EMS Annual Meeting Abstracts
Vol. 9, EMS2012-262, 2012
12th EMS / 9th ECAC

Physical parameterization uncertainties in WRF precipitation forecasts

S. C. Pereira (1), A. C. Carvalho (2), and A. Rocha (1)

(1) CESAM, Department of Physics, University of Aveiro, Portugal (susana.cardoso@ua.pt), (2) CENSE, DCEA, University Nova de Lisboa, Faculty of Science and Technology Universidade Nova de Lisboa, Portugal (accsgc@gmail.com)

Precipitation and cloud microphysical processes in numerical weather prediction systems pose one of the major forecasting challenges. Predicting the sub-grid scale phenomena such as clouds and precipitation, with some degree of accuracy, is still an ongoing ambitious project. Advances in computational resources boosted the use of more sophisticated physics schemes incorporated into models with higher resolutions grids. The choice of the proper combination of such schemes is a challenging task especially in case of high impact weather in which the forecast errors are expected to be large. To overcome the use of a single deterministic run, that represents the future state of atmosphere, one can use several runs from the same numerical weather prediction model but with different physical formulations. The uncertainty associated to the physical parameterizations of the forecast can then be assessed by the range of the different forecasts produced.

The numerical prediction model used to generate a representative sample of the possible future states of the dynamical system was the Weather Research Forecast model with the Advanced Research Weather (WRF-ARW) dynamical core. An ensemble with sixteen forecasts members was created with WRF-ARW by using different physical parameterizations, available in WRF-ARW version 3.2. The control forecast is one obtained configuring the WRF-ARW model with the physical options used in the operational model forced with the analysis field (http://climetua.fis.ua.pt/).

During the October month of 2010, the Northern and Central parts of Portugal experienced two synoptic situations of moderate to high intensity precipitation. The first was associated to a cut-off low, and the second to a frontal system. Two experiments were performed for a 62h and a 10 h period, namely: (I) from 12 UTC 07 to 00 UTC 10 of October 2010 and (ii) from 12 UTC 28 October to 00 UTC 2 November 2010. The WRF-ARW model was forced by Global Forecast System (GFS) fields each 6 hours for the entire simulation period. The model was configured with three nested domains, with resolutions of 25 km, 5 km and 1 km, respectively. The ensemble forecast is evaluated in terms of the ensemble members average concerning the precipitation variable, as well as their degree of dispersion represented by their overall spread.

The ensemble is evaluated against observed precipitation data. In order to enhance the robustness of the measured data used, several historical daily precipitation records for Portugal mainland principal watersheds were studied in respect to their climatologically parameters. A Principal Component Analysis was performed to infer the space variability of the monthly precipitation accounted within the watersheds. This procedure enables us to find the daily series that best represents the variance of the watershed.