Inclusion of Potential Vorticity uncertainties into hydro-meteorological chain predictions: Application to a flash-flood event over Catalonia, Spain

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In the early morning on 10 June 2000, the Catalonian region was affected by a hazardous mesoscale convective system which produced an intense rainfall episode with a large increase on flow regimes in many internal catchments of the region. The present modeling study is focussed upon the Llobregat basin, the biggest internal catchment with a drainage area of 5040 km^2. The characterization of the hydrological response of this catchment to the flash-flood event was assessed in a previous study using rain-gauge data and the HEC-HMS rainfall-runoff model.

In the framework of the Spanish project PRECIOSO devoted to improve the short and mid-range numerical forecasts of cyclones, an ensemble prediction system (EPS) based on perturbed initial and boundary conditions has been designed. A Potential Vorticity (PV) Inversion technique has been used to perturb the initial state and boundary forcing of the MM5 mesoscale model. MM5 has been nested in the ECMWF forecast large-scale fields in a set of 54 h simulation period simulations. In order to introduce realistic perturbations in the EPS, a previous PV error climatology has been derived. Therefore, this climatology allows introducing the perturbations on the ECMWF forecast PV fields in the appropriate error range.

The derived precipitation fields have been used to drive the hydrological model in order to test the performance of the mesoscale model for the Llobregat medium-size basin. That is, the set of MM5 driven runoff simulations are compared against the stream-flow observations, thus employing the one-way coupling between the meteorological and hydrological models as a validation tool. Furthermore, the value of this ensemble strategy for obtaining suitable driven runoff forecasts can also be assessed. The results can be potentially useful to expand the lead-times associated with the prediction of similar future flash-flood episodes, helping to alleviate its possible hazardous consequences.