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 SO_2 and NO_x 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 O_3. 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?