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Biogeosciences Discussions

Interactive comment on "Modelling contrasting responses of wetland productivity to changes in water table depth" *by* R. F. Grant et al.

Anonymous Referee #1

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This paper assesses the ability of the ecosys model to represent fluxes of carbon dioxide measured at Lost Creek, WI. The authors find contrasting responses to changes in temperature and water table depth in a generally wet year, 2002 and a generally dry year, 2006. Warming of wet conditions was observed and modeled to result in increased uptake of carbon and reduced respiration/emission of carbon. Warming dry conditions was observed and modeled to result in decreased uptake and emission of carbon. Raising of the water table following precipitation in the dry year was seen to increase respiration. The authors argue that these responses result from the explicit treatment of the growth, death and competitive interaction of microbial communities in response to changing moisture regimes and their impact on substrate and oxygen availability. The model is further evaluated with respect to variation of the external water table depth as an assessment of the sensitivity of the model.

It is my recommendation that this paper be accepted subject to minor revisions.

There are a couple of technical issues. The sign of the units reporting depth are inconsistent. Removing the negative sign on the units of water table in figures 2, 6, 9, 10 and 11 would ease comprehension. Particularly in figures 9 and 10, where opposing conventions of reporting depth are used in the same figure.

Additionally, it is ambiguous whether the air temperatures reported in figures 2, 3, 4, 5 and 7 are modeled or measured and whether or not there is any meaningful difference.

A typo appears in the abstract, line 23, where it reads "In sensitivity test of the model", and presumable should be either "In sensitivity testing of the model" or "In sensitivity tests of the model".

A more substantive concern is raised by the rise in the water table at day 210 in 2006. The observed rise in figure 2q appears to be nearly half a meter, from about 0.7 to about 0.3 meters below the surface. While the modeled rise looks only to be a change of 0.05 meters, from about 0.75 to about 0.70 meters below the surface.This moistening corresponds to an observed reversal of the sign of the CO2 exchange that appears well represented by the model. Inspection of figure 9 suggests that the CO2 response in the model was insensitive to water table depth; perhaps that the moistening of the unsaturated column rather then the change in WTD was responsible for the efflux of carbon. If this is the case, it would be valuable to test the model's response to an accurate change in water table depth.

Further inspection of figure 2 suggests a consistent overestimate of carbon efflux in the spring and fall that appear correlated with high temperatures. Further comment about this than is found in section 3.2 could help elucidate the behavior of the model; particularly since this behavior was also seen in Sulman et al. (2009) as discussed in section 4.1.3.

Also in section 3.2, the modeled wintertime water table depths are explained to be below observed depths in most years due a lower calculated bulk soil water potential in the presence of ice. Should this be calculated as such? And does the associated wintertime efflux of carbon impact the interpretation of the net carbon balance in tables 2 and 3?

On some days in figures 5e and 7b, the discrepancies between modeled and observed latent heat flux looks to be between 50 and 100%. Presumably this is a result of water inflow from the external water table. In light of the effect this should have on temperatures and carbon exchange, it might be preferable to show one of the same periods of time in figure 10, where the impact of the external water table depth is examined.

Hopefully these suggestions are helpful and feasible, and I look forward to seeing the revisions.

Interactive comment on Biogeosciences Discuss., 9, 5579, 2012.