

## ***Interactive comment on “A simplified gross primary production and evapotranspiration model for boreal coniferous forests – is a generic calibration sufficient?” by F. Minunno et al.***

**Anonymous Referee #2**

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### **1 Scientific comments**

The paper by Minunno et. al. (2015) is a well written and describes a thorough study of Gross Primary Production (GPP) and Evapotranspiration (ET) over the boreal regions of Finland and Sweden. The paper makes use of a well defined Bayesian framework to conduct a sensitivity analysis and calibration on the PRELES model that is statistically comprehensive. The results of this research are very interesting, a little surprising (given the results of Peltoniemi et. al. (2015)) and thorough enough to be published. However, I agree with the previous reviewer that this study is a bit too similar to the previous study by Peltoniemi et. al. (2015). As such, I feel this paper needs to be

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expanded to show more new results furthering the work of Peltoniemi et. al. (2015) to be published in GMD.

In the second sentence of your abstract the authors argue that simple models are "suitable only at local scale". This assertion seems to be at odds with the rest of the paper as the study shows that the simplified model PRELES can be used to achieve a good estimate of a regional carbon balance, in this case over the boreal regions of Sweden and Finland. Later in the introduction the author describes some of the reasons why a simplified model may fail to capture regional or larger areas (Lines 18–31 of the introduction). The use of a simple model with differing calibrations to test what the best sites to use for your regional estimate is a very interesting question that is called "quantitative network design". A good paper on this topic is by Kaminski et. al. (2012).

This is a very interesting avenue of research, as an optimal network of stations for the measurement of some key ecosystem processes (such as GPP) is currently unknown, as the heterogeneity within even a small area of forest or soil can be significant and hard to estimate. So if it is possible, as your work suggests, to optimize a simple model with just one or two measurement sites and then get a strong estimate for the much larger region of Northern Sweden and Finland, that information would be extremely useful to measurement groups like ICOS.

The results of your study are very intriguing but before I convince myself that all the boreal trees are sufficiently similar to those found at Hyytiälä, and therefore that it is possible to calibrate a model for the whole of the boreal region from that one site, I would like to see a few more tests:

- In section 2.2, Minunno et. al. (2015) lists the data used in the study and has chosen to use the gap-filled product from Fluxnet. This however brings up some potential issues, as the procedure of gap-filling is to adjust the data where it is doubtful and extrapolate the good data to fill the gaps using a simple ecosys-

tem/statistical model. The risk is that when using data that has already been through a model is that some of the inputs that are required to run the gap-filling model are the same as the inputs that were used by PRELES in this study, such as climate data. The result is that model output from PRELES and the gap-filled data are no longer independent and therefore poor choices for a Bayesian data assimilation. It would be an interesting test to see how much the results of this study change if the raw data was used instead of the gap-filled.

- It would be useful to extend the sensitivity analysis to also include the other input variables T, P and D.

In section 2.5, you choose to vary the LAI from 0-16, which is  $\pm 100\%$  of the average of 8. How does this range compared with the measured standard deviation at Hyytiälä?

In section 3.2, there is the acronym "MCMC", which I assume stands for Markov Chain Monte Carlo but no expansion is given. Furthermore, if MCMC does indeed stand for this I feel that this method should have a paragraph describing how it works in the methods section (probably section 2.6).

## 2 Grammer comments

- Line 9 of the abstract: I think you should remove "Model calibrations and evaluations were carried out by the means of the Bayesian method;" as this makes the sentence very long, harder to read and says the same thing twice.
- Line 23 of the abstract: Swap the "underlined also" to "also underlined,".
- Line 1 of the introduction now, should have a "the" in front of "atmosphere".
- Line 24: There should be a comma after detail.

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- Line 27: The sentence would read better if the "on the other hand" was at the start of the sentence.
- Line 33: Currently reads "applied in regional scale in the MODIS algorithm" but could be changed to "applied in the regional scale MODIS algorithm".
- Line 54: Change "canopy element level" to "the canopy level".
- Line 57: Currently reads "for parameters for which direct measure measurements" but you can switch it to "for the parameters, where direct measurements".
- Line 64: There should be a "s" on the end of allow.
- Line 67: "providing" should be "provides". There should also be a "which" after the comma.
- Line 321: There should be a comma after "three analyses".
- Line 323: "cover" should be "covers".
- Line 587: After the first comma there should be a "there".
- Line 680: Currently starts with "Eddy-covariance network" but should be changed to "The eddy-covariance network".
- Line 712: The sentence "From carbon modelling perspective, use of a few aerially representative sites with long and high quality records would be optimal" should be re-written.
- In Table 2. continued, is the annual temperature of CAge75yr 29°C or 2.9°C
- In figure 1, I think the arrows and the key at the bottom a little bit messy. I was wondering if the Figure would work just as well without them?

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## References

Kaminski, T., et al., "Observing the continental-scale carbon balance: assessment of sampling complementarity and redundancy in a terrestrial assimilation system by means of quantitative network design", *Atmos. Chem. Phys.*, 2012

Peltoniemi, M. et. al., "A semi-empirical model of boreal-forest gross primary production, evapotranspiration, and soil water-calibration and sensitivity analysis", *Boreal Environ. Res.*, 2015