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Abstract Title: Comparison of several Ensemble Prediction Systems applied to Mediterranean high impact cyclones associated with heavy rainfall and strong winds

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abstract_title: Comparison of several Ensemble Prediction Systems applied to Mediterranean high impact cyclones associated with heavy rainfall and strong winds

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abstract_text: 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. 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 additional EPSs have been developed based on perturbing the model initial and boundary conditions. These two EPSs proceed through a potential vorticity (PV) inversion algorithm after perturbing the initial and boundary PV field. One of them 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 three developed ensemble forecasting systems (Multiphysics, PV-subjective and PV-objective) are tested and intercompared over a collection of high-impact MEDEX cyclonic episodes. Their performace is evaluated for the 24h accumulated rainfall field. 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. Results show a better skill of the EPS following the PV perturbation techniques than the Multiphysics, and among the PV-based methods, we find that an objective choice of the perturbations does not offer better forecasts than our subjective criteria.

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