Biogeosciences Discuss., 6, C2693–C2695, 2009
www.biogeosciences-discuss.net/6/C2693/2009/

Biogeosciences Discussions

Interactive comment on "Process-based simulation of seasonality and drought stress in monoterpene emission models" *by* R. Grote et al.

Anonymous Referee #1

Received and published: 27 October 2009

General comments

The manuscript presented by R. Grote et al. discusses various ways of accounting for the effects of seasonality and drought stress on emissions of monoterpenes from a Holm oak stand in a mediterranean environment. It applies a model framework that represents the physiological environment in which four different emission models are incorporated. The models are calibrated with leaf-level observations of monoterpene emissions from a well-watered Holm oak stand. Observations from a nearby stand suffering from drought stress are used for a succinct evaluation of the different models at leaf scale. Stand scale modelling is used to illustrate the differences between the different models in their representation of drought stress and seasonality.

Both seasonality and drought stress are topics that are poorly represented in emission

models at the moment, and a quantitative assessment as presented here is a welcome addition to our understanding of emissions under non-optimal conditions. The authors should be rewarded for taking up this challenging task. The method chosen to compare the different models, incorporating them all into the framework that provides the physiological properties, allows for a proper comparison, and ensures that the results provide insight into the differences between the different seasonality and drought stress approaches only. However, the study presented here barely compares the different models with observations, which leaves the reader with the somewhat unfortunate conclusion that the different models result in considerably different emission regimes, but that we do not know which of the approaches presented is most promising to help us reduce the uncertainties related to seasonality and drought stress. A more thorough comparison with observations and more pronounced statements on the models' performance are welcomed to make the manuscript acceptable for publication in Biogeosciences.

Specific comments

The study uses observations from a well-watered and a drought stress-affected Holm oak stand to parametrize and evaluate the models, respectively. To both applications I have some questions that I raise below.

The results from the well-watered stand are used to parametrize the loss rates of photosynthetic intermediates LR_i in equation (5), which seems a very indirect way of model parametrization. There is a number of steps between loss rates of photosynthetic intermediates and leaf-scale emissions of monoterpene, and each of the steps brings an additional uncertainty, which reduces the certainty of the parametrization. Would it be possible to use photosynthesis observations to help constraining the loss rate? And how is the iterative derivation done?

The evaluation of the leaf-level modelling of drought stress is done too succinct. The results provided in figure 5 do not give any information on the different models' abilities

to represent drought stress, in particular because the drought-stressed emission rates are presumably on the lower side of the range and thus do not heavily influence the r^2 values and standard errors. The high emission rates in the figure are presumably those from non-water stressed days, so the r^2 could be determined to a large extent by the parametrization mentioned above. I would welcome a figure that provides more insight in the ability of the model to capture the seasonal variability and drought stress effects.

The different models are compared in a setup forcing the framework with meteorological data from 1998-2006. The results are used to discuss the sensitivity to diurnal changes, seasonal changes and drought impact. The authors describe the reasons for these differences in sensitivity in the Discussion part, but do not discuss the range that is considered likely for such a sensitivity. Despite the lack of canopy-scale observations for the site, it should be possible to provide a general judgment on the models' behaviour: how strong should the (temperature and) light dependencies be on the different timescales?

Technical corrections

- page 8971/22: Replace DMADP with DMAPP

- page 8973/22: Please provide units for the Michaelis-Menten constants

- page 8975/25: Clarify what is meant with a "period of flushing"

- In the list of references, there are some ambiguities, e.g. Grote et al., 2009; Niinemets et al., 2002. Please add "a" and "b" according to the text.

- The text contains a number of typos and some words are missing. Please check when revising the manuscript.

Interactive comment on Biogeosciences Discuss., 6, 8961, 2009.