

Interactive comment on “Annual cycle in scots pine’s photosynthesis” by Pertti Hari et al.

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Received and published: 14 August 2017

1 General comments

A mathematical model describing the annual course of photosynthesis in Scots pine was constructed from fundamental concepts and axioms describing the variation in photosynthesis with basic environmental drivers such as ambient temperature and solar light intensity. The mathematical model was tested against a multi year dataset from Northern Finland, which resulted in exact predictions of the daily and annual cycle in photosynthesis.

The theoretical framework is clearly described and the resulting equations seems quite meaningful. I miss a discussion of the meaning of the "constants" ($a_1 \dots a_5$). The estimation of the constants from the tuning of the model to the field data is not well described,

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and it seems there were quite some challenges to this.

The "test" using the field data was not strictly independent, since the dataset was used to estimate the parameters of the model. Has any attempt been made to try the model on field data from other Scots pine stands, and would this result in other values of the parameters? And what determines the exact value of the parameters? Since the model is based on fundamental relationships between photosynthesis and light and temperature, a discussion of its universality would be interesting to include in the paper.

Overall, I find the paper very interesting and well argued. I think the paper could be approved and increase interest if the points mentioned above and in the specific comments are taken into consideration.

2 Specific comments

Title: Change "scots pine's" to "Scots pine's".

Abstract:

p.1, l.20: "Our theory gained strong corroboration for the theory ...": Not immediately meaningful; please re-formulate.

p.2, l.17-18: Delete one of the two instances of the word "summer".

p.3, l.6: Replace "on" with "of" (i.e. "of the annual cycle").

p.4, l.7-10: Considering the prominent role of nitrogen, I wonder why nitrogen is not mentioned directly in the axioms such as light and temperature. Is this because nitrogen is only considered to be internally circulated in the system?

p.5, l.7: Shouldn't it rather be "the **seasonal** state of the photosynthetic machinery"?

p.6, l.13: "is f_3 " should be " f_3 is".

p.7, l.14: A more readable statement would be. "When we quantified the previous axiom with mathematical notations..."

p.8, l.15-21: The procedure for parameter estimation needs some more explanation. What is the exact "graphical method" used? Why was a_2 fixed and how was the value chosen. Exactly which of the measured values were used?

p.10, l.26-27: The sentence starting with: "The physiological bases ..." is unclear; is something missing?

p.10, l.28: Change to: "In **an** efficient metabolic chain".

p.10, l.29: Change to: "... the steps in **the** photosynthesis ...".

p.11, l.6: Change to "... that **at** low ones."

p.11, l.13: Change to: "... into **a** quite stable state ...".

p.11, l.14: Change to: "... according **to** the annual cycle ...".

p.11, l. 19: Change to: "... deactivation of **the** photosynthetic machinery."

p.12, l. 2: It should probably read "severe".

p.12, l.24: Change to "SMEARI".

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2017-532>, 2017.

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