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Comparison of two Perturbed Initial and Boundary Conditions Ensemble Forecasting Systems applied to Mediterranean cyclones

M. Vich, R. Romero, and V. Homar

Grup Meteorologia, Dep. Física, Universitat de les Illes Balears, Palma de Mallorca, Spain

The societies of western Mediterranean coastal countries often suffer from heavy precipitations and strong winds. These high impact weather phenomena are mostly due to the cyclones developed over the region. In order to improve the short to mid-range mesoscale numerical forecasts of this kind of events, different ensemble prediction systems (EPS) have been developed and tested in the context of the Spanish project PRECIOSO. Previous results show an improvement in the prediction capability if an EPS based on varying physical parameterizations is used instead of a deterministic forecast. Encouraged by these results, two new EPS have been developed in the present work, this time based on pertubing the model initial and boundary conditions. Both EPS proceed through a potential vorticity (PV) inversion algorithm after perturbing the initial and boundary PV field. One EPS introduces the perturbations along the zones of the three-dimensional PV structure presenting the most intense values and gradients of the field (a subjective choice), while the other perturbs the PV field over the MM5 adjoint model calculated sensitivity zones (an objective method).

The non hydrostatic MM5 mesoscale model has been used to run the ensemble members. The simulations are performed for a two-day period with a 22.5 km resolution domain (Domain 1 in http://mm5forecasts.uib.es) nested in the ECMWF large-scale forecast fields.

The performace of both ensemble forecasting systems for the rainfall field is tested and intercompared over a collection of high-impact MEDEX cyclonic episodes. This is achieved by a probabilistic verification approach involving several methods since we are dealing with EPS. Some of these verification methods are the attribute diagram, rank histogram, Brier score and ROC curve that describe different quality attributes of the forecast such as reliability, resolution, uncertainty and sharpness. Preliminary results show a better skill of the EPS following the MM5 adjoint sensitivity field than the EPS following the zones with the most intense PV values and gradients.