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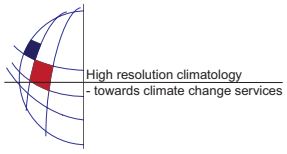

Sensitivity of a simulated extreme precipitation event to spatial resolution, parametrisations and assimilation

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In the morning of the 18th of February 2008 Lisbon and Setúbal were under the influence of a heavy rain event associated to a cut-off low formed in southern Azores between the 14th and 15th of February. The total daily precipitation record was exceeded in the 18th of February at Lisboa/Geofísico station; 36 mm of precipitation were registered between 4 and 5 a.m., whereas in Setúbal 60 mm were recorded during one hour (between 11 and 12 a.m.), of the same day. These two cities are located near the mouth of Tagus and Sado rivers, respectively, running to the Atlantic Ocean, and both have experience severe floods.

The present work will present the sensitivity of the Weather Research and Forecasting (WRF) model to different geometric model configurations and physical parametrisations, and to data assimilation procedures for the same grid resolution and physical parametrisations.

The WRF model is running in operational mode for Portugal at the University of Aveiro in two different horizontal and vertical resolution and physical set of parametrisations, driven by the Global Forecast System (GFS) forecasts. The first configuration (OP1) is shown in http://climetua.fis.ua.pt/main/otempo.php?lang=pt and consists of two nested domains and 27 vertical levels, the coarsest domain (25 km) covering the Iberian Peninsula and part of the East Atlantic and the finer grid domain (5 km) covering Portugal. For the second configuration (OP2) (shown in http://www2.fis.ua.pt/torre/luis/), the outer and inner domains have a horizontal resolution of 21 and 7 km, respectively. The physics parametrisation of the two operational designs differ on the microphysics and cumulus schemes, and on the applied land surface model, which are named respectively for: (i) OP1 - WSM 6 class graupel microphysics scheme, Grell-Devenyi ensemble cumulus scheme and Unified Noah land-surface model; (ii) OP2 - Ferrier microphysics scheme, Kain-Fritsch cumulus scheme and Thermal diffusion land-surface model.

The first part of this study evaluates the sensitivity of the model to horizontal resolution and physical parametrisations in the prediction of the selected precipitation extreme events.

Additionally, two other sensitivity tests were performed with the OP1 configuration, one regarding the cumulus physics parametrisation, which has been switched of (i.e. explicit calculation of convective eddies), to compare the results with the operational configuration and the other with assimilation of surface and upper air data.

Physical processes of the precipitation in this period have been revealed through the analysis of the precipitation fields associated with the microphysics and the cumulus parametrisations. During the early morning microphysics plays an important role, whereas for late morning precipitation is due to a squall line convective system. As expected, results show that model resolution affects the amount of predicted precipitation and the parameterizations affect the location and time of the extreme precipitation. For this particular event, assimilation seems to degrade the simulation, particularly the maximum of precipitation.