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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The impact of multi-species surface chemical observations assimilation on the air quality forecasts in China" *by* Zhen Peng et al.

Anonymous Referee #1

Received and published: 4 September 2018

Summary and general comments:

This manuscript investigated the application of ensemble Kalman filter (EnKF) for constraining the atmospheric chemical species including PM10, PM2.5, SO2, NO2, O3 and CO. The simultaneous assimilation of various surface air quality measurements improved the representation of the initial conditions and emission factors of aforementioned species, as well as their 72-hours forecasts. This investigation on the assimilation of various air quality observations for a severe haze pollution event provides a promising case study for the regional air-quality modeling. I would recommend the minor revision with the considerations of several issues as listed below.

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Discussion paper

List of minor comments:

1) Section 2.1: Which dataset (reanalysis) did you use for the meteorological initial and boundary conditions? Were the perturbations also added to the meteorology? If not, please add one or two sentences to mention that the uncertainty of the meteorology forecasts is not considered in this study.

2) L107-108: Are emission scaling factors λ spatially varying?

3) L154-156: Why the inflation factors for the chemical species β are different among the variables? Could you please provide the strategy you took to find these values?

4) L257-259: How did you perturb the initial conditions, lateral boundary conditions and emissions? In other words, please provide how you estimated the background uncertainty and spatial correlations (i.e. background covariance structures) for the chemical state variables in adding perturbations?

5) L275-279 and Figure 2: This is very promising. I would imagine that the impacts of other sources of uncertainties in air-quality forecast that were not directly considered in this study (such as chemical schemes and parameterizations in forecast model, and meteorology) were indirectly considered through the well-calibrated inflations of state variables. Could you please make a comment about the impacts of these other uncertainty sources in discussion section? I believe it would be helpful for the future readers of this manuscript.

6) Figure 4: It is not clear to me what "The shaded backgrounds indicate the distribution of the observations, where the top edge represented the 90th percentile and the bottom edge the 10th percentile" means. Does this distribution represent the observation values of individual sites in the Beijing–Tianjin–Hebei (BTH) region? Are other (red, black, pink, blue and light green) thick lines average of all sites in BTH region? The purpose to show these two values together is unclear to me, since the grey shaded line and other thick lines do not seem to be comparable each other. I would recommend to

add more explanations about this figure, or to remove the grey shaded lines.

List of specific comments:

1) L174: Please change “chose” to “chosen”.

2) L296: I think “was able to” better fits with this context than “could”.

3) Figure 4: The acronyms of “an” and “ct” is not described (although they can be guessed from the figure caption). Could you please add the explanation of those acronyms in the figure captions, such as “the analysis (referred to as “an”, pink line)”?

4) Figure 11: Please add the explanation of grey shaded lines in the top panels.

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