

Interactive comment on “Why the Indo-Gangetic Plain is the region with the largest NH₃ column in the globe during summertime?” by Tiantian Wang et al.

Anonymous Referee #2

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General comments

The study analyses the possible factors responsible for elevated levels of ammonia over Indo-Gangetic Plain (IGP) regions during summertime. From previous studies, IGP has been identified as a hotspot for ammonia and analyzing the reasons for the high levels is an important study. Considering the implications of high-level ammonia, this study improves the understanding of the scientific community working on the ammonia over IGP. The authors use the air quality model (WRF-Chem), emission inventory and observation data (IASI satellite) to analyze the possible factors namely chemical conversion, emissions, and meteorology on ammonia loading.

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Specific comments with line numbers are provided below and I recommend these issues to be addressed before publication in ACP.

Specific comments

Title: The authors classify June to August as the summer period in the study. However, the Indian summertime is considered from April-June and monsoon begins from mid-June/late June. Summer to monsoon season has a drastic change in regional meteorology over IGP and possibility impact the levels of ammonia (gas phase) over IGP from high to low because of washout effects? I would suggest the authors not to mention the summer season in the title or in the study in general if possible or provide some explanation here.

Methods

Line 65: The authors mentioned the fair agreement of IASI ammonia observations with ground-based measurements citing few studies which are mainly satellite observations. It is not clear whether the fair agreement was for IGP or other regions. It would be helpful if the authors could provide some details about the ground measurements used here.

Line 77: The authors should provide more details on the input of the ISORROPIA-II model or in general the model in order to interpret the gas-particle partitioning of the ammonia for example what are the gas species in input?

Line 80: “As inputs of ISORROPIA-II, the outputs (water-soluble ions, gas species, T and RH) of WRF-Chem were first averaged over the IGP and then averaged for summer 2010”. Please provide more details on averaging here. As IGP is a vast region, averaging the inputs over the region may create a bias for some regions over IGP considering the heterogeneity of the sources over IGP. Again the time averaging may create some bias too as the time period included in the study has few days or a month of the summer season and two months of monsoon as per Indian meteorological

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department classification. It would be useful to check the variability of the inputs month wise for example June, July, and August separately.

Results

Line 105: As per the sowing season, IGP has mainly two cropping cycles which includes summer and winter both. During both cycles, fertilizer applications can be intensive. Is there any study/data supporting the highest N- fertilizer application during the months mentioned in this study? Line108: Authors cited the Riddick et al. 2010 for the exponential increase of ammonia emission with temperature. Would it be possible to expect similar results, if the temperature data and ammonia satellite observations from the present study taken in to account?

Line 160: The analysis of the low gas-to-particle conversion of ammonia demonstrates the sensitivity to SO₂/NO_x emissions. This is an excellent analysis based on the model output data. Is it fair to expect similar results if the data for SO₂/NO_x not modeled but taken from observations either ground or satellite observations? Please comment on this.

Line 200: The authors concluded an interesting observation about the other factors than wet conditions and high RH controlling the high ammonia loading over the IGP. More details on this would be useful to support this conclusion. Even a simple time series of IASI ammonia observations with RH for the period of study would provide an important context.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2019-1026>, 2019.