Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2020-597-RC1, 2020

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Insights into particulate matter pollution in the North China Plain during wintertime: Local contribution or regional transport?" *by* Jiarui Wu et al.

Anonymous Referee #3

Received and published: 12 August 2020

Source attribution of air pollution is of great importance in emission control policy making. This work developed a source-oriented method in WRF-Chem regional model and applied it in the source appointment of fine particle pollution in the highly-pollution North China Plain region. Based on a one-month simulation using this source-oriented version of the WRF-Chem model, the authors indicated different contributions from local and non-local emissions for Beijing, Tianjin and other provinces and highlight the cooperation among provinces. Overall, this work is well structured but still needs more clarification and some in-depth analysis. Here are some issues that are suggested to be addressed for further improving this work.

Some detailed configurations of model need to be clarified and updated. The definition of source regions needs to be provided in the method. There is no information or figure of the model domain and designation of source regions. See Fig.1 in Hu et al. (2015). Also, technically, the simulations are performed based on an emission inventory for the year of 2006. It is well known that China has made great effort in emission control in the past decade. For instance, SO2 has been dropping sharply since 2006, and the SO2 emission are estimated to be drop by over 70% in NCP in past 5 years due to the implementation of the toughest-ever clean air policy in China (Zhang et al., 2019). Is the emission inventory for the year of 2006 can represent the current emission scenario since the emissions underwent dramatic changes in both magnitude and spatial distribution in recent years?

Besides of photochemistry and heterogeneous chemistry, chemical production in cloud water is also an important contributor to secondary aerosol like sulfate and SOA. Why not track it in the SA calculation?

The descriptions on the model modifications need more detailed information and supporting references. 1. The yield value is vital for the simulating SOA but most references cited in this work is too outdated. Please specify the yield values from different VOCs to S/IVOC used in this simulation. 2. Line148-150, how the heterogenous oxidation of SO2 in the aerosol water are parameterized? The aerosol water is not an ideal solution and thus all the classic reaction rate is not applicable here, and how the effect of ionic strength and aerosol water acidity that would significantly influence mass transfer are considered. 3. As mentioned, ISORRPIA is calculating aerosol thermodynamical equilibrium. How does the model attribute the chemical production from different sources since they are interacting with each other. The authors' writing style makes it quite hard to follow or repeat.

Another, the discussion of the results is a little descriptive, and more in-depth analysis and political implications are suggested here. For instance, is there any difference in source attributions at different altitude, and why? To control the air pollution in a more

cost-effective way, which kinds of emission sectors, like residential combustion and transportation, should be given priority over any other.

This work aims to discuss the contribution of local emissions and trans-boundary transport in NCP. Recent studies have demonstrated that the aerosol from cross-regional transport could exert substantial impacts on local meteorological condition in North China Plain, thereby deteriorating the PM2.5 pollution in this region. Such interaction has been also identified to be an important process in trans-boundary pollution (Huang et al., 2020). Can this source-oriented model resolve such kind process and quantify the relative contribution.

References:

Hu, J. L., Wu, L., Zheng, B., Zhang, Q., He, K. B., Chang, Q., Li, X. H., Yang, F. M., Ying, Q., and Zhang, H. L.: Source contributions and regional transport of primary particulate matter in China, Environ. Pollut., 207, 31-42, doi: 10.1016/j.envpol.2015.08.037, 2015.

Huang, X. et al., Amplified transboundary transport of haze by aerosol-boundary layer interaction in China, Nature Geoscience, doi:10.1038/s41561-020-0583-4, 2020.

Zhang, Q et al., Drivers of improved PM2.5 air quality in China from 2013 to 2017,Proceedings of the National Academy of Sciences Dec 2019, 116 (49) 24463-24469; DOI: 10.1073/pnas.1907956116

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-597, 2020.