Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2021-23

Anonymous Referee #1

Referee comment on "Evaluation of the coupled high-resolution atmospheric chemistry model system MECO(n) using in situ and MAX-DOAS NO_2 measurements" by Vinod Kumar et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-23-RC1, 2021

This is a nice piece of work, I enjoy reading it. This work provide a comprehensive evaluation of NOx high-resolution simulation over Germany. NOx is one of the most important tracer gases in the atmosphere, which largely impacts photochemistry and generate secondary pollutants, including ozone and nitrate. High resolution simulation is critical to improve the non-linear photochemical processes and heterogeneous processes, the latter of which is also important for both air quality and climate, eg. (Chen et al., 2020). The work uses a broad surface observation network and DOAS column observations of NOx to provide a valuable evaluation of the high-resolution results using different emission inventories, and help us understand the uncertainties in model and inventories. I am more familiar with modelling and possibly not the best person to comment on the observation part, while, I have collaborated with MPIC a few years ago, I trust the data is of high quality from their rigorous research style. And authors have described the observation method in details and it looks convincing for me. This manuscript is well organized and written. I am happy to recommend it for publishing.

A few minor comments may help improve the discussion.

1) line 39, “secondary chemistry”, may be better using secondary pollution?

2) A little more information on the emission inventory would be helpful. Such as, the resolution of TNO and UBA inventory, and how does seasonal variation considered? What does “fl” subtitle mean, better introduce it.

3) In conclusion, up to 50% higher human emission of NOx only have a minor effect on ambient VMRs and dSCDs, and authors think this possibly stem from the short lifetime of

NOx. I feel we may want a more careful discussion here, because, no matter what time scale it is for NOx lifetime, NOx concentration is a result of the equilibrium between sources and sinks. And 50% higher of anthropogenic source has a minor impact on surface concentration, I feel it could due to two reasons: 1) anthropogenic emission is a minor source in afternoon, clearly this cannot be true over Germany, or 2) boundary layer vertical mixing is high in afternoon, this maybe more likely to be the reason. You may want to take a look of the column NOx value, VCDs. If there is a clear increase of VCDs, it could be an evidence of vertical mixing.

References:

Chen, Y., Cheng, Y., Ma, N., Wei, C., Ran, L., Wolke, R., Größ, J., Wang, Q., Pozzer, A., Denier van der Gon, H. A. C., Spindler, G., Lelieveld, J., Tegen, I., Su, H., and Wiedensohler, A.: Natural sea-salt emissions moderate the climate forcing of anthropogenic nitrate, Atmos. Chem. Phys., 20, 771-786, 10.5194/acp-20-771-2020, 2020.