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Biogeosciences Discussions

Interactive comment on "Coupling land surface and crop growth models for predicting evapotranspiration and carbon exchange in wheat-maize rotation croplands" *by* H. Lei et al.

Anonymous Referee #2

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General comments: The paper proposes a coupled land surface and crop growth model that can estimate an energy budget including ET and CO2 flux by considering the response of crop phenology and physiology to environmental change. The validity of the model is examined at two EC measurement sites on a wheat-maize rotation field. Simulation results for ET and yield at different irrigation amounts and CO2 concentrations are shown and discussed. The subject of the paper is important and the results could be useful for many readers; in particular, the simulation results could be well-expressing the actual behavior of long-term evapotranspiration and CO2 exchanges on cropland, which have not previously been expressed using only LSM. Comments and questions for the authors are as follows:

1. Page 5162 Lines 18-22: Carbon allocation pattern to each part with GDD could be important in this coupled model since it strongly controls LAI and grain biomass. It seems that the patterns in Fig. 1 were determined based on past experimental results (and seems to linearly connect some plots); however, the practical step is unclear. I think only an artificial determination of this pattern to fit LAI should be avoided. Please provide a more detailed explanation about how these allocation patterns with GDD were determined.

2. Fig. 4: Calculated latent heat flux from the coupled model seems to be overall larger than the observation especially during the summer (maize) season; although I think it is within an acceptable range to apply the model for later simulation, it is necessary to discuss the reason. A related point: it would be valuable to provide a brief description about the energy budget closures at the two EC measurement sites in this paper. Soil heat flux at 0-3 cm depth should be estimated if it is possible from soil temperature measurements, etc.

Minor remarks:

1. Fig. 1: It would be helpful to show these fractions are "under unlimited water conditions" (alpha) in the figure or caption.

2. Eqs (1)-(4): The change in the allocation fraction to leaf by light use availability on original function seems to be unused. Is it negligibly small?

3. Page 5165 line 8-12: LAI are measured both directly by random sampling and indirectly using LAI-2000. Please identify which measurements are used in the comparison with the model at each time-series in Figs. 2 and 3. This is related to the discussion on Page 5167 lines 10-13.

4. Page 5165 line 26 "the coupled model was run half-hourly": Allocation of accumulated carbon was calculated half-hourly or daily? It would also be helpful to show time-intervals for the calculations of growth/maintenance respiration and the impact of

BGD

7, C2962–C2964, 2010

water stress on carbon allocation.

5. Some of the light-grey lines in the figure are barely visible (e.g. Figs. 2, 3, 6. and 8).

6. Page 5169 line 11-16: Differences of water stressed duration and their effects on LAI, ET and Yield could be an interesting result from the simulation. If I understood correctly, water stress in the coupled model affects not only through carbon allocation fractions but also stomatal conductance. It would be valuable to show the threshold of SWC for stomatal closure (or a rough estimation of photosynthesis/transpiration decline at the SWC=0.22 level).

Interactive comment on Biogeosciences Discuss., 7, 5157, 2010.