Comment on acp-2021-474
Anonymous Referee #2

Referee comment on "A New Inverse Modeling Approach for Emission Sources based on the DDM-3D and 3DVAR techniques: an application to air quality forecasts in the Beijing-Tianjin-Hebei Region" by Xinghong Cheng et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-474-RC2, 2021

Comments to “A New Inverse Modeling Approach for Emission Sources based on the DDM-3D and 3DVAR techniques: an application to air quality forecasts in the Beijing-Tianjin-Hebei Region”

General comments:

Timely precise emissions of air pollutants are crucial for air quality prediction and mitigation. The authors present a newly developed emission inversion method based on the combination three-dimensional decoupled direct (DDM-3D) and 3DVAR data assimilation techniques. The emission inversion method is applied to update the SO2 and NOx emissions over the Beijing-Tianjin-Hebei region during a heavy haze period. Their results demonstrate the newly updated emissions are reasonable and helpful to the prediction of the air pollutants including O3. The manuscript is well-organized and scientifically sound. Therefore, I recommend accepting it after minor revision.

Specific comments:

L180 Please describe the random perturbation method more detail.

L203 Matrix $D$ can not represent the impacts of local emissions at one grid on other grids. It should be $C$.

L270 Please change the $Ls$ here and in formula (5), since you also use $Ls$ in Line 214.

Figure 6 What are the reasons for the large discrepancies of the simulation and sensitivity coefficient over December 29?