

Interactive comment on “Two perspectives on the coupled carbon, water, and energy exchange in the planetary boundary layer” by M. Combe et al.

Anonymous Referee #2

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The paper investigates crop surface process and links to the atmosphere using three models, focused on a single site and a single day. It sets out to investigate surface-atmosphere coupling effects on atmospheric CO₂ concentrations. This is an important topic, which should help interpretation of atmosphere data with respect to governing processes.

The paper sets out 2 science questions, but it never specifically answers these in the discussion. The questions also seem poorly linked. Q1 is a process question, and is linked to the most interesting outcomes of the study, re surface-atmosphere linkages. It would help to set out some hypotheses related to this question that could be tested. Such an approach would improve the structure and flow of the paper. It would also help to evaluate more than a single day of data and modelling. A more detailed set of

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sensitivity studies could then be used to show the nature of surface-atmosphere interactions. Q2 is a more technical question about modelling plant physiology, which is not really addressed in the paper (there are no plant physiological data presented or used to test the models, for instance). I would suggest that Q2 is dropped, and that a single LSM is used, rather than 2 compared. The evaluation of the 2 LSMs is incomplete and perhaps infeasible given their different initialisations and parameterisations.

Detailed comments: p. 5289: I am not sure this creation of random weather is satisfactory, as there are expected to be significant changes in mean climate across a month – mixing up a month therefore is unlikely to create realistic climate particularly in spring, when days are lengthening rapidly. It would be better to use a range of historical climate drivers to explore this sensitivity. This component of the paper could anyway be dropped if the focus is shifted entirely towards surface-atmosphere interactions.

P. 5290. Is there any testing of the drought effects represented in the model? It would strengthen the analysis to see that the model can recreate observed changes in processes during periods of low soil moisture.

P 5291: L. 1. How are these large errors correlated with other drivers? Is there information in this mismatch that could explain crop-atmosphere interactions at this point?
L 8. This testing would be better with realistic weather from historical data, see above.

P. 5292. L. 3. It would be better to start this paragraph with a topic sentence – what is the key message here? The ms would read better with a focus on topic sentences throughout.

L. 19. So it seems the A-gs model has been fitted to better match the data.

P. 5293. What are the implications for model evaluation of ignoring Phase A?

P. 5296. But it seems A-gs performs best because it was tuned to do so. Would it not be possible to tune the other model to perform as well? i.e. is there any intrinsic reason why A-gs is better? Can that be proven? Why not use a single model?

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P. 5297. This sensitivity section is the most interesting and novel component of the paper, and would benefit from more detail.

L. 17. WUE should relate to GPP (photosynthesis), not NEE. WUE is expected to rise as water becomes limiting, as plants become more conservative (i.e. opposite response to what is observed here) – please comment.

L. 21. Please express NPP and GPP as $\text{gC m}^{-2} \text{d}^{-1}$ (not g CO_2). L. 24. Please use another word than “aggravate”. L. 25. Extrapolation from a single day seems unwise. It would be better to restrict discussion to the modelled period. Comparison against multiple days of data would strengthen the paper considerably.

P. 5299. The role of correct soil moisture values for model validity is well made. I wonder if the experiments could be reformulated to show the sensitivity of BL dynamics to variation in initial soil moisture values? That might make this point more generally valid.

L. 26. The comparison of A-gs and GECROS models seems disconnected from the atmospheric coupling investigation.

Interactive comment on Biogeosciences Discuss., 11, 5275, 2014.

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