

Interactive comment on “Analysis of atmospheric ammonia over South and East Asia based on the MOZART-4 model and its comparison with satellite and surface observations” by Pooja V. Pawar et al.

Anonymous Referee #3

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Ammonia is an important short-lived pollutant with a huge global relevance for air quality, biodiversity and climate due to the wide spread food production. Improving the nitrogen use efficiency in agriculture is of key importance, which requires an understanding of the nitrogen budgets and the ability to monitor these. The atmospheric ammonia burden is difficult to model, and hence, improving our modelling capacity is an important activity. After reading the paper in detail I recommend a major revision is required to improve the paper to a level which is beyond a simple comparison between a coarse model field and observations, which is currently basically is.

A major drawback of this study is the coarse resolution the modelling is performed on.

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Not only in a spatial sense, also the output is available on 4 hours of the day, with IASI overpass (9:30) right in between the output times (06 and 12). The description of the comparison to the satellite data is very short. Giving the strong diurnal cycle of ammonia and the fact that the satellite data availability is affected by all kinds of factors I would like to see a much more detailed description on the method and the impacts of the choices made. - Were the monthly mean comparisons made by averaging paired observations across the month? How many valid pairs were required to allow for a valid number? If pairing was not done than a motivation/discussion why this is not important should be included. Normally the large degree of variability of ammonia column densities between days requires to pair. Satellite data availability and patterns in these within a large grid cell can also impact a non-paired comparison. - How was the modelled column for 09:30 estimated? Later I read that a daily mean model value is used. . . correct? - Which quality flags of the satellite data were used? - In our experience the diurnal emission cycle largely impacts the ammonia columns at overpass. What was assumed in this study? Given the agricultural practices in India, is it warranted to use a flat emission cycle across the year?

The paper is severely hampered by the coarse comparison and I am afraid that the comparison methodology may impact the systematic differences seen in this paper. The differences between overpass time and a daily mean for instance relate to the daylength (variability) and associated mixing, diurnal emission cycle, frequency and kind of precipitation events, etc. I would have like to see an analysis / consideration of such factors in this paper. Part of the observations might be useful for this purpose.

The discussion does not include a comparison to other modelling studies evaluating ammonia levels across Asia or studies on ammonia life time.

I could identify many grammar mistakes in the english language use. The author list includes native speakers and I would like to urge to perform a careful language check.

Minor comments:

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Abstract: Please use past tense for the method description

Introduction The introduction focusses mostly on the contribution of different agricultural activities to emission estimates in south and east Asia. The challenges with respect to the emission estimation, spatial and temporal emission variability, chemistry transport modelling and model-satellite comparison are not focused on although these are relevant to the paper and partly addressed. I would like to ask the authors to address these issues in the intro.

Line 43: chemical should be syntethic Line 50: 64 % of total means total global? if yes line 53 repeats this statement Line 60-62: could you use the recent edgar numbers or thise from v4.3? Should these statements be presented with the global comparison the paragraph above? Line 63 and 67 are in direct contradiction to each other

Data and methodology Line 85: this sentence implies only trace gases were modelled, which is not the case I guess

Line 97: Does Mozart use a land use mosaic within a gridcell? Or dominant LUC? How do the wesely land use classes match those in the domain? Were the latter updated? Line 122: didn't you use emissions of all sectors? Line 133: cow dung is not fossil

Results: Line 226: the methodology describes that nitrate is present – please explain 250: the model has no maximum emissions in summer as antrop is flat and soil is a few percent of total, so this statement seems incorrect

Figure 2: the scale on the upper left figure is misleading. It seems a seasonal cycle where it is basically flat.

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