:22 Z (7:22 local hour).

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