Geophysical Research Abstracts
Vol. 19, EGU2017-119, 2017
EGU General Assembly 2017

A two-way-tracking localized ensemble Kalman filter for assimilating aircraft in situ volcanic ash measurements

Guangliang Fu (1), Hai Xiang Lin (1,2), Arnold Heemink (1), Arjo Segers (3), Martin Verlaan (4,1), Tongchao Lu (5), and Sha Lu (1)

(1) Delft University of Technology, Delft Institute of Applied Mathematics, Delft, The Netherlands (g.fu@tudelft.nl), (2) Leiden University, Leiden Centre of Data Science, Leiden, The Netherlands, (3) TNO, Department of Climate, Air and Sustainability, Utrecht, The Netherlands, (4) Deltares, Delft, The Netherlands, (5) Shandong University, China

After the eruption of volcano Eyjafjallajökull in 2010, which had a huge impact to aviation and economy, improvements of volcanic ash forecasts have been put onto the research agenda. Data assimilation uses observations to improve the forecast accuracy. Among the data assimilation approaches, the ensemble Kalman filter (EnKF) is a well-known and popular method. A proper covariance localization strategy in the analysis step of EnKF is essential for reducing spurious covariances caused by the finite ensemble size, as shown for this application for assimilation of aircraft in situ measurements.

After analyzing the characteristics of the physical forecast error covariances, we present a two-way tracking approach to define the localization matrix for covariance localization. The result shows that the Two-way-tracking Localized EnKF (TL-EnKF) effectively maintains the correctly specified physical covariances and largely reduces the spurious ones. The computational cost of TL-EnKF is also evaluated and is shown to be advantageous for both serial and parallel implementations. Compared to the commonly used distance-based covariance localization, the two-way tracking approach is shown to be more suitable. In addition, the covariance inflation approach is verified as an additional improvement to TL-EnKF to achieve more accurate results.