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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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<A.J. Dolman (Referee)>

Dear Reviewer,

We deeply appreciate the time and effort you spent on reviewing our manuscript. We trust that all of your comments are addressed in the following point-by-point reply to your comments, and which greatly helped to improve our manuscript.

Reviewer's Comment 1:

p5677 Storage in groundwater, this is issue as the authors note, given the 12-80% additional delivery rate. Can the authors comment on the need for further model development in this area in the discussion? It seems that calibrating this for every catchment in the world is a bit of an issue.

Response 1:

Agreed, we propose to modify page 5677, lines 18-19 to read:

The need to incorporate these calibration factors, which are at the present basin specific, indicates that future improvements to LM3-TAN should focus on resolving these processes (i.e. N cycle in microbes, reservoirs, and vertically distributed soil layers).

Reviewer's Comments 2 & 3:

p5686 Validation. the use of a correlation coefficient is a bit poor. Is it possible to have some more advanced metrics, like the Nash Sutcliffe efficiency that are more common in hydrological models?

p5686 Is it possible to add a table with these results. This makes a comparison between the various outputs a lot easier.

Response 2 & 3:

In addition to R2, we will present two more correlation coefficients (Pearson and Spearman) with the corresponding p-values in a new table (Table 5).

Reviewer's Comments 4:

p5686 I am somewhat surprised by the low r2 of the discharge values and how the 28% lower flows translate back into the N-transport uncertainty.

Response 4:

The reason for the low r2 is a bias in the flow predictions during wet years. To address the low r2 we will modify page 5686, lines 7-12 explaining:

Using global hydrological data and a universal parameter set for the entire watershed, the model produced reasonable temporal patterns of annual stream discharge. The simulated stream discharges were in a good agreement with the reported values in dry years and periods (July to September), but under-estimated stream discharges in wet years and periods (March to May). Overall, although the 19-year average simulated discharge was about 28% lower than the corresponding reported value, their linear and rank correlations were significantly high (Table 5), implying that the bias was systemic and accounted for in the calibration of the N species.

Reviewer's Comments 5:

p5701 Figure 1 is rather complicated to read with too many arrow crossing the boxes. Either simplify or redraw to make it more clear (i.e. "route" the arrow along the boxes).

Response 5:

We fully agree, however, we tried many ways to draw this figure, and as presented it is the simplest way not to lose important model components. Routing the arrows along the boxes increase lines and makes the figure more difficult to interpret. Our preference is to leave Fig. 1 as is. We will made the dashed arrow lines clearer.

Interactive comment on Biogeosciences Discuss., 11, 5669, 2014.

Table 5. Temporal evaluation of the annual stream discharges and N loads for the period 1987-2005 at Marietta. If a p-value is smaller than 0.05, the correlation between the modeled and reported data is significantly different from zero.

		Discharge	DN	Nit. N	Amm. N	DON
R^2		0.6	0.5	0.4	0.5	0.4
Corr. Coef.	Pearson's linear (p-value)	0.7 (< 0.0001)	0.7 (< 0.0001)	0.6 (0.0044)	0.7 (< 0.0001)	0.6 (0.0064)
	Spearman's rho (p-value)	0.7 (0.0011)	0.7 (< 0.0001)	0.6 (0.0056)	0.6 (0.0099)	0.6 (0.0160)

Fig. 1. Table 5

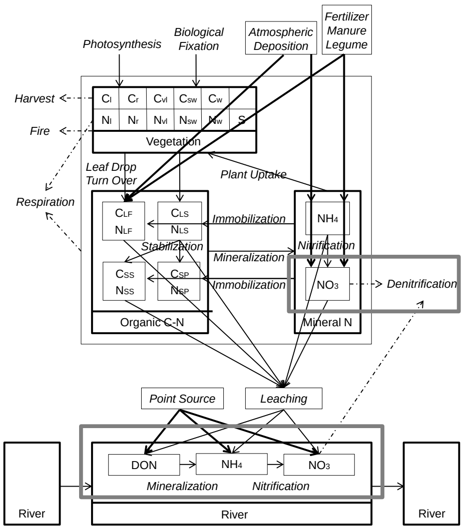

Fig. 2. Figure 1