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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Atmospheric nitrogen deposition to the northwestern Pacific: seasonal variation and source attribution" *by* Y. H. Zhao et al.

Anonymous Referee #2

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General comments This paper discussed atmospheric N deposition in the northeastern Pacific Ocean in relation to anthropogenic and natural reactive N emissions using the GEOS-chemical global chemistry model. The authors provided very important information on both dry and wet N deposition in Yellow Sea and South China Sea and compare their results with satellite data and emission inventory data with regional differences in anthropogenic reactive N sources. This is a significant contribution to scientific knowledge on how the terrestrial reactive N emissions affect N wet and dry deposition onto the northeastern Pacific Ocean (e.g. Yellow Sea and South China Seas). Scientific comments The authors jointly used modeling tool, satellite observation and surface

measurement to obtain relatively accurate and comprehensive information on atmospheric nitrogen deposition to the northwestern Pacific, especially the China Seas. The results of this study contribute to a better understanding of coastal atmospheric N deposition and help to make effective strategies for mitigating N deposition. To further improve the quality of the manuscript, I suggest that a section of the uncertainty analysis (as also mentioned in later) may be presented in the text. Technical corrections / comments Introduction Page13660. Line 7. The formation of ammonium particles increases... Page13660. Line 8. As dry removal of the particles... Sect. 2.1 General description Page 13662. Lines 10, 15. The monthly dry deposition velocities of Nr species (e.g. NO2 and NH3) over the northwestern Pacific and seasonality of them differ from the results reported by Zhang et al. (2010) over the China Seas. Did this study consider impact of the sea-surface height on the velocities? How is the reliability if using the current deposition velocities to the China Seas? Reference mentioned: Zhang Y., et al. Atmospheric deposition of inorganic nitrogen to the eastern China seas and its implications to marine biogeochemistry. Journal of Geophysical Research, Vol. 115, D00K10, doi:10.1029/2009JD012814, 2010. 3 Column concentrations and wet deposition fluxes over Asia Page 13667. Line 5. The highest sensitivities Page 13668. Line 5. This study shows that Annually model simulated nitrogen wet deposition (NH4+ + NO3-) fluxes over China averages 9.3 kg N ha-1 a-1 with NH4+ contributing 70 %. However, this modeled magnitude of wet deposition was 1.6-times lower that the results reported by recent studies (Jia et al., 2014, 13.9 kg N ha-1 a-1; Zhu et al., 2015, 13.2 kg N ha-1 a-1) based on published large amount of Chinese surface measurements. In addition, although the contribution of NH4+ to total wet N deposition (70%) was similar to that in north China (Pan et al., 2012, in the range of 63-78%), it might be overestimated at the national scale as an average value of 55% has been observed by Zhu et al. (2015) based on 41 in situ monitoring sites across China. Therefore, the modeled flux of wet deposition may have some uncertainties. Please make a comprehensive comparison in the text. References mentioned: Jia, Y. L. et al., 2014. Spatial and decadal variations in inorganic nitrogen wet deposition in China induced by human activity. Sci. Rep., 4,

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3763. Pan, Y. P. et al. 2012. Wet and dry deposition of atmospheric nitrogen at ten sites in Northern China. Atmos. Chem. Phys., 12, 6515-6535. Zhu, J. X. et al., 2015. The composition, spatial patterns, and influencing factors of atmospheric wet nitrogen deposition in Chinese terrestrial ecosystems. Sci. Total Environ., 511, 777-785. Page 13668. Line 5. are greater than 0.7. Page 13668. Lines 7-8. This is similar to Lv et al. (2007) who estimated... 4.1 Seasonal variation and deposition process Page 13669. Line 25. Accounting to Zhang et al. (2012), there were some uncertainties on seasonal amounts of NOy deposition modeled by Geos-Chem. Does this affect the current findings? Please clarify. Reference mentioned: Zhang, L., et al. 2012. Nitrogen Deposition to the United States: Distribution, Sources, and Processes, Atmos. Chem. Phys., 12, 4539-4554. Page 13670. Lines 1-2. higher than in April and July Page 13671. Line 10. spatial and seasonal variations of atmospheric nitrogen...

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 13657, 2015.