

## ***Interactive comment on “Global nitrogen and phosphorus fertilizer use for agriculture production in the past half century: Shifted hot spots and nutrient imbalance” by Chaoqun Lu and Hanqin Tian***

**Anonymous Referee #2**

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This paper presents a global 0.5-degree resolution spatially-explicit annual time-series N and P fertilizer use data for the period of 1900-2013 by combining country-level fertilizer use record, crop-specific fertilizer use data, global maps of annual cropland area. While for the period of 1900-1960, some assumptions and simplifications were used due to the limitations in the input IFA/FAO data used for this work.

This harmonized data set is beneficial and valuable by providing a consistent set of long-term spatially-explicit time-series synthesis fertilizer use information, which can be directly used as an input driver for a variety of global- and regional-scale modeling

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and assessment researches. Even though there is possibility to improve the quality of this data set by including additional fertilizer use information as inputs, e.g. early IFA/FAO/IFDC data and province/state-level fertilizer use data in select countries, this data set still makes one step forward, compared with other existing similar data sets, by providing both crop type-based spatial variation and longer time period for fertilizer use rate data.

The methodology described in this paper needs further clarification. Specifically,

1. There is no mention of which country boundary polygon layers were used in this study.
2. In section "Crop-specific N and P fertilizer use rate", it's unclear whether the spatial resolution of "grid cell g" is 0.5-degree or same as the resolution of Monfreda data (i.e. 5-arc min).
3. In section "Crop-specific N and P fertilizer use rate", there is no mention of how the situation of a grid cell sitting on the boundary of multiple adjacent countries was handled.
4. In section "Harmonizing national total and crop-specific fertilizer use rate", it's unclear the spatial resolution of "grid cell g" is 0.5-degree or same as the resolution of HYDE data (i.e. 5-arc min)
5. Figure 1 only contains data elements. It can be improved by:
  - 1) Including process elements to form a full workflow diagram. Data and process elements can be represented in different shapes, for example, data in oval and process in rectangle;
  - 2) Adding metadata information (e.g. spatial resolution and time period) into data elements to better describe the characteristics of each data element
6. Using "Crop-specific N and P fertilizer use rate" to calculate fertilizer use rate for all

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other years suppose to be based on assumptions:

- 1) Relative fertilizer use rates across 13 crop groups in each country was assumed to be unchanged within the whole time frame of this study
- 2) Crop groups mixing ratio in each grid was assumed to be unchanged within the whole time frame of this study

Both those two assumptions could introduce uncertainties into the final data set. But in the "Uncertainty and future needs" section, only bullet 1) was mentioned, while not bullet 2).

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