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Maximizing the statistical diversity of an ensemble of bred vectors by using the geometric norm

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We show that, contrary to what is claimed in the literature, the choice of the norm has a great impact on the construction of ensembles of bred vectors. The geometric norm maximizes (in comparison with other norms like the Euclidean one) the statistical diversity of the ensemble while, at the same time, enhances the projection of the bred vector on the linearly most unstable direction (the leading Lyapunov vector). The geometric norm is also optimal in providing the least fluctuating ensemble dimension among all the spectrum of q-norms studied. Our results are presented using a toy model of the atmosphere (the Lorenz-96 model), but our findings are expected to be generic for spatially extended chaotic systems due to the generic multiplicative character of error growth.