

# Adaptive Localization in Ensemble Kalman Filter Methods by Controlling the Observation Space

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In data assimilation using ensemble Kalman filter methods localization is necessary to make the method work within the constraints of geophysical systems. For the LETKF, domain localization (DL) and observation localization (OL) are typically used. Even though localization is widely used, no criteria for the choice of an optimal localization radius are known yet.

In idealized twin experiments with the Lorenz-96 model and a wind-driven shallow water model we investigate the dependence of the localization radius to the ensemble size for different localization functions. It turned out that for DL, if the ensemble size is small compared to the state dimension, there is a linear dependence of the optimal localization radius to the ensemble size. This can be related to other localization functions by considering the effective observation dimension  $o_{\text{eff}}$ . This quantity is defined as the sum of the observation weights and is taken as a measure of the degrees of freedom that are available in the ensemble for assimilation.

Based on the results, we propose an adaptive localization method. This method aims to keep  $o_{\text{eff}}$  constant and adapts the localization radius accordingly. Thus, in dense regions the localization radius can be reduced and in sparse regions increased. In order to account for regions with very sparse observations, one has to limit the maximal localization radius, so that observations beyond a certain distance are not used any more.

We present first results of this method for different observation densities and show the effect of the adaptivity.