Geophysical Research Abstracts
Vol. 20, EGU2018-5281-1, 2018
EGU General Assembly 2018
© Author(s) 2018. CC Attribution 4.0 license.

Chaotic dynamics and the role of covariance inflation for reduced rank Kalman filters with model error

Colin Grudzien (1), Alberto Carrassi (2), and Marc Bocquet (3)

(1) Nansen Environmental and Remote Sensing Center, Bergen, Norway (colin.grudzien@nersc.no), (2) Nansen Environmental and Remote Sensing Center, Bergen, Norway (alberto.carrassi@nersc.no), (3) CEREA, Joint laboratory of École des Ponts ParisTech and EdF R&D (marc.bocquet@enpc.fr)

The ensemble Kalman filter and its variants have shown to be robust for data assimilation in high dimensional geophysical models, with localization, using ensembles of extremely small size relative to the model dimension. A reduced rank representation of the estimated covariance, however, leaves a large dimensional complementary subspace unfiltered. Utilizing the dynamical properties of the filtration for the backward Lyapunov vectors, this work explores a previously unexplained mechanism, describing the intrinsic role of covariance inflation in reduced rank, ensemble based Kalman filters. Our derivation of the forecast error evolution describes the dynamic upwelling of the unfiltered error from outside of the span of the anomalies into the filtered subspace. Analytical results for linear systems explicitly describe the mechanism for the upwelling, and the associated recursive Riccati equation for the forecast error, while nonlinear approximations are explored numerically.