Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC1
https://doi.org/10.5194/acp-2020-1185-RC1, 2021

Comment on acp-2020-1185

Anonymous Referee #1

Referee comment on "Impact of international shipping emissions on ozone and $PM_{2.5}$ in East Asia during summer: the important role of HONO and $ClNO_2$" by Jianing Dai and Tao Wang, Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-1185-RC1, 2021

This paper presents a modeling study on the impact of HONO and $ClNO_2$ chemistry on ROx budgets and pollutant formation in marine and coastal environments. The WRF-Chem model, with an updated chemical mechanism, is used to determine how ship emissions and added HONO and Cl chemistry affect ROx, O3, and PM2.5 levels. The results of the study are clear and the paper is publishable, however the comments below should be addressed before publication.

In the model setting section (2.1), more thorough descriptions of the model updates are needed to assess this study. A list of the HONO reactions and their reaction rates would be helpful to readers. The rate should especially be included for the HONO formation from particle nitrate photolysis since this is not included in Zhang et al., 2017, so it is unclear what values are used here.

In the emissions section, please cite the land-based HONO/NOx emission ratios used. It would be useful to give an approximate range of ship-based NOx emission rates as well since this plays a large role in HONO and ClNO2 chemistry.

In the model validation section (2.4), please clarify what data is being used to validate model performance and which model run is being compared. Are the values listed in Table S2 daytime hourly averages and is this averaged over the entire observational region? Is the SIM values listed for the BASE model case? Similar clarification is needed for Table S3 and the subscript description is incorrect in this table.

In the results section, clarification is again needed about the data that is shown in the figures. Is average HONO referring to daytime averages or 24-hour daily? The values seem quite high if nighttime data is included in the averages.

Check the order of your subsections – section 3.2 is missing.

In line 279, you discuss the switch between NOx and VOC-sensitive regimes, stating that increased HONO provides an additional source of NOx. The increase in ROx will also increase the back reaction from NO to HONO. Can you comment on the balance between these two reactions?

In section 2.4, you state that the model under predicts NO2 and over predicts PM2.5. I think this should be discussed in the results/discussion as well as to how this impacts your

conclusions about the importance of HONO and Cl chemistry.

In line 196, you state that HONO spatial distribution is consistent with NO2 due to the homogeneous and heterogeneous conversion. Are you referring to the HO2+NO2 as the homogeneous conversion? It's my understanding that this is a relatively unimportant HONO source compared to others. A comparison of the default to base run should provide more information since HO2+NO2 is included in the default mechanism. Perhaps you should discuss if direct emissions of HONO from ships is relevant here.

In line 340, the conclusions would be more clear if you presented values for coastal versus oceanic regions rather than just giving the total range of ROx, O3, and PM2.5 increases.