Geophysical Research Abstracts
Vol. 17, EGU2015-7195, 2015
EGU General Assembly 2015

Towards robust particle filters for high-dimensional systems

Peter Jan van Leeuwen
University of Reading, DARC, Department of Meteorology, Reading, United Kingdom (p.j.vanleeuwen@reading.ac.uk)

In recent years particle filters have matured and several variants are now available that are not degenerate for high-dimensional systems. Often they are based on ad-hoc combinations with Ensemble Kalman Filters. Unfortunately it is unclear what approximations are made when these hybrids are used. The proper way to derive particle filters for high-dimensional systems is exploring the freedom in the proposal density. It is well known that using an Ensemble Kalman Filter as proposal density (the so-called Weighted Ensemble Kalman Filter) does not work for high-dimensional systems. However, much better results are obtained when weak-constraint 4Dvar is used as proposal, leading to the implicit particle filter. Still this filter is degenerate when the number of independent observations is large. The Equivalent-Weights Particle Filter is a filter that works well in systems of arbitrary dimensions, but it contains a few tuning parameters that have to be chosen well to avoid biases.

In this paper we discuss ways to derive more robust particle filters for high-dimensional systems. Using ideas from large-deviation theory and optimal transportation particle filters will be generated that are robust and work well in these systems. It will be shown that all successful filters can be derived from one general framework. Also, the performance of the filters will be tested on simple but high-dimensional systems, and, if time permits, on a high-dimensional highly nonlinear barotropic vorticity equation model.