

## ***Interactive comment on “Incorporating grassland management in a global vegetation model: model description and evaluation at 11 eddy-covariance sites in Europe” by J. Chang et al.***

### **Anonymous Referee #2**

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#### Overall assessment

The paper presents the integration of a grassland management module into the ORCHIDEE global vegetation model and the evaluation of the new model setup against measurements of biomass and carbon fluxes from 11 European flux-net sites. The paper is clearly structured and overall well written. Nevertheless there are several critical issues that should be addressed in a revision.

- The management module introduced into ORCHIDEE is essentially the one already developed, tested and applied within the framework of the PaSim model, and there is a necessity to justify the additional efforts. This is done only vaguely in the Introduction.

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There is also a need to take up again the comparison of plot and global vegetation models and to stress the benefits of ORCHIDEE-GM as compared PaSim and other plot models when discussing the results and implications.

- ORCHIDEE is a global vegetation model that can be employed to study different issues. Given this background, the overall goal of the present exercise is not always clear. Title and Conclusions (p. 2792, line 23: “[The paper is an attempt] to realistically represent the impacts of management on the C balance of European grasslands . . .) suggest that the main aim is the simulation of carbon fluxes (and other greenhouse gases), while line 7, p. 2774 of the Introduction indicates a need for modeling the “cultivation of European grasslands”.

- More clarity could be achieved by reconsidering the title, which could be made more specific.

- With regard to the evaluation of the ORCHIDEE-GM, much emphasis is on the assessing the model performance in simulating the variability of carbon fluxes at different time scales. However, the importance of the variability [of the carbon fluxes] is not addressed in the introductory section. Therefore it is not always clear why a relatively detailed analysis has been undertaken, employing a technique that I believe] is still not a standard outside the flux community.

- There is no critical discussion of key technical aspects of the modeling exercise. As pointed out in the Discussion (p. 2788-2792) model parameterization, model initialization, etc. all play a crucial role in determining the overall model performance. Actually, at the end my impression is that these issues are even more relevant than a realistic representation of management, which brings me back to the need to better justify and specify the goals of this work.

- Similarly, I would like to have some comments concerning the coupling strategy. In particular the question arises of whether the fact that the management module feeds back only two variables to ORCHIDEE (p. 2776, line 3) is appropriate or not.

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- Apart from a few details in Section 2.3 (p. 2776, lines 9 and 10) there is very little information concerning grazing. Since one of the main conclusions is that “improvements at grazing sites are only marginal” (Abstract, p. 2770, line 13) there is a need for a more thorough introduction of how grazing is modeled and which processes having an effect on vegetation are considered. Questions come up for instance concerning the types of herbivores are considered (Only cattle? Others?), how are the returns of nitrogen and carbon in excreta and urine taken into account, etc. etc.

- Estimates of the carbon balance of European grasslands obtained with ORCHIDEE-GM are only briefly compared to previous estimates in Section 4.4 (p. 2788, line 1 ff.). In view of the scientific and political relevance of this question, a more thorough discussion seems could be of interest.

- As previously mentioned, ORCHIDEE is a global model, whereas the focus of this work is on European grasslands. Possible applications of the new model version outside Europe are briefly brought up in the Conclusions (p. 2793, line 9 ff: “This model with a realistic management process could enable us to re-examine the C balance in the regions e.g. Europe and China which distribute a large area of managed grasslands”). It is not clear, however, whether the current model version can be used to tackle issues that may arise in a different context.

#### Minor remarks

- Introduction. There is a nice review of grassland ecosystem models, but little information concerning how management is taken into account in these models.

- Section 3.3 (Model set-up), p. 2781, line 20: what is the “(idealized) management history of each site” used for the model spin-up?

- Section 3.4 (Methods for evaluating . . .): replace “index of agreement indicator” (p. 2781 line 25) simply with “index of agreement”

- Section 3.4 (Methods for evaluating . . .) The discussion of the Singular System Analy-

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sis should be either shortened (assuming that most of the readers are acquainted with it) or than a little bit expanded (assuming that readers from outside the flux community are not necessarily familiar with it).

- Table 1 could be accompanied by a map of Europe showing the location of the 11 sites considered for the analysis.
- Axes labels in Fig. 6 (print version) are relatively small. Please also label the x-axis of the upper panel.

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Interactive comment on Geosci. Model Dev. Discuss., 6, 2769, 2013.

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