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Interactive comment on "Comparing three vegetation monoterpene emission models to measured gas concentrations with a model of meteorology, air chemistry and chemical transport" *by* S. Smolander et al.

Anonymous Referee #2

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I was very pleased to read this manuscript. The topic is highly relevant with respect current scientific focus and well written. It is highly relevant for Biogeosciences and then it is a joy to see scientists using models and observations in combination for improved understanding instead of just focusing on improving certain model components and then comparing with observations.

Having said this, then this is both the strong and weak part of the manuscript. The focus of the paper is to increase understanding of the dynamics of biogenic emissions and its consequences. It appears, that the main unknown parts on BVOC emissions

relates to biological processes. This particular manuscript does not add much new information with respect to the underlying biological processes that drives the biogenic emissions. This is also reflected in the conclusion. Three quarters of the conclusion is about the intercomparison of three existing BVOC emission models and the last part conclude that it is feasible to improve atmospheric chemistry models so that they can provide reliable descriptions of seasonal and diurnal variations of BVOC emissions. This conclusion is not a very substantial conclusion.

In my opinion, the conclusions in this manuscript do not really reward the investigations that are presented. One reason could be that the data handling in this manuscript is not detailed enough. The manuscript contains very few statistics measures. There are no scatter plots, no correlation coefficients and no information about statistical significance. I am also missing error bars in all figures (time series and histograms) that show aggregated values such as monthly mean values or summer values. This limits the possibility to analyse and discuss the results. I therefore suggest improvements on that part throughout the entire manuscript.

The implication of emissions on atmospheric dynamics and atmospheric chemistry is covered in an excellent way by using the SOSA model, the master chemical mechanism and by nudging observations into the model from the SMEAR II site. This provides a very good understanding of many physical and chemical processes in the atmosphere during the experiments. Here the SOSA model is much more advanced than most atmospheric chemistry transport models (CTMs) that are covered in the conclusion. Compared to SOSA, most CTMs rely on crude parameterisations (e.g. WRF/WRF-Chem) of the atmospheric boundary layer and the surface layer, which can have a direct or indirect impact on the emissions. But information from the atmospheric part of the experiments does not go into the conclusion, although it takes up quite some space in the manuscript and as this is quite relevant too with respect to CTMs. As an example, in the WRF/WRF-Chem model, then the different schemes for the atmospheric boundary layer, the surface layer and the land surface model are dynamically connected.

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Changes in one scheme affect the dynamics in the other, which includes physical variables and vertical structure of the atmosphere, thus affecting the processes that drives the emission of BVOCs. In fact, not all schemes will work together due to this interaction. The detailed experiments (the atmospheric part) in this manuscript with focus on BVOC emissions could therefore be very relevant with respect to model improvements of a number of parameterizations that are used in CTMs, especially when the use of CTMs is to study BVOCs or other climate dependent emissions. This could be carried out if the manuscript had a more a more quantitative description of vertical concentrations of BVOCS – compared to the existing qualitative description – and which processes that drives the main patterns in the vertical structure with respect to both atmospheric physics and BVOCs.

Interactive comment on Biogeosciences Discuss., 10, 18563, 2013.

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