Thank you for your prompt comments. In this study, the observations and observation errors (constant 0.1) used in these two assimilation tools are same. However, their model errors are not the same, which is partly due to their different engineering structures. As we mentioned that GSI is 3D-var system, and its error covariance and length scales have vertical variation as shown in Figure 1. The OI assimilation is made in horizontally in $11 \times 11$ grid box (12km resolution each grid), so its horizontal length scale is approximately $11/2 \times 12 = 66$km. Vertically, OI applies its adjustment ratio up to PBL top for surface PM2.5 assimilation, or whole column for AOD assimilation over
each grid location. OI’s model errors for surface PM2.5 assimilation have diurnal vari-
ation and are varied from location to location based on the raw run’s statistics, which
is carried out in this study (Figure 2 of Tang et al., 2015). The GSI’s model errors have
no temporal variation or horizontal changes, but have vertical variations. Their biggest
behaviors difference can be seen from the Figures 4a,b: the OI assimilation mainly
affect local or nearby grids while GSI 3D-var increment expands more broadly.

Interactive comment on Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2017-147,
2017.
Model Relative Uncertainties use in OI’s surface PM2.5 assimilation at 17 UTC