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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Modeling Atmospheric Ammonia using Agricultural Emissions with Improved Spatial Variability and Temporal Dynamics" *by* Xinrui Ge et al.

**Anonymous Referee #1**

Received and published: 24 June 2020

General comments This remains a very long paper and some parts resemble more a good working draft written by a PhD student than a final draft that has had the guiding hand of an experienced scientist. In this respect, the authors are doing themselves a disfavour, since the work is otherwise something of a tour de force. In particular: - The English needs to be improved. I started making corrections to the language but stopped at page 24, as I was being distracted from my main task (considering the science). - Some of the text in the Results section is actually a discussion of the results and should be moved to the Discussion section.

As I noted in my original review, I am surprised that the authors did not choose to



compare their simulations with measurement sites that did not have local ammonia sources. Such sites would be expected to reflect the consequences of agricultural practices over a wider area.

Use of 'ammonia' and 'NH3' is inconsistent. I would suggest using NH3 (once it has been defined), except when it starts a sentence.

Specific comments

Page 7 What do the authors mean by 'non-fertilizer N input'? Is this biological N fixation or atmospheric deposition (or both)? Replace 'available manure' with 'available manure N'

Page 8 The authors write: It has to be noted that the ammonia emission estimates from INTEGRATOR differ from the officially reported national emission totals which are used in the MACC-III inventory. Because each country utilizes its own estimation algorithms that deviate from the INTIEGRTOR methodology which starts with animal number, excretion rate and emission fraction.

The national methodologies will also start with animal number and excretion rate, though they may not be the same as those used in INTEGRATOR. I suggest the following formulation: It should be noted that the NH3 emission estimates from INTEGRATOR differ from the officially reported national emission totals that are used in the MACC-III inventory. This is because each country uses its own emission inventory methodology whereas INTEGRTOR uses a uniform methodology for all countries. Change 'time profiles that distribute annual emission total in a grid cell over the course of a year' to 'time profiles that distribute the annual emission total in a grid cell over the course of a year'

Page 10 The authors write: Even though the difference between daily mean temperature and the base temperature is larger in the south, the greater reference thermal sum makes it longer to reach. Whereas for spring wheat, the reference thermal sum in the

south is less significantly bigger than that in the north, resulting in earlier sowing day in the south. I think this would be better: For winter what, even though the differences between daily mean temperature and the base temperature are larger in the south, the greater reference thermal sum it takes a longer time to reach this thermal sum. Whereas for spring wheat, the reference thermal sum in the south is less than that in the north, resulting in earlier sowing day than in the north.

The authors write: Also, Gyldenkærne et al. (2005) argued that there still expect to be variation in the timing of fertilizer and manure application because farmers often spend several days applying fertilizer and manure to the field. This means that a normal distribution around the central estimate and Gaussian functions are used to characterize it.

I think this would be better: In addition, Gyldenkærne et al. (2005) argued that there would still be variation in the timing of fertilizer and manure applications because of the time it would take farmers to complete these operations. As a consequence, a normal distribution around the central estimate was used here and Gaussian functions used to characterize it.

The authors write: Except that spring-summer application's deviation is 16 days, the other applications are given a deviation of 9 days. Besides, mineral fertilization in early spring and summer have a deviation of 9 and 16 days, respectively. Therefore, in this paper, we followed the systematic: for fertilizations that lie between mid-May and mid-August the deviation of corresponding emission function is 16 days, while for the others the standard deviation is considered to be nine days. I think this would be better: The standard deviation of the spring-summer application is 16 days while that of the remaining applications was 9 days. The standard deviation of the timing of the mineral fertilization applications in early spring and summer were 9 and 16 days, respectively. We make a similar assumption in this paper: for fertilizations that lie between mid-May and mid-August, the standard deviation of the corresponding emission function is 16 days, while for the remainder, the standard deviation is considered to be 9 days.



Page 11

The authors write: intrusion effectiveness of manure and lead to an enormous amount of nutrient losses. Besides, after excessive precipitation, it is much more difficult for farmers to perform fertilization practices I think this would be better: infiltration rate of liquid manures and would risk serious surface runoff. In addition, trafficking the wet soil surface with heavy machinery would likely be impossible.

I am unclear what the authors mean by: Therefore, manure application is not effective during these conditions. As far as I can judge, this sentence is not necessary, since the subsequent sentences define how the model treats this situation.

Page 16 The abbreviation IASI is used before it has been defined: The following sentence does not make sense: Furthermore, the retrieval algorithm if IASI needs an accurate temperature profile, without which larger measurement errors will occur. I guess they mean: Furthermore, the retrieval algorithm of the IASI needs an accurate temperature profile, without which large measurement errors will occur.

The authors write: Even though for the comparison with modeled concentrations, the used measurement data should be representative of a wider region, it is impossible to get rid of local influences completely. In this study, all measurements were also looked to determine the overall performance of the original and updated model I think this would be better: For the comparison with modeled concentrations, the measurement data used should ideally be representative of a wider region. However, with measurements made at a single location, it is impossible to remove the local influences completely.

I do not understand this sentence: In this study, all measurements were also looked to determine the overall performance of the original and updated model

Page 17 The authors write: Because thermal contrast

I think this would be better: This is because the thermal contrast

Page 18 The authors write: Because they use different I think this would be better: This is because they use different. . .

Page 19

Change caption above Fig 4a to read '. . . total NH3. . .'

Page 21 The authors write: the outcome is supposed to

Supposed by whom? Need a reference here.

Page 22 The authors write: standing out I think this would be better: prominent

Replace 'plumes' with 'clusters'. Replace 'demonstrated' with 'shown' Replace 'the less spreading-out distribution in the y-axis' with the lower dispersion along the y-axis'

Page 23

Replace 'sorely' with 'solely'.

Page 24

Replace 'look' with 'show' in Fig 7 caption The authors need to make the captions above the figures more meaningful. They are all identical at the moment, which means the reader has to read the main figure caption to identify what they show.

(End of English copyediting at page 24)

Page 25

Much of the second and third paragraphs does not present the results but discuss them. This text needs to be moved to the Discussion.

Page 28 Again, much of the second and third paragraphs does not present the results but discuss them. This text needs to be moved to the Discussion.

Page 33



ATAN is not defined.

'Preliminary results show' – preliminary results of what and by whom?

Page 34 The 6 to 7 lines from 'Regarding the newly developed temporal..' repeat the description given in the Methods section and can be removed.

Page 35

The abbreviation 'CrIS' is not defined.

'Moreover, simulations could be shifted horizontally compared to measurements' I think they mean that the simulation could be systematically lagging in time behind the measurement.

Page 36

The authors state that: Most ideally, a station next to arable land but is distant from an animal house or manure storage would be most optimal in this paper to verify the timing of emission from manure/fertilizer application

If one was assessing the ability of a model to simulate agricultural field operations, it would not be sufficient to do so at just a single site.

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