Biogeosciences Discussions

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Comment on bg-2020-483

Anonymous Referee #2

Referee comment on "A novel representation of biological nitrogen fixation and competitive dynamics between nitrogen-fixing and non-fixing plants in a land model (GFDL LM4.1-BNF) " by Sian Kou-Giesbrecht et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2020-483-RC2, 2021

In this study, Kou-Giesbrecht reported the GFDL LM4.1-BNF model with a new representation of biological nitrogen fixation and evaluated the impact of competition between nitrogen-fixing and non-fixing plants on simulated carbon, nitrogen and demographic dynamics in a temperate forest site. They showed the LM4.1-BNF did a fair job in simulating the many lumped variables reported in the US forest inventory and analysis database for a temperate forest site at Coweeta Hydrologic Laboratory in North Carolina. Particularly, they showed that the competition between N-fixing and non-N fixing plants is an important factor in interpreting the dynamics of carbon accumulation. Overall, the paper is clearly written, but there are some issues need to be resolved before the model is able to be considered as doing sufficiently well.

More details are listed below

The abstract is generally OK; however, it lacks details on the model performance. The authors may consider to add more content from their model evaluation against the observational data.

Technical description is long but written well.

For results, my major complain is the authors have yet to demonstrate the model LM4.1-BNF compares well with high frequency temporal data, such as eddy flux measurement of carbon and water fluxes. The comparison with lumped data is fair, but not great. This is especially important to evaluate the effect of new temperature response function. Perhaps the authors should consider applying the model for a site with eddy flux measurements as well?

Further the discussion is a little bit detached from results. Authors may consider move some of the analysis into discussion to better explain the significance of updated processes.

Code availability: some of my colleagues say "upon request" is a bad exercise. Authors should at least provide whom to send such a request, or provide a web link to send such a request.

Other comments

Table 2. Missing group separation between 2nd and 3rd sets of analyses?

Figure 2. Why does the model under predict the low dbh growth rates?

Figure 4. Use stronger color contrast between two FIA data? Or maybe even different symbols? Currently, it is not easy to differentiate them.

Figure 6. What is the uncertainty of the data points? Also, why does LM3-SNAP predict more evident oscillations?

Figure 9a: what happened to LM4.1-BNF_{NPP}? Why its time series is much shorter?

Equation (A1), why is there no adsorption effect considered? The behavior of NH4 and NO3 are quite different in soil.