

## ***Interactive comment on “Simulation of nitrogen deposition in the North China Plain by the FRAME model” by Y. Zhang et al.***

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We thank the referee for the comments. We would like give feedback and list all the reply in detail

Q: p8164 line13: please use NH<sub>x</sub> (NH<sub>3</sub> and NH<sub>4</sub><sup>+</sup>) and NO<sub>y</sub> (NO<sub>x</sub> and NO<sub>3</sub>)

A: Agreed and changed.

Q: p8166 line5: 'displayed higher intercepts' - higher than what?

A: "...higher than those in the simulation in the UK (Dore et al., 2009)"

Q: p8167 line7-18: you use rather a lot of words here to say that the deposition is high in the NCP. Furthermore, I don't think that the comparisons are always relevant, given

C3893

the large difference in emissions/activities in those areas.

A: Yes, the emissions, meteorology, land cover, etc in the NCP are quite different with those in the Europe. Here, we just conducted the comparisons to imply that the N deposition in the NCP is much higher than that in the Europe. N deposition in the NCP, UK and Poland were all simulated by the same model and for similar areas. As N deposition hotspot in the world, the averaged deposition rate was more than five times that of the EU27. That's why the comparison of averaged deposition values was carried out for the NCP and EU.

Q: p8167 line26-28: 'Excluding the NH<sub>x</sub>-N deposition, only the average ...'. I do not fully understand what you want to tell us with this sentence, please explain.

A: It was changed to "Average NO<sub>y</sub>-N deposition was 11 kg N ha<sup>-1</sup> yr<sup>-1</sup>, comparable to the modeled total N deposition in the UK (Dore et al., 2009)."

Q: p8168 line8: exported and imported N budget. I'm not native English speaking, but I'm not sure if one can export/import a N budget. Perhaps just leave budget out of this sentence.

A: It was changed to "component"

Q: p8170 line6: bi-exchange. Is perhaps 'bi-directional exchange'?

A: Thank you. It was changed to "bi-directional exchange".

Q: p8170 line13: 'Therefore there is some potential to improve ....'. perhaps you want to say that there is some 'need' rather that 'potential' to improve?

A: Yes, it was changed to "need".

Q: p8170 line16-26: this bit is perhaps somewhat confusing. First you start with a sentence about critical loads, then critical levels and the loads again. I would suggest to cluster it: first start with levels and then start explaining the loads

C3894

A: Agreed and changed as the suggestion.

Q: p8171 line2: 'intolerant'? shouldn't this be 'tolerant'?

A: Yes, it was corrected.

Q: p8171 line22: '..exposed to high N deposition for the transportation of ...'. strange sentence, please rephrase.

A: It was changed to "In addition, natural regions surrounding the NCP were exposed to high N deposition for the diffusion of nitrogenous pollutants from intensive emission sources, ..."

Q: p8171 line27-29: are you sure about these statements with respect to the contribution of high N concentrations to 'reduced visibility, regional haze ....'? Please give references for it.

A: References were added.

Q: p8172 line11: 'must had been happened already'. again, I'm not perfect in English, but please check this again since it sounds a bit funny.

A: It was changed to "must have been happened already".

Q: p8172 line12-13: 'have been kept increasing'. also a strange phrase. perhaps just leave out the 'have been'

A: "have been" was deleted.

Q: p8172 line13: change 'downwind' to 'downward'

A: It was corrected.

Q: p8172 line21: 'Assuming total N deposition in the coastal region from precipitation'. I guess you want to say something like 'Assuming that the total N deposition in the coastal region originates from precipitation'?

C3895

A: Changed as suggestion.

Q: p8173 line4: 'As our study,' something is missing here - don't know what.

A: It was changed to "As the simulated results in our study, ..."

Q: p8174 line21: 'resulted coastal' - 'resulted in coastal'

A: Agreed and changed.

Q: general remark with respect to the model calculations: when comparing the NH<sub>x</sub>-dry deposition/NH<sub>3</sub> concentration and NH<sub>3</sub> emission maps, a strange inconsistency occurs - for the Shandong province (the large part outside NCP), high NH<sub>x</sub> depositions seem to occur at locations where there are low NH<sub>3</sub> concentrations/emissions. How is that possible? Can only a multiplication with a dry deposition velocity explain such a large difference in the overall pattern? How does this influence the overall picture with respect to NH<sub>x</sub>?

A: Thank you for the question. Figure 1c. was added to explain the landuse. Actually, this area was covered by artificial forest, grassland and farmland. It will be easier to understand with the landuse type.

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C3896