EGUsphere, referee comment RC1
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Comment on egusphere-2022-882

Anonymous Referee #1

Referee comment on "Cross-evaluating WRF-Chem v4.1.2, TROPOMI, APEX, and in situ NO_2 measurements over Antwerp, Belgium" by Catalina Poraicu et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-882-RC1, 2022

This is a very meticulous study to cross-validate the various tropospheric NO2 column products from TROPOMI over the Vlanders region, by additionally using a high-resolution chemistry-transport model, and in turn validate, and optimize, the regional NOx emissions.

The authors carefully assess uncertainties across any of the steps that is needed to perform this study, with a particular focus on the (NOx) emissions total amounts and configuration in the WRF-Chem model version, as well as effects of different assumptions of vertical mixing parameterizations.

This manuscript is also very clearly written - I don't have any major comments and I believe it can essentially be published as such. There are only a few small questions that arise when reading the manuscript, which the authors may comment upon:

- page 6, l.162: 'NCEP GFS': Would it make a difference to try to use the ECMWF products instead to initialize the WRF-Chem model.
- The authors provide a detailed overview of the various emissions, with focus on the NOx emissions. However, I miss a reference to a (small and uncertain) soil-NOx emission category. Or is this implicitly included in one of the other categories?
- l.225. "About 94% of NOx emissions from Flanders is injected above the surface' . I didn't fully understand this sentence, as I assume that traffic emissions are considered as surface emissions, and consist of a large fraction. Could you possibly clarify/reformulate this statement?
- the model-observation discrepancy against surface observations for NO2 is still intriguing. I would find it useful to better understand the reasons for this discrepancy. Could one hypothesis be that the assumed PAN concentrations, required to compute the correction factor 'R', is (significantly) under-estimated? More in general, To what extent can the uncertainty in the correction factor contribute to the discrepancy?

technical correction

l.173: ‘VMM’ appears used before it is defined