Forecast errors at convective scale

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Despite the use of a limited domain, the high computational cost of Numerical Weather Prediction (NWP) systems at convective scale explains why most of the existing operational configurations are still based on variational Data Assimilation (DA) methods that make use of climatological background error covariances, computed for instance off-line from ensembles of background perturbations. However it will be shown that, either for classical model variables or hydrometeors, such errors strongly depend on the weather types and that different spatial covariances and coupling relationships can be found in specfic areas (e.g clouds and precipitation). Flow dependency is thus needed to optimize the use of observations (such as radar data or cloudy radiances) in these areas where the climatological hypothesis is clearly unadapted.

Using a large Ensemble Data Assimilation (EDA) at convective scale coupled with a large EDA at global scale, based respectively on the AROME and on the ARPEGE NWP systems, the flow dependency of background error parameters, such as the variances and the Hessian tensor of the local correlation, will be illustrated. Compared to results at global scale, heterogeneous and anisotropic features, that are linked for instance to the explicit resolution of convective processes or to the lateral boundary conditions, are frequently observed. These behaviours can eventually be considered partially or totally in the background error modelling while runing small EDA, provided that sampling noise is efficiently reduced. The shapes of correlation functions at the origin given by the tensor give also an insight of the type of localization procedures that should be applied in ensemble-based DA methods.

This large ensemble has been also used to validate a method, based on the vertical deformation of climatological values, aiming in producing multivariate background error vertical covariances for hydrometeor contents in different cloudy conditions. The characterization of such covariances is indeed essential to take into account observations related to clouds and precipitation, whose assimilation is made possible thanks to the explicit treatment of convection and the detailed microphysical parameterization which allow to represent realistically their simulated counterparts. For the purpose of illustration, an application of such covariances for the assimilation of cloudy IASI radiances in a 1Dvar will be presented.