Geoscientific

Model Development

Discussions

[GMDD]

Interactive comment on "Global evaluation of nutrient enabled version land surface model ORCHIDEE-CNP v1.2 (r5986)" *by* Yan Sun et al.

Anonymous Referee #2

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The work by Sun et al. is impressive in the sense that many analysis are taken to understand the Orchidee-CNP model. But on the other hand the paper lacks a clear flow of arguments.

1. The reason why every time the models need to be more detailed is that we are not satisfied by the performance of the old models. If we only focus on carbon and water (WUE) then we clearly see problems in the dynamics, sinks and sources, which was the reason to include Nitrogen and now also the Phosphorus cycle. However, if one the main conclusions is that the current version of this model is unable to simulate carbon sinks, then the choices of expanding the model need to N and P should be much more discussed in detail. As long as we can not model the carbon cycle, what kind of implications has this on the N and P cycle? If there is a large problem in land

carbon sink estimates, then I would like to see the consequences to all other coupled processes, including water. If this is large, then this should be solved first or we should simply conclude that there is too less understanding to couple the models as proposed in a global model. An evaluation as proposed by the authors of this version of the model doesn't help us in answering this problem.

2. A second major concern is therefore that the evaluation is far too broad while missing the in depth analyses. The number of figures are too many and jumping from one type of comparisons to another: a. On one hand you are showing the dynamics, but then I would like to have much more information on understanding the drivers. For instance how much dependent is the dynamics of P and N on the P and N deposition? There are studies who have shown in other models that this N Deposition is one of the main drivers. b. Then you make some snap shots of global patterns, while later on you focus on different ecoregions and then different soil types and then on vegetation with different photosynthetic pathways. It would be very helpful to structure this far better and to integrate those aspects.

3. A third major concern is the for me random way of comparing the results. I found the comparison with only ORHIDEE-C not very convincing. Why not comparing to the average performance of the land models as done in TRENDY? There are other global model results as well on C and N. For instance LPJ guess.

Then I have a couple of smaller remarks, but are not extensively as in next version I would expect that parts of analysis will not be reported anymore and need to be seen as a number of examples: 4. L402: why do you have a smaller natural land cover? Is it a problem from ORCHIDEE or from GOLUM-CNP. Is it then still useful to compare? 5. Comparing global news N-leaching: other forcings → this doesn't help us in understanding the role of the different mechanisms → can you also compare it with similar forcings? If not, is it still valid to include this comparison? 6. How did you downscale from HYDE3.2 to 1x1 km? Did you use the same allocation rules as done by Klein Goldewijk for the 30 minute resolution? 7. L890: N and P leaching: the current

problem of understanding N and P leaching is large: there are all kind of confounding factors that determine these leaching rates which are in the end extremely important to understand water quality and functioning of the system. In the current paper I can not find this sensitivity back. Leaching is highly dynamic due to fire, soil water fluxes by extremes, different season lengths depending on ecoregion and latitude etc.