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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Do alternative inventories converge on the spatiotemporal representation of spring ammonia emissions in France?" *by* Audrey Fortems-Cheiney et al.

**Anonymous Referee #2**

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Summary

The authors present an inter-comparison of two alternative inventories with the European reference inventory (TNO) to quantify the French NH3 emissions during spring 2011; (i) NH3SAT inventory which is based on a top-down approach of correcting TNO NH3 emissions based on total column observations and (ii) CADASTRE-CIT inventory which is built from the bottom-up based on modeled NH3 emissions related to fertilizer application and animal husbandry. There is a thorough comparison of inventories based on different regions of France with known anthropogenic NH3 emitting activities. The work specifies which regions in France, represented in the European reference



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Discussion paper

inventory, need to be improved upon and highlights the general conclusion of improving NH3 emissions inventories based on measurements and process knowledge is required.

Inventories are key inputs in forecasting air quality, so the goal of this study to build a more representative inventory over France is important work. Building NH3 inventories is very challenging because of its varied lifetime in the atmosphere and complex exchange mechanisms making its spatial distribution and temporal behavior difficult to predict. Atmospheric NH3 is an important precursor to PM and can also damage N-sensitive ecosystems, therefore, refined emissions inventories are needed for air quality modeling and monitoring emissions reductions. This study details methods to refine inventories, therefore, I would recommend publishing this manuscript after some revisions.

Major Comments

There have been other global inventories built by the atmospheric community using similar methods that have not been mentioned and would add to the discussion of the authors' work.

Work from Zhang et al. (ACP, 18, 339-355, 2018), who reconcile bottom-up and top-down inventories, also show including more detailed information on crop-specific fertilizer application practices and met factors does a better job at reproducing spatial and seasonal variations in China, which seems to be similar in this study, but in France.

How do the two alternative inventories compare to currently available inventories, aside from TNO? How does CADASTRA-CIT compare with the MASAGE_NH3 inventory? and other global inventories that represent France, such as EDGAR? Is TNO built upon any of these inventories already?

Atmospheric NH3 is known to undergo bi-directional exchange with surfaces and this aspect is not discussed. The NH3SAT is generated based on chemical transport mod-

eling of TNO, however, the CHIMERE model parameterizes NH3 dry deposition unidirectionally. Is this a limit of the model? If NH3 dry deposition is assumed to be a net sink, then in most cases that would underestimate atmospheric concentrations. How does this impact NH3 estimates? and to what degree?

Can the authors comment on how well CHIMERE can predict particulate NH4+? How much does that influence NH3 estimates?

What are the limits of the Volt'air model? It is usually used to predict emissions from slurry applications, so it doesn't account for a crop canopy. Does that matter? Are there any fast-growing crops that would sprout in the first month in which the model was run?

What is the availability of ground-based NH3 measurements in regions which have the most variation? If so, how do they compare with IASI observations if we assume the total column of NH3 is all at the surface? Were ground-based NH3 concentrations used as an a priori for IASI total column calculations?

Minor Edits

Line 401 is missing a parenthesis - (68, 73, and 71 ktNH3, respectively).

I am not sure if there is something funky with the text editor file that messes with the spacing in the pdf, but there are some words that have been compounded throughout the article.

IASI reference should also include Clarisse, L., Clerbaux, C., Dentener, F., Hurtmans, D., and Coheur, P.: Global ammonia distribution derived from infrared satellite observations, Nat. Geosci., 2, 479–483, 2009.

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