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# The breeding method for ensemble forecasting: application to Western Mediterranean

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Weather forecasting is one of the most challenging problems the scientific community currently faces not only for its theoretical value but also because, besides other less critical applications, weather forecasting systems must provide precise information to guide civil protection agencies in their mission against severe weather events in order to prevent personal and material losses. Numerical weather forecasts are inherently uncertain and this uncertainty is typically quantified by means of probabilistic information expressed in terms of probability density functions (PDF). Currently, at operational centres, only an ensemble of discrete samples of the PDF can be considered. Therefore, choosing a sampling strategy is a key question for any ensemble prediction system (EPS).

In this work, we examine the performance of an EPS for short-range forecasts in the Western Mediterranean based on Bred vectors, which are hypothesized to efficiently and accurately sample the subspace of actual uncertainties in the initial conditions atmospheric systems. Traditional arithmetic Bred vectors used at National Centers for Environmental Prediction (NCEP) are obtained from the difference between a control run and a random perturbed run rescaled at certain time intervals with an Euclidean norm (e.g. rms amplitude). However, logarithmic Bred vectors obtained with a geometrical rescaling are shown to produce better results in terms of ensemble diversity in low complexity toy models. In this work, a comparison between the characteristics and performance of arithmetic and logarithmic bred vector based ensembles for the Western Mediterranean region will be presented together with a new generation method consisting in an exponential rescaling of the perturbation that is hypothesized to allow full control on ensemble spread and seamless scale representation of uncertainties in high resolution EPS.