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Improving ensemble forecasting with q-norm bred vectors

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Error breeding is a popular and simple method to generate initial perturbations for use in ensemble forecasting that is used for operational purposes in many weather/climate centres worldwide. There is a widespread belief among practitioners that the type of norm used in the periodic normalizations of BVs does not have an effect on the performance of ensemble forecasting systems. However, we have recently reported that BVs constructed with different norms have indeed very different dynamical and spatial properties. In particular, BVs constructed with the 0-norm or geometric norm has nice properties (e.g. enhancement of the ensemble diversity), which in principle render it more adequate to construct ensembles than other norm types like the Euclidean one. These advantages are clearly demonstrated here in a simple experiment of ensemble forecasting for the Lorenz-96 model with ensembles of BVs. Our simple numerical assimilation experiment shows how the increased statistical diversity of geometric BVs leads to improved scores regarding forecasting capabilities as compared with BVs constructed with the standard Euclidean norm.