Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2019-689-RC1, 2019

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Quantification and evaluation of atmospheric ammonia emissions with different methods: A case study for the Yangtze River Delta region, China" *by* Yu Zhao et al.

Anonymous Referee #2

Received and published: 20 December 2019

This paper compares and contrasts two methodologies for estimating emissions of NH3 in China, and illustrates the consequence through model simulations. The paper deals with an important subject, since the large uncertainties surrounding ammonia emissions need to be understood by modelers and policy experts.

The paper is generally well written, and generally sound, but I miss consideration of many of the factors omitted from the emission estimation procedure. This study basically used temperature, and agricultural statistics, to calculate emission factors (EFs). However, with respect to emissions from livestock/poultry, wind-speed is also a very

important factor (e.g. Gyldenkaerne et al., 2005, Skjoeth et al., 2011, Flechard et al, 2013). Many other factors should also impact NH3 emissions, such as radiation, rainfall (and other precipitation), leaf-wetness, atmospheric stability, large uncertainties in the so-called Gamma factors, or bi-directional exchange in general (Bash et al, 2013, Flechard et al., 2013, Massad et al, 2010, Wichink Kruit et al., 2012).

Consideration of such factors might also help to explain some if the model discrepancies outlined in Section 3, and should at least be considered before trying to explain all such discrepancies in terms of temperature and a few selected variables only.

The authors use meteorology from ECMWF for their emissions, but why not the WRF model, since that is obviously available and is used for their CMAQ runs?

The equations used are generally clearly written out, although it isn't always clear where they are coming from. For example, is it correct that equations 2 & 3 are a mixture of methods from Huang et al 2012 and EEA 2013? On the other hand, I read in various sections of EEA 2013 that temperature functions could not be provided (e.g. chap. 3.D crop production and agricultural soils) If from EEA, then it would also be good to cite the scientific papers underlying the EEA guidelines, and to be more specific as to which sections of EEA are being cited (it is a monster document).

Some other points:

P2. The abstract is rather long, and should be shortened for clarity.

P3, L67. NH3 is said to react with NOx, but NOx usually means NO+NO2. I think the authors mean HNO3?

P3, L78-81. The sentence is a little unclear. Clarify.

P4, L112. Methods of including meteorology in NH3 emissions have been around for some time and should be mentioned, e.g. Gyldenkaerne et al., 2005, Skjoeth et al., 2011, , Wichink Kruit et al., 2012, Bash et al., 2013.

P5, L148. Another source of human-related NH3 emissions is pets. As shown in e.g. Sutton et al 1995, 2000, human pets can be as significant as human metabolism with regard to NH3 emissions.

P6, L168. Using should be used.

P7, L187. Give reference for radiometer

P7, L202. The study of Huang et al 2012 uses a linear relationship between pH and EF. Why is the relation here said to be near-linear?

P7. What is the time-resolution of the EF calculations?

P8, L232. Surely fertilizer application at 15-20cm affects the pH of the soil; doesn't this affect the assumptions made when using global pH data from IIASA?

P9. The basic references of the CMAQ model should be given, not just a web-address.

P10. Which version of MEGAN was used? Did you use data provided by Sindelarova, or did you use the MEGAN model itself? If the latter, a Guenther et al ref would seem more

P10. Again, give reference to the model developers - this time for WRF.

P11. The Lanciki 2018 reference for MARGA is missing.

P15. The citation of Wei et al (2015) is in Chinese, and thus not helpful for most authors. This instrument has been around for many years, and the artifacts documented elsewhere. Please find some citations in English for the problems mentioned.

P28, Use molecule not "mole.", to avoid confusion with the mole unit.

P31. Table 3. Correlation coefficients should be added, and the time-resolution of the statistics mentioned.

P31 cont. for all Tables make it clear if statistics are calculated from hourly, daily or monthly values.

There are small English misses throughout, for example with regard to singular or plural, or omission of the definite article (the).

References

Bash, J. O., Cooter, E. J., Dennis, R. L., Walker, J. T. & Pleim, J. E. Evaluation of a regional air-quality model with bidirectional NH_3 exchange coupled to an agroecosystem model Biogeosciences, 2013, 10, 1635-1645

Flechard, C. R., Massad, R.-S., Loubet, B., Personne, E., Simpson, D., Bash, J. O., Cooter, E. J., Nemitz, E. & Sutton, M. A. Advances in understanding, models and parameterizations of biosphere-atmosphere ammonia exchange Biogeosciences, 2013, 10, 5183-5225

Gyldenkaerne, S., Skjøth, C., Hertel, O. & Ellermann, T. A dynamical ammonia emission parameterization for use in air pollution models J. Geophys. Res., 2005, 110

Skjoeth, C. A., Geels, C., Berge, H., Gyldenkaerne, S., Fagerli, H., Ellermann, T., Frohn, L. M., Christensen, J., Hansen, K. M., Hansen, K. & Hertel, O. Spatial and temporal variations in ammonia emissions - a freely accessible model code for Europe Atmos. Chem. Physics, 2011, 11, 5221-5236

Sutton, M. A., Dragosits, U., Tang, Y. S. & Fowler, D. Ammonia emissions from non-agricultural sources in the UK Atmos. Environ., 2000, 34, 855-869

Sutton, M., Place, C., Eager, M., Fowler, D. & Smith, R. Assessment of the magnitude of ammonia emissions in the United-Kingdom Atmos. Environ., 1995, 29, 1393-1411

Wichink Kruit, R. J., Schaap, M., Sauter, F. J., van Zanten, M. C. & van Pul, W. A. J. Modeling the distribution of ammonia across Europe including bi-directional surface-atmosphere exchange Biogeosciences, 2012, 9, 5261-5277

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2019-689, 2019.