

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.

G. Billen (Referee)

gilles.billen@upmc.fr

Received and published: 7 April 2015

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
C1072

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 NANI_r (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. (By the way, I found Fig 2 not extremely clear in showing the distinction between point and non point fluxes, and how the NANI_r and NANI_p are counted)

One of the interests of the distinction is to permit investigating the impact of anthropogenic 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?

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 modelling of water quality is clearly appearing here.

I have another remark concerning diffuse sources management:

P 3597 I 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!.

Minor formal remarks P 3585 I 22: “Repeated calculation” or “double counting”? 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) Fig 3 needs a more explicit legend

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