

Interactive comment on “Modelling sun-induced fluorescence and photosynthesis with a land surface model at local and regional scales in northern Europe” by Tea Thum et al.

Anonymous Referee #2

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The authors use GPP data derived from CO₂ fluxes measured at 4 boreal forest sites, together with SIF derived from the GOME satellite and leaf-level active fluorescence data to test a new version of the land surface model JS-Bach, which has been updated with a description of ChlF fluorescence. Finally, JS-Bach is applied at regional scale.

The authors demonstrate overall good correspondence between measured and simulated GPP (which was calibrated though) and satellite SIF and site-level GPP and reasonable correspondence to leaf-level active fluorescence data. SIF compares better to measured GPP compared to remotely sensed fAPAR.

I think this is a useful and original contribution. My comments are mostly meant to improve clarity, which the ms frequently lacks.

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Detailed comments: p. 3, l. 6: as ecosystems exchange various forms of carbon, use carbon dioxide if you actually refer to carbon dioxide p. 3, l. 11: strictly speaking this is only true for fAPAR, while NDVI is just the normalized difference between reflectances in NIR and red, which happens to correlate with fAPAR p. 4, l. 1: I would contradict the “readily”, given that we are still far from a truly process-based description of SIF; the Farquhar model though offers most of the interfaces for coupling to SIF p. 4, l. 12: “Both these regions ...” p. 4, l. 15-15: here you might explain why you focus on spring and autumn p. 4, l. 19: here you haven’t mentioned yet that you did implement SIF into your LSM p. 4-5, section 2.1: while this section clarifies some of the basics, it entirely lacks details, such as which instrument was used for active measurements in the field and how the experimental protocol was, etc. – I see this comes later, so an appropriate header reflecting this is required here p. 6, l. 6-7: the acronyms/abbreviations do not make sense – maybe use subscripts like *dir* and *dif* to distinguish between direct (beam) and diffuse radiation; Wouldn’t the equation be easier to understand if fAPAR was calculated as the difference between the radiation balance at the top of canopy (layer 1) minus the radiation balance below the lowermost layer (layer 3); replace “transmitted” by “used” or similar p. 6, l. 12: “... is used ..” p. 6, l. 16: typically the temperature dependency of *J*_{max} is either exponential or even follows an optimum shape p. 6, l. 17: isn’t the value of α typically around 0.05 (mol CO₂/mol photons) p. 7, l. 19: “obtained” – use past tense throughout p. 8, l. 19, 24: two times same header numbering p. 9, l. 5: is it a good idea to introduce a bias into the data? Isn’t there some other way to deal with the negative values? p. 9, l. 9: does this explain how fAPAR is derived? I mean in the sense that a reader should be able to repeat the author’s approach? p. 9, l. 18: what does “adjusted” exactly mean? Which metric did you use to measured the success of the “adjustment”? typically, *J*_{max} is linked to *V*_{cmax} through the ratio of the two – was that done here too, i.e. only *V*_{cmax} adjusted and *J*_{max} “followed” based on the relatively conservative ratio of the two? p. 10, l. 14: what exactly means “most” in this context? p. 11, l. 1: doesn’t the term “midday depression” refer to the drought-related midday decrease in leaf net photosynthesis and

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stomatal conductance? p. 16, l. 2: “wider footprint” – be more precise . . . Fig. 1: might be worth commenting on the negative measured GPP values

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