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Biogeosciences Discussions

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.

Anonymous Referee #2

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This BGD article studies competence of three global biogeochemical models to simulate annual gross primary production (GPP) of European boreal, temperate and Mediterranean forest ecosystems. Reference data is GPP inferred from eddy-covariance flux measurements and Leaf Area Index (LAI) data. The comparison method is based on an idea that Absorbed Photosynthetically Active Radiation (APAR) (fractional Absorbed Photosynthetically Active Radiation (fAPAR)) and GPP and Radiation Use Efficiency (RUE) which may be estimated from both flux data and simulations. The method is applied on annually resolved values. It is simple but robust method providing illustrative but rather limited information on the quality of simulations.

There are some aspects which I would like to raise and have further information and clarifications. The comments are relevant to the statement of the authors that comparison provides confidence in simulations of GPP for European forests.

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 observed fAPAR values concerning direct and diffuse radiation?

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.

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 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.

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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.

Minor comments

p. 1362 discussion that at the Mediterranean sites local heterogeneity may be more important factor explaining the larger discrepancy between the simulations and observations. However, the systematic nature of low simulated GPP suggests that there are systematic discrepancies, for example hydrological cycles and phenology.

Chapter 3.2 p. 1362 l. 27, indicate a problem with the parameterization OF WHAT?

Table 1. The smallest RMSE underlined - underlined is missing

Fig. 1. At a northern Swedish site triangle inside a square. Which one it should be?

Fig 3. Bottom panels yaxes fPAR should be fAPAR.

References:

Reichstein, M., Papale, D., Valentini, R., Aubinet, M., Bernhofer, C., Knohl, A., Laurila, T., Lindroth, A., Moors, E., Pilegaard, K. and Seufert, G. (2007) Determinants of terrestrial ecosystem carbon balance inferred from European eddy covariance flux sites. Geophysical Research Letters 34, L01402, doi:10.1029/2006GL027880.

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