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Biogeosciences Discussions

Interactive comment on "Modeling nitrogen loading in a small watershed in Southwest China using a DNDC model with hydrological enhancements" *by* J. Deng et al.

Anonymous Referee #2

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This manuscript describes the application at the watershed of an enhanced version of the widely used DNDC model for the simulation of carbon and nitrogen fluxes from soils. The enhancement of the model regard the simulation of lateral water flow by implementing two commonly used methods, the SCS and MUSLE equations for surface water runoff and soil erosion, respectively. As the authors note, such a feature is very useful in biogeochemical models in order to combine their complexity in the description of biogeochmical processes while still delivering important information on nitrogen loading of a watershed, which are a major issue of concern, in particular for agricultural areas. The manuscript is well written and structured. It conveys essential information in a clear way.

The manuscript relies heavily on a prior paper of the authors (Deng et al., 2011) which have developed the new model and tested it at the field scale. Also, several factors required for the new functions at the watershed scale have been overtaken by Deng et al. (2011). The authors make this very transparent when describing the methodology, but I would nevertheless suggest that more emphasis is put on these field application also in the results and discussions. For example, to evaluate the value of the good correlations reported for runoff and N-loading, it would also be of relevance to discuss the number and representativeness of the field sites.

Results are presented also in terms of N-gas emissions. N2O fluxes correspond well with measurements obtained from an earlier study, however, much emphasis is also put on the losses of the other gases (in particular NH3, which dominates the gas losses), justified by the fact that gas losses '. . .inherently affects the loading of soil N to the water systems'. However, first, as long as N loading has been calibrated at the watershed, a good fit does not indicate that also other gas losses are quantified correctly. These must, second, be discussed when being presented. For example, why does Table 2 not report N in plant uptake in order to 'close the balance'. For dry land, the difference of 213 kg N/ha/yr seems like an impressive yield in a monocropping (?) system. Why does the table not report any nitrogen leaching (TN refers only to surface runoff) – is it not occurring?

Even though it reads well, a large part of the discussion (up to page 6398) is more a summary of introduction and methodology. The 'real' discussion addresses then one issue, the fate of N in the channel system, which is important but falls short with respect to the results presented. Here, N-gas fluxes should be discussed, such as the very low N2/N2O ratio obtained for dryland, the magnitude of NH3 and N2O fluxes (the latter 0.5% in dryland and 0.1%/0.6% in rice paddies) etc. What impact does the implementation of lateral flow have on the simulated N-gas fluxes (in Wang et al. 2009)? In general, I think that the discussion should touch all major results presented, and sections that are not considered important for being discussed might also be dropped

or mentioned with less emphasis.

In conclusion, I believe that the manuscript should be published, but I think that it could benefit from a revision along the lines sketched above.

Minor comments:

page 6389/4. I would say that the term ‘precisely’ is a bit exaggerated to describe the capabilities of the model.

Table 1: Please avoid the use of etc. in the table. For most categories the missing items will not be many and could easily be written out.

Table 2: see above

Figure 2: this figure is very little informative. I would suggest to skip it or to make it more informative by including model- links/feedbacks/loops into the schematization, in particular with regard to the newly introduced modules.

Figure 6: it would be good to add information on management practices in the figure (timing of fertilizer application, tillage etc.).

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