Dear Editor and Katharina,

I am writing to you to seek approval for making some corrections in equations. These corrections have absolutely no impact on the results that have been presented in the accepted manuscript, but they will make these equations much easier for readers to implement and to understand. Please accept my apologies for not spotting these errors.

The corrections I hope to make are summarized below and shown in red in the attached text:

Item descriptions	Explanations
Adding transpose in equation (9) and (14)	The transposes are needed; otherwise, the dimensions of the matrices and vectors won't match.
Changing $\mathbf{E}_k^f$ to $\mathbf{E}^f$	As shown in equation (12), there is no dependence on k. For clarity, it would be best to use $\mathbf{E}^f$.
Removing $\boldsymbol{X}$ and $\bar{\boldsymbol{X}}$	Removing them will read better; more importantly, readers won't get confused about $\boldsymbol{x}$ and $\boldsymbol{X}$.

Your consideration is very much appreciated.

Sincerely,
Christine Chiu

$$\boldsymbol{x} = \left(\log_{10} N_{0,\mathrm{P}}^{(i=1\ldots G)}, \log_{10} D_{0,\mathrm{P}}^{(i=1\ldots G)}, \log_{10} N_{0,\mathrm{A}}^{(i=1\ldots G)}, \log_{10} D_{0,\mathrm{A}}^{(i=1\ldots G)}\right)^T, \tag{9}$$

where the superscript i represents the index of the range gate, and the total number of gates to be retrieved is G. Let us use Q members to form an ensemble, i.e.,

$$\cancel{\boldsymbol{X} =} \{\boldsymbol{x}_1, \ldots, \boldsymbol{x}_{\mathrm{Q}}\} \tag{10}$$

such that the mean $\cancel{\bar{\boldsymbol{X}}}$ represents the best estimate of the state vector, and the spread of the ensemble members around the mean represents the uncertainty in the best estimate.

Using the Iterative Stochastic Ensemble Kalman Filter approach (Evensen et al., 2019), each ensemble member is updated based on:

$$\boldsymbol{x}_k^a = \boldsymbol{x}_k^f + \mathbf{E}^f \boldsymbol{w}_k, \tag{11}$$

in which $\boldsymbol{x}_k^f$ and $\boldsymbol{x}_k^a$ are the prior and posterior ensemble member k, respectively, and

$$\mathbf{E}^f = \left[\boldsymbol{x}_1^f - \bar{\boldsymbol{x}}^f, \ldots, \boldsymbol{x}_Q^f - \bar{\boldsymbol{x}}^f\right] \tag{12}$$

is the initial ensemble matrix with the prior mean ($\bar{\boldsymbol{x}}^f$) subtracted, and $\boldsymbol{w}_k$ are weight vectors that are calculated from iteratively minimizing the following cost function:

$$J(\boldsymbol{w}_k) = \frac{1}{2}\boldsymbol{w}_k^T \boldsymbol{w}_k + \frac{1}{2}\left(\boldsymbol{y} - \boldsymbol{h}(\boldsymbol{x}_k^f + \mathbf{E}^f \boldsymbol{w}_k) - \varepsilon_k\right)^T \mathbf{R}^{-1}\left(\boldsymbol{y} - \boldsymbol{h}(\boldsymbol{x}_k^f + \mathbf{E}^f \boldsymbol{w}_k) - \varepsilon_k\right). \tag{13}$$

In equation (13), the observation vector $\boldsymbol{y}$ is defined as gate-by-gate radar observables:

$$\boldsymbol{y} = \left(Z_{\mathrm{H}}^{(i=1,\ldots,G)}, Z_{\mathrm{DR}}^{(i=1,\ldots,G)}, -\ln K_{\mathrm{DP}}^{(i=1,\ldots,G)}, -\ln \rho_{\mathrm{hv}}^{(i=1,\ldots,G)}\right)^T, \tag{14}$$