Biogeosciences
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Discussions

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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Received and published: 30 July 2014

\<Author Comment\>

Dear Reviewer, Dear Editor,

We deeply appreciate the time and effort you spent on reviewing our manuscript. We here propose additional modifications to improve our manuscript.

Comment 1

We will clarify the capacity of LM3-TAN to describe N dynamics with a single universal parameter set for the study of Susquehanna watershed and potential limitation of LM3-TAN when applying it to other watersheds very different from the Susquehanna watershed. We also will suggest how LM3-TAN may be able to meet the challenge in the discussion.

We will modify page 5672, lines 16-21 to read:

In addition, many regional models (e.g. EPIC, ANIMO), which have been applied to far smaller basins compared to the Susquehanna watershed, often use basin-specific parameters for mineralization, nitrification, and denitrification, which complicates their application on a global scale for decadal-to-century scale studies. LM3-TAN is capable of describing N dynamics with a universal parameter set – the same parameters for all of the sub-basins within an area of 71,220 km2 and time periods for this simulation.

We will add the following sentences to page 5680, line 15:

Still, care has to be taken when applying the model to other watersheds that may be very different in terms of soil and climate properties from the Susquehanna watershed. Furthermore, since soil denitrification becomes zero-order in extreme nitrate rich environment, instead of using the first-order loss function for all of the land use types, using a Monod function for agricultural land use may help LM3-TAN's global application where N loadings would vary widely.

Comment 2

We will explain an implication of the size of a calibration factor by adding a sentence in page 5677, line 18:

Considering its importance in groundwater, a relatively larger size of the nitrate N factor is expected.

Comment 3

We will explain how river depth has influence on denitrification rate by adding sentences in 5680, line 25:

River denitrification happens mainly in the benthic and/or hyporheic zones. Therefore, a river denitrification rate that is inversely proportional to the river depth accounts for the ratio of water column to benthic area.

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

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