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Geoscientific Model Development Discussions

Interactive comment on "ORCHIDEE-SRC v1.0: an extension of the land surface model ORCHIDEE for simulating short rotation coppice poplar plantations" *by* T. De Groote et al.

Anonymous Referee #2

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De Groote et al. present an extended version of the land surface model ORCHIDEE that has been developed further to simulate short rotation coppice plantations. The authors describe the technical implementation in ORCHIDEE and evaluate the new module using measurements of biomass yields, stand level photosynthesis, and ecosystem respiration from two poplar plantations in Belgium. Results show that the model is capable of reproducing key processes of SRC plantations at these sites. The authors introduce an important enhancement of ORCHIDEE that may be used to study the potential effects of expanding bioenergy production on carbon and water balances, and when used in coupled mode, also climate feedbacks of albedo changes when SRC plantations are established over large areas.

In it's current form, however, the manuscript does not provide sufficient evidence that the extended model is able to "simulate the C and water fluxes of SRC plantations over a range of site conditions". Only two data sets from similar sites were used to calibrate and validate the model. More validation effort is needed to show that ORCHIDEE-SRC is able to simulate the cultivation of SRC crops in different world regions under various climatic conditions and site conditions.

Comments

1. I suggest to review the literature again for more data on poplar plantations to use for model validation. For example Searle et al. (2014, http://dx.doi.org/10.1016/j.biombioe.2014.01.001) provide a good overview and Nair et al. (2012) introduced the Biofuel Ecophysiological Trait and Yield Database (BETY-db) maintained by the University of Illinois. You should find enough information to validate ORCHIDEE-SRC under a range of climatic conditions.

2. Searle et al. (2014) also show that yields observed on small, intensively managed test sites may not be achieved at commercial scales. You could test the performance of simulated SRC crops using parameters of their corresponding plant functional types in natural vegetation (temperate broadleaf summergreen tree?).

3. Please explain in more detail the longer-term purpose of developing ORCHIDEE-FM. As ORCHIDEE is part of a coupled earth system model do you plan to use the model in coupled mode to study climatic feedbacks from changes in albeo, latent and sensible heat fluxes, CO2 and other greenhouse gas emissions? If this is a goal, then the problems with modelling surface heat fluxes need to be fixed first.

4. Changes in soil carbon under different land use options are an important determinant of the overall carbon effects of land use change. How do soil carbon pools change under SRC compared to natural vegetation and croplands in ORCHIDEE-SRC?

5. Make sure to differentiate between calibration and validation. I think you used the

eddy flux data from the POPFUSS site to calibrate the model. If this is the case, it is clear why observed and simulated variables (Fig. 3 and Fig. 4) agree so closely.

6. p. 4028-4029: Please explain the spin-up procedure in more detail. What is the purpose of the different steps required to compute the soil carbon equilibrium? What does "the model was optimized to achieve a soil C equilibrium“ mean in this context? How do you account for the land use history of the two test sites? Differences in previous land use may in part explain differences in simulated and observed carbon sources and sinks.

7. Table 1: A more detailed explanation of the variables, equations and their function in the model would be helpful.

8. Figure 3 and figure 4 show similar information. Does figure 4 provide any addtional information?

9. Is irrigation possible on SRC plantations?

10. ORCHIDEE also simulates nitrogen fertilization. As N2O fluxes are an important element of the overall GHG balance of energy crop cultivatoin, does this also work for SRC plantations?

Interactive comment on Geosci. Model Dev. Discuss., 7, 4019, 2014.