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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impacts of climate change and emissions on atmospheric oxidized nitrogen deposition over East Asia" *by* Junxi Zhang et al.

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Comments from Reviewer 2:

General comments:

Zhang et al., used the ensemble model outputs from ACCMIP to study the future spatial distributions of total NOy deposition, including wet and dry NOy. They discussed that under the future reductions of anthropogenic emissions, the fractions of the ship emissions, as well as lightning emissions will have relatively important role in contributing the NOy deposition. The authors also estimated the marine primary production form

the future NOy depositions. The manuscript is well-written and designed. I suggest to be accepted by ACP with minor revisions.

Response: We thank the reviewer for the constructive comments to help us further improve the manuscript. Please see the detailed responses to the specific comments below.

Specific comments:

In the abstract, I suggest the authors to add the marine primary production projected in the future, as this could be one innovation distinguished from other studies. I will suggest move the sentences from line 61 to line 63 before the discussion of ship and lightning emissions.

Response: We thank the reviewer for the suggestion to highlight the finding. The projected future changes of the marine primary production under RCP scenarios have been addressed in the revised abstract. For the sentences from line 61 to 63, it refers to ship emission. The original manuscript did not specifically point this out and this has been clarified in the revised manuscript.

In section 3, I suggest the authors also add the model evaluations for the NOy deposition in East Asia sine Larmarque et al.,2013 focused on wet NO3 only.

Response: It would be good to add the evaluation for the NOy deposition. Unfortunately, the observations of EANET does not contain NOy deposition. Therefore, the precipitation in East Asia was evaluated as it has a dominant influence on wet NOy deposition.

Also in reporting the future NOy changes under the four scenarios (RCP4.5, RCP8.5, Em2000Cl2030, Em2000Cl20100), I would suggest the authors to add tables listing the standard deviations, considering the multi-model and multi-year averages.

Response: As the reviewer suggested, the standard deviation of regional future NOy changes over BYE areas for each season (Table S2 for dry NOy and Table S3 for wet

NOy) has been added.

P3 line 73-74: Split up these references so that they are associated with the specific impacts being discussed, rather than all placed at the end of the sentence.

Response: This has been revised following your suggestion.

P3 line 95: Should HNO4 also included in the NOy species?

Response: Right, this has been added in the revised manuscript.

P4 line 107-108: I feel the reference to the ship emissions are out of nowhere. I know the authors discuss heavily on the contributions of future lightning and ship emissions on NOy deposition, but I do not think the authors did a very good job in summarizing the current literature on ship emissions. Instead, line 336-341 should be moved up to the introduction.

Response: We thank the reviewer for bringing up the important point. We have revised the manuscript by moving up line 336-341 to the introduction, and rephrased the sentences as well.

P6 line 173: captured to captures

Response: This has been revised.

In section 5: add a table discussing the emission changes in 2030s and 2100 from the ship and lightning from ensemble models, since the authors were arguing the these two emission sources will have import influence for NOy deposition in the future.

Response: We have added a table (Table S4) summarizing the multi-model mean ship and lightning NOx emission over Yellow Sea and East China Sea under all scenarios studied. The corresponding discussion has been added in last two paragraphs of section 5, paragraph 7,8.

In Fig 2: Adjust the vertical color bar to cover the plots on second to fifth rows. In row

1, add the region names BS, YS, and ES into the top left plot.

Response: This has been revised. Region names BS, YS and ES have been added into the top left plot with pink colors for names and boxes. The vertical color bar has been adjusted, and this applied to Fig. 3 as well.

In Fig 78: I will suggest to change “eminox” for ship to “emisnox”

Response: This has been revised.

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