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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Northwestward Cropland Expansion and Growing Urea-Based Fertilizer Use Enhanced NH_3 Emission Loss in the Contiguous United States" *by* Peiyu Cao et al.

Anonymous Referee #1

Received and published: 21 April 2020

In this study, Cao et al. derive US NH3 emissions associated with fertilizer application from 1900 to 2015. The strength of this study lies in the use of spatially-explicit time-series for cropland distribution and fertilizer application. The authors rely on a very simple emission scheme to estimate NH3 emissions. While this is acceptable considering the goal of this study, better quantification of the role of each factors and associated uncertainties for the authors' conclusions are needed before publication can be considered.

General comments

line 130 How would application of fertilizer at emergence (early spring) for winter wheat

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Discussion paper

impact the authors' conclusions

line 305 relationship with wet deposition is not very compelling. As noted by the authors there are a lot of different factors that could be at play. I would suggest to focus on spring and fall months where the authors expect the fertilizer contribution to be maximum

Trend attribution ————————

I recommend the authors better quantify the relative importance of the different factors that contribute to changes in the magnitude and seasonality of NH3 emissions. I would suggest the authors perform their analysis using a climatology for a) temperature, b) fertilizer type, c) spatial crop distribution, e) crop mix

There are two important factors that I would like the authors to analyze in more details a) planting dates The authors rely on a climatology for planting dates. However, Kucharik (2006) showed using the USDA crop report that corn planting took place $\sim$2 weeks earlier in 2005 relative to 1980. This dataset is available for other crops and it would be useful for authors to assess the impact of changing planting dates over this time period.

There also exists simple parameterizations to estimate planting dates based on temperature/precipitation that I would recommend the authors consider to estimate the variability in planting dates before 1979 (e.g., Bondeau (2007))

b) could the authors comment on the impact of long-term acidification that has been reported in several studies

Veenstra, J.J. and Lee Burras, C. (2015), Soil Profile Transformation after 50 Years of Agricultural Land Use. Soil Science Society of America Journal, 79: 1154-1162. doi:10.2136/sssaj2015.01.0027 Fuqiang Dai, Zhiqiang Lv, Gangcai Liu. (2018) Assessing Soil Quality for Sustainable Cropland Management Based on Factor Analysis and Fuzzy Sets: A Case Study in the Lhasa River Valley, Tibetan Plateau. Sustainabil-

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ity 10:10, pages 3477

Comparison with other inventories ———————————

the authors need to compare their inventory against other efforts to develop historical emissions from EPA, EDGAR, and CMIP6. I believe that only gridded NH3 emissions from agriculture may be readily available from EPA and CMIP6 but I encourage the authors to contact the inventories' developers to obtain their estimates for historical US fertilizer emissions.

http://www.globalchange.umd.edu/ceds/ -> code is freely available https://edgar.jrc.ec.europa.eu/

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Technical comments:

line 30: please rephrase to more clearly separate the impacts associated with N deposition and with PM2.5

line 70 I would recommend discussing alternative (more recent) approaches used to derive NH3 emissions not only in the US but also in China and Europe. There have been a lot of progress in NH3 inventories since the work of Bouwman and the authors need to better explain why this approach was selected.

line 42 grammar: for quantifying long-term spatially explicit of NH3 emissions

line 63 objects -> goals

Line 136 The authors need to clarify that this dataset represents a climatology of present-day planting dates.

line 196 I am not sure what reportedly means in this context

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