

Interactive comment on “Reconstruction of spatially detailed global map of NH_4^+ and NO_3^- application in synthetic nitrogen fertilizer” by Kazuya Nishina et al.

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This work aims at generating time-series gridded map of nitrogen fertilizer use rate, application timing and fraction of NH_4 and NO_3 , based on FAO national survey, crop calendar data, crop distribution map, and land use history. It is very important for us to understand the spatial patterns of agricultural chemical fertilizer uses over the past half century. However, I have a few questions regarding its data development:

1) How do you decide whether a region is single or double-cropping based on crop calendar data (Sacks et al., 2010)? As I know, it's impossible for the US to have such large areas of double-cropping agricultural land (over half of country land shown in your figure 1). I am attaching a USDA report on the recent trend of double-cropping in the

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US. There are only small percentage of cropland using such practice (about 2% of total cropland in the US). If that's the case, it will substantially affect the cropland areas used in your study and the estimated fertilizer use rate. If harvested area is overestimated or nearly doubled, the fertilizer use rate would be underestimated.

2) You assume there are two fertilizer timing: the first is 7 days before sowing/transplanting and the second is 30 days after based fertilizer application, and the ratio of fertilizer use between these two are 7:3. Is there any supportive evidence or citation for such assumption (timing and ratio to split fertilizer)? In addition, the SAGE dataset has just one average date for each crop in a region. So the dates of N fertilizer inputs were fixed during 1960-2010. Considering the changes in crop distribution and agricultural practices, this timing should vary a lot. Could you discuss what potential consequence would yield by using the fixed application timing?

3) I think the fraction of NH₄ in North America may be largely underestimated because the Anhydrous Ammonia and Aqua Ammonia, two important NH₄ fertilizer sources in North America, were not included in FAO dataset, but present in USDA data (see table 4 in a single worksheet: <http://www.ers.usda.gov/data-products/fertilizer-use-and-price/> and <http://ageconomists.com/2016/02/15/nitrogen-fertilizers-shift-happens/>) Do you think if it can partially explain why NH₄ fraction in North America shown in your figure 6 and 7 is the lowest across the world? I don't know if the same condition also exists in other countries or regions.

Please also note the supplement to this comment:

<http://www.earth-syst-sci-data-discuss.net/essd-2016-24/essd-2016-24-SC1-supplement.pdf>

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