

Interactive comment on “A three-dimensional variational data assimilation system for multiple aerosol species with WRF/Chem and an application to PM_{2.5} prediction” by Z. Li et al.

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Thanks for this important comment. The incorporation of the background error correlations that have different decorrelation length scales for different species is one of the major motivations for developing the scheme presented. In this

C3222

scheme, we use eight species as the control variables, that is, the control variable x in (1) consists of the mass concentrations of eight species. The minimization of (1) generates analysis increments for each of these eight species. The background error correlation matrix for each species is estimated and incorporated as shown in (6) (note that five species are used for this case, see section 3). The estimated decorrelation length scales turned out to differ significantly between different species.

Equation (10) is

$$\delta m_{Sl}^a = \frac{\sigma_{Sl}^2}{\sum_{l=1}^L} \delta x_S^a \quad (1)$$

where σ_{Sl}^2 is the root-mean-square (RMS) of the mass concentration background error for each species and size bin, S stands for one of the eight

C3223

species, and L is the number of size bins. This equation is applied to the increment of the individual species one by one. Specifically, (10) is used only to distribute the increment of one individual species over the size bins. The assumption behind (10) is that the background errors across size bins are uncorrelated and the decorrelation length scales are the same for all the size bins.

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