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Verification of a Multiphysics Superensemble Forecast Technique in Mediterranean Heavy Precipitation Situations

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The Superensemble Forecast technique is a powerful post-processing method for the estimation of weather forecast parameters, like precipitation. This method reduces the direct model output errors improving the forecast of the parameter. Since the western Mediterranean coastal countries are characterized by heavy precipitations, the superensemble technique is tested in the region to asses a possible improvement in the prediction capability before these potentially dangerous events and therefore reduce their impact on the society. Previous results obtained using an ensemble prediction system (EPS) based on varying MM5 model physical parameterizations have already shown an improvement in this capability compared to a deterministic forecast. In the present study the superensemble method is applied to the above Multiphysics EPS, thus defining a Multiphysics Superensemble Forecast Technique, an alternative to the more traditional Multimodel Superensemble Method.

The superensemble method has two clearly differentiable phases. The first one, the training phase, is made up of previous forecasts from the ensemble members and the corresponding observed states, in order to recognize past performances of members and assign weights accordingly through a multiple linear regression technique. The second one, the forecast phase, is derived using the training phase weights and current ensemble members forecasts. The non hydrostatic MM5 mesoscale model has been used to run the multiphysics 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 superensemble training period corresponds to a four month period from September to December 2001 and the tested forecast phase corresponds to a collection of 19 MEDEX cyclones comprising 56 heavy precipitation days.

The performace of the superensemble method for the rainfall field is tested and compared with that of the ensemble mean (a simple average of all the members), the bias-corrected ensemble mean and the Multiphysic EPS control member. This is achieved by a deterministic verification approach involving Bias, Taylor diagrams, ROC curve and other indices that describe different quality attributes such as reliability, resolution, uncertainty and sharpness. First results emphasize the benefits of the superensemble approach over deterministic members and simple methods of ensemble averaging.