**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Past and future scenarios of the effect of carbon dioxide on plant growth and transpiration for three vegetation types of southwestern France" *by* J.-C. Calvet et al.

Anonymous Referee #1

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General Comment

This paper uses a land surface model to investigate the sensitivity of different vegetation types to changes in atmospheric CO2. The authors focus on two different aspects of CO2 response by vegetation: (1) the effect on stomatal conductance, and (2) the effect on biomass and leaf area index (LAI). The balance between these two components is interesting. Stomatal conductance could fall, but increased LAI could mean overall that canopy conductance increased. A series of model outputs are presented, but there is little information on model corroboration to support the predictions.

Specific Comments:

The model is used for wheat, maize and coniferous forest, with past, present and future CO_2 levels, and meteorology from 4 recent years (2001-4). While it seems appropriate to use this approach for annual crops such as wheat or maize, it seems less suitable for the forest with a decadal life-span. The response of forest vegetation over many successive years to CO_2 changes, and factors such as N deposition and climate change, is likely to have an important feedback on vegetation dynamics and process. The decadal coupling between biomass/LAI change, alterations in canopy conductance, and local hydrology and perhaps meteorology need to be explored in more depth in this paper to justify the inclusion of the forest component of the study.

The authors make use of recent meta-analyses on leaf N response to changing CO_2, and also link their research to FACE and enclosure experiments with altered CO_2. However, the meta-analysis revealed major uncertainties in plant responses, and these are not properly acknowledged or incorporated in this work. How do the results of the paper change if uncertainty is introduced into equations 2 and 3?

It would have been very useful to see some corroboration of the model for current (past and future) conditions of CO_2, and to see that the model effectively addresses vegetation responses to changing temperature, soil moisture and atmospheric humidity. Currently the paper only addresses corroboration of the high CO_2 runs using experimental data, and the discussion of this is overly brief. A historical modelling study, using crop data from past decades for corroboration would be very useful.

This paper suggests that changes in LAI are likely to be significant in counteracting the antitranspirant effect of CO_2. However, predicting future biomass remains a very difficult goal. Without a clear test of the model capability (and likely errors) in this paper (for instance, can wheat and maize dynamics be predicted across the years 2001-4?) the conclusions of this paper seem insubstantial. Currently none of the figures includes any independent data for model corroboration. It is also not clear how the

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fourth conclusion, about light interception, is generated.

p. 4768, l. 23. How can canopy conductance increase +540%? This seems unrealistic.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 4761, 2007.

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