

Interactive comment on “Capturing interactions between nitrogen and hydrological cycles under historical climate and land use: Susquehanna watershed analysis with the GFDL Land Model LM3-TAN” by M. Lee et al.

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This is an excellent work, which carefully accounts for some key mechanisms of N dynamics. The authors have done a great job in terms of both analysis and write-up.

That said, I have several comments (generally minor) that may help improve the manuscript:

- Table 3: For the 9 short-term SRBC sites, it seems that only limited periods of data (around 1 year or less) were used in the model evaluation, given that the modeling

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period ends in 2005. Therefore, the author may consider specifying how many (or which) months of data at these new sites were used.

- Table 4: It is not very clear how the non-point and point source loads for each sub-basins were obtained. If this is from literature or SRBC, a citation would help readers better understand the source.

- Figure 3: This is a comprehensive map. Nicely done. However, what is missing from this map is the Conowingo site (managed by USGS) at the basin outlet. It is surprising (and also a waste of resource) that the Conowingo site was not used in the model, which has even longer N data for multiple sub-species than any of the long-term SRBC sites (1979). To clarify, Marietta is actually the most downstream "SRBC" site. It may be misleading if not including "SRBC" (in line 5 of Section 7.1). To me, it would be very interesting to see how much the results would be affected by including this outlet site in the model.

If the authors are concerned with the reservoir system located between Marietta and Conowingo sites and want to exclude potential influences by the reservoir system on their model, then such kind of considerations should be at least briefly discussed in the text. In fact, N load has not been affected much by the reservoir system, at least not to the extent that phosphorous and sediment have. These issues have been recently examined by Hirsch (2012) [<http://pubs.usgs.gov/sir/2012/5185/>] and Zhang et al. (2013) [<http://www.sciencedirect.com/science/article/pii/S0048969713001757>].

- Figure 4: The figure caption is a little confusing for (c) and (d) – do they only differ by unit? Why "fertilizer, manure, and legume applications" are grouped? In addition, unit is missing for CSO (b).

- Figure 5: The word "observed data" is not strictly correct, since the SRBC loads were calculated based on the ESTIMATOR model. I suggest alternative wording such as "estimated load based on monitoring data", if a definition of "observed" is not given in the caption.

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- Figure 6: It might be more clear if two contrasting colors are used, instead of light and dark colors.

- Figure 7: It is inconsistent with other figures that here the unit is in logarithm scale. If this is because the values are rather large, why not use units such as " 10^6 kg/year "?

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