Tsuyuki, T., 2019: Ensemble Kalman filtering based on potential vorticity for atmospheric multi-scale data assimilation. *J. Meteor. Soc. Japan*, **97**, 1191-1210.
https://doi.org/10.2151/jmsj.2019-067

Plain Language Summary: A multi-scale data assimilation method for the ensemble Kalman filter (EnKF) is proposed and its performance is demonstrated using a shallow water model. The method is based on the conservation and invertibility of potential vorticity. It suppresses spurious error correlations between the balanced and unbalanced parts of dynamical state variables and makes it possible to appropriately address the balance issue of covariance localization.

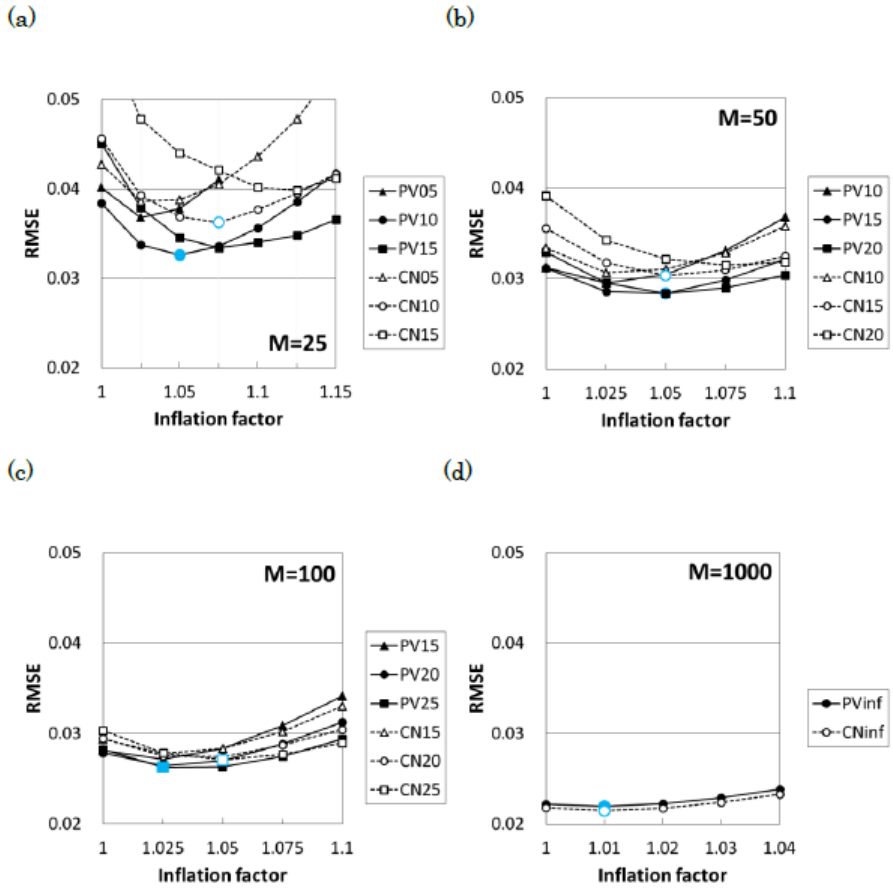

Figure 1. Comparison of RMSEs of the analysis of the proposed EnKF (solid lines) and conventional EnKF (broken lines) for ensemble sizes of (a) 25, (b) 50, (c) 100, and (d) 1 000. They are plotted against the covariance inflation factor for three covariance localization radii, which are indicated by two-digit numbers in the legends (unit: grid points).

- The proposed EnKF is superior in the accuracy of the analysis to the conventional EnKF unless the ensemble size is sufficiently large.
- The adjustment of balanced and unbalanced mass variables is necessary for the proposed EnKF to outperform the conventional EnKF.
- The computational cost of the proposed EnKF is about 10% more than that of the conventional EnKF.