Biogeosciences Discuss., 4, S958–S961, 2007
www.biogeosciences-discuss.net/4/S958/2007/

Biogeosciences Discussions

BGD

4, S958–S961, 2007

Interactive Comment

Interactive comment on "Assessing the ability of three land ecosystem models to simulate gross carbon uptake of forests from boreal to Mediterranean climate in Europe" *by* M. Jung et al.

M. Jung et al.

Received and published: 25 July 2007

We thank Hisashi Sato and the anonymous reviewer for there constructive criticism. Our replies to their comments are outlined below.

Remarks of H. Sato

We thank Hisashi Sato for valuing the relevance of our work. His main criticism about our statement that we can gain confidence about global biogeochemical models from our analysis is valid. In terms of absolute numbers, the data-model mismatch can mostly be considered to be within the uncertainties involved. However, we can identify certain systematic patterns, i.e. a too flat gradient of simulated GPP from boreal to temperate climate, which we explain by deficiencies of the models, most importantly

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

EGU

related to nitrogen effects and simulation of LAI accordingly. We will have reworked all the relevant sections in the revised manuscript.

Remarks of Anonymous Referee #2

The comments and suggestions of reviewer#2 were useful and help us to clarify several aspects for the revised manuscript. Reviewer #2 raised three major concerns:

(1) "According to the authors, fAPAR is essentially a scaled LAI. The maximum observed and simulated fAPAR are scaled to match. According to many studies LAI is the most important parameter explaining GPP. Scaling maximum observed and simulated fAPAR values to match helps to reach good comparison results. It also helps to take into account differences in forest age and structure. Simulations are for mature forests, whatever it means. However, the flux sites are mostly in fast growing stage. Authors should add a discussion how much the CF scaling improves comparison results to look better than they actually are. Is there a difference between the methods of calculation of simulated and observedfAPAR values concerning direct and diffuse radiation?"

We think that we have been not clear enough about our methods of evaluating the simulations by decomposing GPP into APAR and RUE, which resulted in a misunderstanding. We have transformed LAI to fAPAR using the Lambert-Beer's law, which is also used by the three models. We do not account for effects of diffuse radiation on fAPAR as we had stated in section 2.3. None of the three models accounts for effects of diffuse radiation. The transformation of LAI to fAPAR allows a better interpretation to what extent a simulated mismatch in light harvesting might be responsible for the mismatch of simulated and observed GPP since light transmission is a negative exponential function of LAI. Simulated LAI as discussed in section 3.2 and displayed in figure 4 have not been scaled to match observed values. The simulated LAI is just transformed to fAPAR to allow better interpretation about its potential effect on differences of light absorption (which translates into differences of GPP) between real and

BGD

4, S958–S961, 2007

simulated ecosystems. In order to approximate and illustrate the effect of different amounts of absorbed radiation in real and modeled ecosystems we estimate APAR for the simulations using the modeled fAPAR and for the real ecosystem by scaling the modeled fAPAR to match the observed fAPAR, fAPAR values being calculated from LAI (as described in section 2.3). We will rewrite the relevant paragraphs and remov some statements that could be misleading.

(2) "Deciduous tree species are the most important ones in temperate forests. It is difficult to understand why only partial analysis was conducted concerning for deciduous forests. The headline and abstract of this article don't exclude deciduous forests. Analysis of deciduous forests and discussion of possible problems related to the simulation of phenology would be very interesting for the readers."

Deciduous tree species are indeed important in natural temperate forests in Europe. However, in terms of total forest area deciduous forests are less important since the largest forest area is the boreal forest, which is dominated by conifers and many temperate forests are now coniferous forest plantations. The primary aim of our paper was to investigate to what extent models reproduce variations along large continental scale environmental gradients. We did not go into depth with the deciduous forests, because there is no large gradient for them which is sampled sufficiently; they are concentrated in the temperate zone. However, reviewer 2 makes a good comment by stating that the effect of phenology is indeed interesting to investigate in more depth and we will inserted a paragraph on possible effects of phenology in section 3.1. A systematic study on the effects of simulated vs. observed phenology is beyond the scope of this paper, which evaluates the broad patterns of GPP simulations. Such an intensive study on phenology would require an analysis on daily time step, daily measurements of light interception and a suite of model runs forced with in-situ measured driver data.

(3) "GPP of ecosystems in northern Europe are temperature and in southern Europe water limited (Reichstein et al., 2007). The analysis presented in the present manuscript is biased on the temperature limited part of Europe in spite of the fact that

BGD

4, S958–S961, 2007

the models seem to have more problems in the southern part of Europe. Authors should develop a method to illustrate the effect of water limitation. Reichstein et al. used Index of Water Availability (IWA) together with Mean Annual Temperature (MAT). I would like to encourage the authors to include water use related aspects to the final version because simulations of drought conditions is very important presently and more in future climates. The authors say that the analysis of terms GPP = APAR * RUE is good way of studying model performance. However, the analysis, particularly in the southern European conditions, is very thin. This article would be clearly more useful if the authors could separate between problems related phenology and hydrology. Following the same lines, in temperature limited parts of Europe, it is difficult to separate the difference between north-south radiation gradient from LAI gradient because the annual sums are used in the analysis."

Reviewer 2 makes a good comment here. Indeed we have presented very little material and discussion on the effect of water availability for forest sites along the gradient from temperate to Mediterranean climate. Initially we stayed away from including such material because we cannot separate the effect of uncertain input data. Simulated water stress effects are particularly sensitive to precipitation and VPD input data and prescribed soil water holding capacity. Gridded soil properties from global databases may be far off from the site of measurements, given the very heterogeneous nature of southern Europe. Moreover, the meteorological driver data of the models were found to have a dry bias in southern Europe in comparison to an alternative data set from ECMWF (Jung et al. in review, Global Biogeochemical Cycles). However, we fully agree with reviewer 2 that a closer look on the water limited part of Europe as an important missing part of the paper. We will therefore follow the suggestion of reviewer 2 and insert a figure with observed vs simulated GPP along the index of water availability from Reichstein et al. 2007 for southern sites (figure 3) and a discussion in section 3.1. accordingly.

Interactive comment on Biogeosciences Discuss., 4, 1353, 2007.