Towards an Ensemble Prediction System for the North-Western Mediterranean
S. Fresnay, D. Lambert and E. Richard
Laboratoire d’Aéologie, Université de Toulouse and CNRS, Toulouse, France

1. Abstract
During the last 15 years ensemble weather forecasting has made substantial progress and has proved its skill in forecasting probabilities of relevant weather events. More recently, the development and growing use of high-resolution, convection-permitting models has significantly increased the potential of atmospheric modeling. In the framework of the French project MEDUP and in preparation of the forthcoming Hydrological Cycle in the Mediterranean experiment (HyMeX, www.hymex.org), several preliminary studies have been carried out aiming at a better understanding of the predictability of Mediterranean intense events and a better quantification of their forecast uncertainties. Different methodologies have been investigated including perturbed initial or boundary conditions and perturbed physical parameterizations. This presentation focuses on the physical parameterizations and especially the parameterizations associated with the cloud microphysics.

A first ensemble was designed by varying the tunable parameters of the microphysical scheme within their admitted range of variation whereas in the second ensemble the tendencies of the microphysical processes were randomly perturbed. The results are analyzed and assessed for an episode of heavy precipitation which recently occurred over south-eastern France.

2. Model set-up
Numerical simulation were performed on the French non-hydrosatonic mesoscale model MIESO-NH, with following features:
- Analytical formulation (acoustic wave theory)
- Integration time step: 8 sec
- Microphysical 6 species bulk scheme
- Convection: only shallow convection
- Land fluxes: ISBA model

Domain: South-Eastern France (Fig 2)
Resolution: 2.5 km
Grid size: 288 x 288

3. Case of 10/20/08: Observation and control experiment

4. Perturbation methods
In a previous study (Garaud, 2009) all the tunable parameters of the microphysical scheme have been systematically perturbed in a series of idealized simulations (isolated storms, squall lines) to investigate the model sensitivities to the microphysical parameterizations. The highest sensitivities were obtained for perturbations applied on the raindrop size distribution and to a lesser extent snow graupel and graupel characteristics. An alternative methodology, in which time tendencies of all the microphysical processes were randomly perturbed, showed that the model results were mostly sensitive to the perturbation of warm processes: rain evaporation, rain autoconversion and accretion.

Hereafter, 3 perturbations methods are assessed on the case of 10/20/08. In each of them, the perturbation is kept constant both in space and time.

Perturbation ensemble 1 (E1):
Change of intercept N_0 in raindrop size distribution

Perturbation ensemble 2 (E2):
Change of evaporation rates

Perturbation ensemble 3 (E3):
Multi-process perturbation

The Buzzi et al. method is applied on 3 different processes at the same time: evaporation, autoconversion and accretion rates. For each process, a random drawing of β is performed at initial time.

5. Results (1)

6. Results (2)

7. Statistical analysis

References: