

Supporting Information for "Accounting for Transport Error in Inversions: An Urban Synthetic Data Experiment"

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Description This supporting information provides an example of the spatio-temporal structure. It describes the spatio-temporal patterns of the initial model-data error of the OSSE conducted in the paper.

S1 To better understand the spatio-temporal patterns present in the error, we also compute the OSSE initial model-data error as $\mathbf{H}_3\mathbf{s}^* - \mathbf{H}_2\mathbf{s}$. In ETKF, model-data error evolves as the background ensemble changes over iteration. However, through initial model-data error we can look at the spatio-temporal patterns present in the error. From Figure S1a-c, we can see that errors from Washington sites are correlated among themselves. We can also notice that large errors are shifting from Washington D.C. to Baltimore as time progresses. This can also be clearly observed in Figure S1g by the shift of the red patch from lower left to top right. This phenomenon is an evidence of space time interaction of the errors. Figure S1d shows how the errors from Washington D.C., outer urban, and Baltimore sites are covarying in time with periods of divergence. Periods of divergence in Figure S1d are consistent with periods of large spread observed in Figure 2 of the main text. It also supports the non-constant nature of the error variability in time.

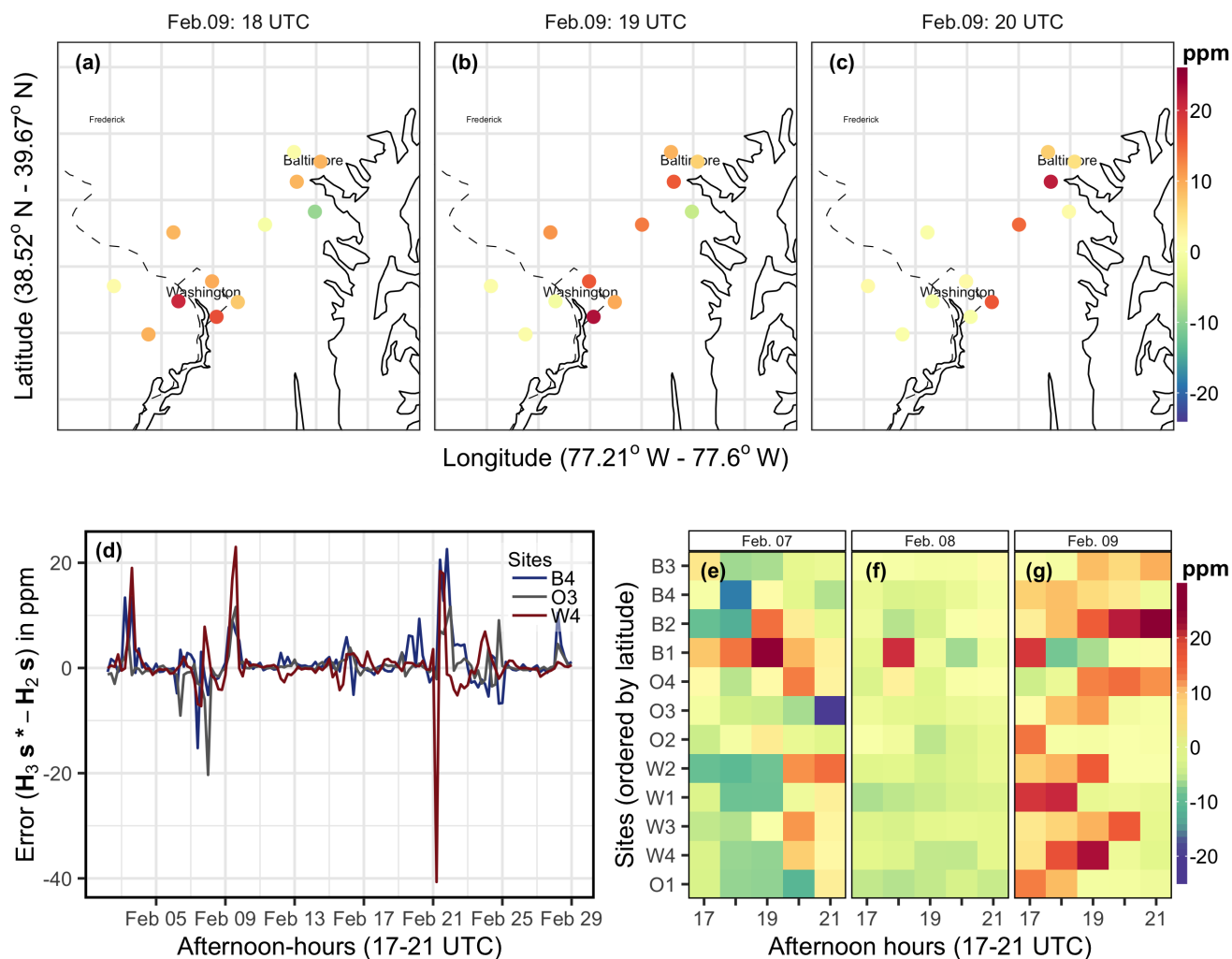


Figure S1. Top panel (a)-(c) shows spatial distribution of the initial model-data errors from twelve sites combined over the BW region at three consecutive hours 18-19 UTC on February 9th, 2016. Lower left panel (d) shows time-series of the initial model-data errors for the W4, O3, and B4 sites. Lower right panel (e)-(g) shows the Hovmöller diagram of the same quantity as a function of the tower sites (space) and time from February 7th to 9th. In the Y-axis, towers are ordered based on their latitude.