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Geoscientific Model Development Discussions

Interactive comment on "Integration of nitrogen dynamics into the Noah-MP land model v1.1 for climate and environmental predictions" *by* X. Cai et al.

Anonymous Referee #1

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This manuscript presents the incorporation of nitrogen processes into Noah-MP by leveraging the process descriptions from the FUN and SWAT models respectively. The topic is important given the role of Noah-MP as the next generation land component of WRF. The strategy, i.e., learning/adopting from FUN for the plant nitrogen dynamics and from SWAT for soil nitrogen dynamics, is overall appropriate. However, I have a few concerns specified as below, and hence recommend a moderate revision before possible acceptance for publication.

1. Lack of a clear parameterization strategy. The authors should provide a concentrated description of how they determine the hydrologyical, and plant and soil nitrogen parameters for this study site. Moreover, a land model such as Noah-MP is usually

expected to be applied over large scales, say regional for example. How would the authors envision the parameters used, hence the understanding gained at this specific site, to be generalized to other places? Some discussion in the end along this line would be useful since this study is motivated to provide simultaneous predictions of weather and environment, both of which are generally large-scale in nature.

2. Systematic bias in the model simulated soil moisture, as clearly shown in Figure 2. Given that nitrate is highly soluble and highly affected by soil water dynamics, one would infer that this systematic bias of soil moisture simulation may propagate to the nitrogen simulation. It appears to me that Noah-MP in this study is systematically underestimating the variation range of the soil moisture. This is very likely due to some deficiencies in the hydrology component, being the runoff scheme or parameters. Which TOPMODEL scheme is used in this study, the one with groundwater or with an equilibrium water table? Is the groundwater level at this site shallow enough so that all TOPMODEL assumptions hold? Have you tried to calibrate/adjust the hydrology parameters for this site? If currently Noah-MP is not hooked up with an automatic calibration package, some manual calibration will be feasible at least and just enough.

3. Inconsistent treatment of tillage between the water and nitrogen, as indicated at Line8-10, Page 4127. The authors need to carefully evaluate the possible bias in soil moisture simulation and the subsequent nitrate simulation, then decide whether it is appropriate to consider the tillage effects in nitrogen redistribution only but not in water redistribution.

Interactive comment on Geosci. Model Dev. Discuss., 8, 4113, 2015.