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Interactive comment on "Anthropogenic point and non-point nitrogen inputs into Huai River Basin and their impacts on riverine ammonia-nitrogen flux" *by* W. S. Zhang et al.

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We would like to thank Dr. Gilles Billen for taking the time to comment on our manuscript and offering many constructive suggestions.

General comments:

This paper has two merits: The first one is to provide information about one of the most polluted large watershed in the world, with a tremendous level of N contamination. The fact that this 270 000 km2 wide watershed receives as much as 27 000 kgN/km2 /yr of anthropogenic nitrogen is remarkable and deserved some details about the forms and the special distribution of these huge inputs. The authors reveal that these are mainly

diffuse inputs through fertilizer application and atmospheric N deposition.

The second interest of this paper is of methodological nature. The common NANI methodology, relating total anthropogenic inputs of new reactive nitrogen into a catchment with riverine N output at the catchment outlet, suffered from the fact that, by essence, it could not differentiate between point and non-point sources of N to the drainage network. Yet, this distinction is important when the mechanisms of N transfer and retention within the watershed and the river network are to be considered in more details: diffuse pathways are subject to landscape retention processes, while N transiting through point release of wastewater, possibly after treatment in purification facilities, are only subject to in stream retention processes. Here the authors present a modification of the NANI approach aimed at differentiating NANI into two parts: point and non-point sources. Their approach is equivalent to distinguishing urban systems as separate from the rest of the basin, considering that the mechanisms of their inputs to the river system are different: point NANI = urban NANI Here the urban system is defined as the part of the territory served by a sewer system. In the estimation of NANIn (the NANI of the rural watershed) the amount of food (imported or locally produced) used to feed the urban population is subtracted as if it was an export from the rural system.

Specific comments and response:

(1) I found Fig 2 not extremely clear in showing the distinction between point and non-point fluxes, and how the NANIn and NANIp are counted

Authors' response: Thanks for your suggestion. In order to better show the estimates of point N and non-point N inputs, we have split the human system into urban and rural subsystems because of their different modes of delivery to aquatic ecosystems. In addition, their abbreviations were also added for the purpose of better matching with the accounting equations of NANI.

(2) One of the interests of the distinction is to permit investigating the impact of anthro-

pogenic point and non-point N inputs on riverine AN flux, instead of only total N fluxes. However, the approach is subject to a number of difficulties. What about atmospheric deposition onto urban surfaces, an often significant part of it being collected by sewer systems?

Authors' response: We agree that atmospheric N deposition could become a point source because it can also be collected by sewer systems. However, as you mentioned, it is difficult to be estimated because the draining area of impervious land is quite variable. In addition, many districts have undergone rapid urbanization growth in recent years. There should be a very large change in the municipal drainage system, as well as the amount of atmospheric deposition. Therefore, the estimates could have a lot of noise. But the contribution of atmospheric N deposition to the sewer system should be paid more attention because it could be a significant source for some areas. The atmospheric deposition of N onto impervious surfaces has been estimated for assessing the overall contribution to point source N. The result has shown that this input is a relatively small source, which just accounts for about 12% of point source inputs. Given that many urban landscapes such as ponds and lawn, have a strong ability to trap this input, the contribution could be much smaller. Hence, rather than being explicitly estimated in this study, we address the part in the paper to provide some thoughts for other researchers. Please see P9 L9.

(3) The attempt made here also shows the limits of the black box approach inherent to the NANI methodology (see the discussion in Billen, G., Thieu, V., Garnier, J., Silvestre, M. (2009). Modelling the N cascade in regional watersheds: the case study of the Seine, Somme and Scheldt rivers. Agriculture, Ecosystems and Environment. 133: 234-246). Thus, the analysis of the sensitivity of NANI to its different components (p 3597) is interesting in terms of management. However, N management should not be based only on NANI or overall export of N at basin outlet, but rather on local river water quality. From this respect, point sources and degree of treatment are obviously crucial parameters. The need for a more spatially explicit mechanistic modeling of

water quality is clearly appearing here.

Authors' response: Thanks so much for the comments. We think it is much better if the result was based on the water quality. Actually, this work is just one part of our series work on N models. This paper focuses on the NANI methodology, but we have another manuscript (unpublished) that specially discusses the contributions of point and non-point sources to riverine flux, and their impacts on water quality. We have found the point source is a critical source although it just comprised 2% of total N inputs. The sensitivity analysis was presented here because we think it can provide some implications for source management. In order to address the concern, we clearly stated in the paper that (P19, L16): "However, N management should not be only based on the overall anthropogenic N inputs, but also on local river water quality and the riverine and management processes affecting it. Including more spatially explicit biophysical details related to the response to N loading is needed to better support N management."

(4) I have another remark concerning diffuse sources management: P 3597 l 18: "We found feed N is the second sensitive input sources to NANIn, indicating that N intake by livestock is very important N source. Hence, the priority strategies of N management in non-point system in the Huai River Basin should be focused on the reduction of fertilizer application rate, manipulation of dietary N intake by animals, and management of manure." Manipulation of dietary N intake by animals has rather limited effect compared with changing the importance of livestock itself!! What is at stake is the regional specialization into intensive livestock breeding activities, rather than the rationalization of livestock feeding or even of manure management!.

Authors' response: Thanks very much for the correction. We revised this part as (P19 L3): "Hence, the priority strategies of N management in non-point source system in the Huai River Basin should be focused on the reduction of fertilizer application rate and the control of livestock populations (e.g. reduction of the intensity of livestock breeding, manipulation of dietary N intake by animals and management of manure)."

(5) Minor formal remarks P 3585 l 22:“Repeated calculation” or “double counting”?

Authors’ response: Revised as recommended.

(6) P 3588: For clarity in equation (6) Irem should be spelled specifically for AN than for total N as the values are not the same (eg. Ireman vs Iremtn)

Authors’ response: Revised as recommended.

(7) Fig 3 needs a more explicit legend

Authors’ response: Revised as recommended.

Please also note the supplement to this comment:
http://www.biogeosciences-discuss.net/12/C3360/2015/bgd-12-C3360-2015-supplement.pdf

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Interactive comment on Biogeosciences Discuss., 12, 3577, 2015.

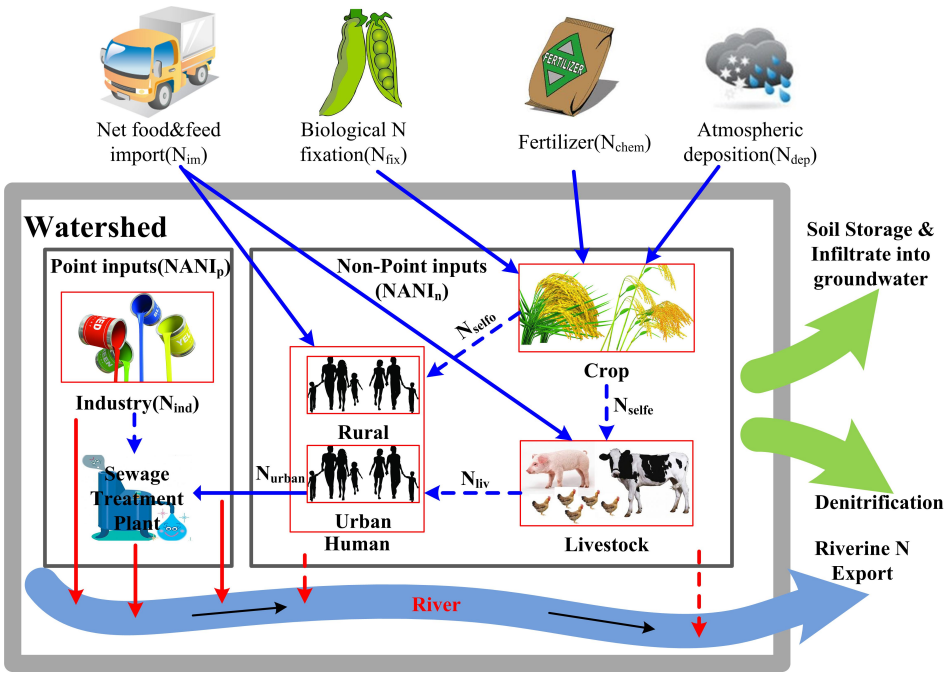

Fig. 1. Diagram of major components of net anthropogenic nitrogen inputs (NANI) and exports from a watershed ecosystem

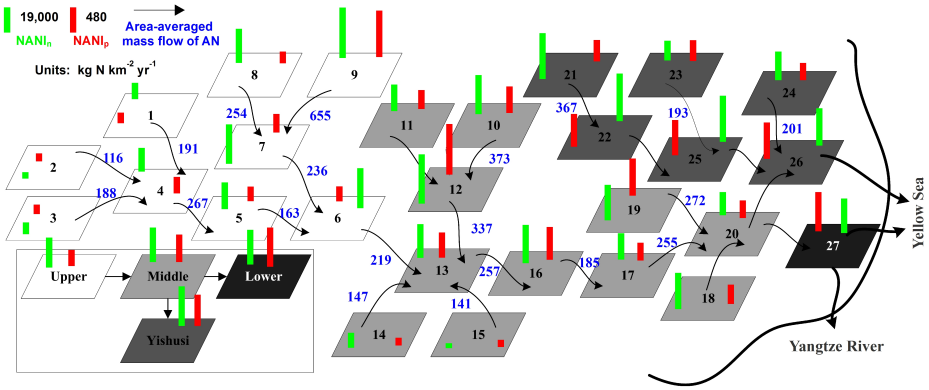

Fig. 2. Average net anthropogenic nitrogen inputs and riverine ammonia-nitrogen flux in Huai River Basin of China