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Localisation of Particle Filters

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A problem that must be faced when applying ensemble data assimilation methods to large geophysical systems is that even the most powerful supercomputers permit only a small number of ensemble members relative to the dimension of the system. Amongst other difficulties, this leads to spurious correlations in the ensemble's representation of the statistics of the background field. When observations are assimilated, these spurious correlations propagate the effects to implausibly distant locations.

In the ensemble Kalman filter (EnKF), a solution to this problem has been found in the technique of localisation, whereby observations are only permitted to influence grid points close to their own location. This has the beneficial side-effect of increasing the effective ensemble size. Through localisation, it has become possible to apply the EnKF to large geophysical systems such as the atmosphere.

The particle filter is an ensemble data assimilation method that offers the possibility of improved performance over the EnKF in non-linear and non-Gaussian systems. However, it is not obvious how localisation can be applied to the particle filter. This presentation will consider several possibilities and present results from applying them to simple systems. Both direct and indirect localisation techniques will be considered, with the latter achieved by using an EnKF as a proposal density.