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Biogeosciences Discussions

Interactive comment on "Needle age-related and seasonal photosynthetic capacity variation is negligible for modelling yearly gas exchange of a temperate Scots pine forest" *by* M. Op de Beeck et al.

Anonymous Referee #2

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General

This study presents evidence for small but significant variations of key photosynthetic parameters with needle age in a Scots pine canopy and their relatively small impact on the predictions of canopy gross primary productivity and transpiration using a process-based multilayer model. The paper is well written and the results are overall well presented, and I think the paper could be published provided small revisions are made, notably to put the paper in a broader context and discuss the generality of the results.

In particular, some clarifications should be made on which variations of the photosynthetic parameters are considered, here or in other studies. Indeed, needle-age variations can include seasonal variations (each needle cohort age over the growing season) but can also create spatial variations (if the needle cohorts do not occupy the same part of the canopy). I think the apparent contradictions with or between other studies would vanish if such distinction was made. For example, if the total canopy leaf area is small (the case for this study), then spatial variations are less important because all canopy layers have nearly the same photosynthetic capacity and see almost the same amount of radiation. This is vaguely evoked in the paper (for example p. 9738 l. 29) but obviously not stated clearly enough (see for example comments by M. Letts). I would suggest for example to add "sparse" temperate Scots pine forest in the title.

I would also suggest to pay more attention (and give more details) about the way light penetrations is computed, and especially how the grouping of needles into shoots or whorls is dealt with. Depending on the species, whorl structure (and thence radiation interception) changes dramatically with needle age and this could have a bigger effect on simulated photosynthetic or transpiration fluxes than age-related changes in photosynthetic parameters. For example, and although not stated explicitly in their study, I believe this is what Ogée et al. (2003), who accounted for both shoot structure and photosynthetic capacity changes with needle age, observed.

Specific

p. 9738 l. 5 Comma missing after parameters

l. 6 Remove capital letters and replace 'different-aged needles" by "needle cohorts".

l. 9 Capital letters

l. 10 Add "and/or spatial"

l. 15 Indicate by how much.

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l. 20 Remove “Measured”. By how much?

l. 22 “needle age-related”

p. 9739 l. 8 Add “and cohorts” after “clumps”

l. 9-10 Maybe add older references (e.g. Wilson et al. 2000, 2001, Meier et al. 2002)

l.18-20 Some global models include seasonal changes in Vmax/Jmax and, to some extent, age-related changes too (i.e. maximum needle age is ca. 3 years and the Vmax/Jmax change with age but pooled together over the season a bit like in scenario S here).

l. 21 “Here” is a bit ambiguous.

l. 24 “canopy scheme reduction” is a bit vague. References cited did not discuss Vmax/Jmax variations or assumed it varied vertically in a similar fashion between the multi-layer and big-leaf approach.

l. 25 Add references. In general, I think the presentation of previous literature is a bit messy. See general comments above.

p. 9743 l. 15-7 It would have been good to give the reader some indications on how these vertical distributions look like.

p. 9745 l. 16 What is a “biurnal”? I would replace each instance by “24-period”.

l. 26 “validated against”.

p. 9746 l. 28 Maybe add “as in Ogée et al.” after “weighting factor”.

p. 9750 l. 20 Reformulate “more than satisfying degree”.

p. 9755 l. 7-14 If the footprint at night is such a problem why not using a different method to partition NEE into GEP and TER, based only on daytime measurements?

l. 19-22 Rephrase (but see below).

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l. 19-24 A bit redundant with the results section...

p. 9756 l. 15-20 This is part of the explanation but the density of the canopy and the treatment of radiation interception contribute also largely to the apparent contradiction.

p. 9757 l. 2-5 But this is the case at least in Ogée et al. no?

p. 9758 l. 20 Replace “uniform” by “spherical”

p. 9759 l. 15 It is not clear how radiation at a given level is distributed between needle cohorts. Do they have the same interception efficiency?

Interactive comment on Biogeosciences Discuss., 6, 9737, 2009.