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## ***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 #1**

Received and published: 14 July 2015

Minunno et al., presented a study that assess PRELES model GPP, ET predictability using different calibration data. The modeling exercise was carried out successfully, and the paper itself is well written. The sensitivity analysis, calibration and uncertainty evaluation are comprehensive, worthy of publishing. However, several issues still warrant further explanation and investigation, before the paper could be published on GMD.

The primary concerning is the novelty of this study. A similar work was published early this year. Peltoniemi et al., 2015 used two boreal forest EC tower data (Hyytiala and Sodankyla) to calibrate PRELES model. They highlighted the difference in model parameters and predictions when the model was calibrated by different EC tower data.

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I didn't see much added value of this calibration study, compared with that similar study (Peltoniemi 2015) (same model, similar calibration data and method). I also want to mention that this study drew a conclusion different from Peltoniemi 2015, even though the two EC sites involved in Peltoniemi 2015 were also included in this study.

I am quite surprised by the major results. I expected that (site-specific) S-S calibration and (multiple-site) M-S calibration should be different due to spatial heterogeneity of the 10 boreal forest EC tower measurements. And intuitively, more data should lead to a better model, unless the data are redundant, which should not be the case for EC tower measurements. The author found no significant difference of (site-specific) S-S calibration and (multiple-site) M-S calibration, in terms of parameters estimations and predictions. This is the most important message the paper delivered. I think the author should discuss such conclusion more thoroughly.

I have done lots of model calibration. My experience is that plant functional type (PFT) (in this case is boreal coniferous forest) is basically not enough; large variations exist at species level. The 10 EC tower are classified as the same PFT, but they are different in terms of plant species. The model parameters for different plant species should be more or less different. This is because that different plant species reside in different ecological niches; therefore, they have different tolerance to environmental changes, different temperature sensitivity and different light response. This is part of the reason why site-level calibrated model often failed when it was extrapolated to a large-scale region with the same plant functional type. Related to that, my second major concerning is that: Why the model calibrated at one EC tower could be representative at other sites, given that the representativeness of EC tower is just about a few kilometers (scale of its footprint)? Please dig into this question thoroughly in the discussion section. In addition, PRELES model is a simple flux model, detail complex mechanistic interactions (e.g., nutrient constraint), physiological responses (e.g., drought tolerance) are simplified. However, EC tower data are heterogeneous and they intrinsically contain those types of information (detail interactions and responses). Then the question

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become: why a model that does not consider those mechanisms could reproduce EC tower observation reasonably. In order to reproduce the 10 EC tower heterogeneous observations, I would expect that PRELES need site-specific calibration for site-level application multiple-site calibration for multiple site calibration due to the model simplicity, unless those complex interactions are just second order significance at those EC tower sites.

Other minor comments: Page 3. Line 2. material and energy -> mass and energy

Page 3. Line 4. weather variables -> climate forcing

Page 4. Line 5. applied in -> applied to

Page 4. Line 9. And the resulting model was found to describe daily GPP rather generally and independently of site, rephrase

Page 5. Line 10. test and calibration -> calibrate and test

Page 5. Line 27. to -> against

Page 8. Eqn. 14. What is  $S_k$ ? Should it be just "S"? What does the k represent?

Page 9. Line 19. a and x are empirical parameters. Are they just scaling parameters? No physical meaning? Am I right? Please explain them a little bit more.

Page 10. Line 4. Table 2 appears before the appearance of Table 1.

Page 10. Line 26. Eq. (22). Should it be Eq. (21)?

Page 11. Line 5. Eqn. (22) -> Eq. (21)

Page 13. Line 14. also -> removed

Page 16. Line 23. The results for Hyytiala are representative of all sites except Norunda. Figure 2 only show the SA result for Hyytiala and Norunda. Could you plot out SA results for the other 8 sites (e.g., in supplementary material)? Why Hyytiala is representative? In Page 13, you stated that sensitivity is regulated by soil moisture

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status, site conditions and weather inputs. Does it mean that Hyytiala's soil moisture, weather inputs are representative of the other 8 EC sites?

Page 18. Line 9. In MS- calibration the highest correlations were between beta and gama. Any implications? Does high correlation affect model calibration? If does, in a good way or bad way? Does it mean that variations of those parameters could cancel out each other?

Page 19. Line 1. Only Alkkia site stand out. It's interesting.

#### Reference

Peltoniemi, Mikko, et al. "A semi-empirical model of boreal-forest gross primary production, evapotranspiration, and soil water-calibration and sensitivity analysis." (2015).

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Interactive comment on Geosci. Model Dev. Discuss., 8, 5089, 2015.

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