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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Annual cycle in scots pine's photosynthesis" *by* Pertti Hari et al.

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The work presents substantial ideas about autotrophic production processes of the forest ecosystem. The testing of the theory has the central position in the scientific analysis. Basic assumptions in the model are presented in a strict order to capture essential logical behavior of the system.

Introduction: the idea about the modelling is presented! Page 3, line 5 – 6: What do we mean as an "ecological level" here? The modelling attempt based on the physiological data can aim the different level starting from one single organism stretching to landscapes and global ecosphere?

Theory development! Page 3, line 27: How the Finnish summers are supposed to be mild? The geographical extent of the country is very wide.



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Discussion paper

The evolutionary dynamics of life processes is highly varying: the idiosyncratic response of an organism, species or population to environmental conditions contains many possible solutions. I would like to have a more detailed comment on the limits of physiological reaction to annual cycle in light and temperature variation including extreme cases (page 4, line 16)? BTW: the population variation has been mentioned in the discussion part: page 10, line1. Results of the work discuss the variation at different levels: would it be useful attempt to describe variation with known and unknown source separately?

The methodology presented in the form of definitions and axioms is a brilliant idea. The wording and structure of the definitions and axioms can be improved in several cases. Definition 3 introduces the "emergent property": how this properties are organized (hierarchy, spatial or temporal generalization)?

I am a little confused by use of term "linear" (page 6)? What do we mean here: the linear function?

Results: One can judge the match between observed and predicted photosynthesis dependence on the cloudiness to be rather good. Why the highest overestimation happens in the afternoon with intermittent cloudiness (Figure 3A)?

Does the data from Värriö Subarctic Research Station include extreme cases or disturbance events: e.g. low temperature during the vegetation period or extreme droughts?

What are the actions mentioned in the discussion (page 11, line 4)? Semantically action refers to purposeful and systematic interplay between components of the system! Although the action (or operation) of the system can be interpreted as evolutionary developed property of a living organism, the biochemical mechanism (enzymes, pigments, membrane pumps) as such lacks the purpose oriented action?

In conclusion: the presented modelling is only a minor part of the research conducted during many years. The wider and more profound presentation of the study can be

found in other printed sources. Material presented with current manuscript is an elegant demonstration of powerful methodological tools to create better comprehending of complex nature of living world. I do recommend to accept the paper with some modifications.

Minor comments I suggest some improvements to the abstract: the repetition of “theory” in concluding sentence should be avoided.

Number of measurements: 30000 datapoints during a summer (page 9, line 18): is it connected to total record 130000 (page 11, line 30)?

Acronyms at the Acknowledgement part are understandable only for very few specialist: nevertheless the Google can provide more or less correct hints. Still, what is SMARI?

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