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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Simulated effects of changes in direct and diffuse radiation on canopy scale isoprene emissions from vegetation following volcanic eruptions" *by* D. J. Wilton et al.

Anonymous Referee #1

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General comments

This is a modelling study on effects of changes in radiation (quantity and quality) on isoprene emissions from vegetation. The authors introduce absorption of direct and diffuse radiation by sunlit and shaded leaves into the Gunter et al.(1999, 2006) isoprene emissions model. The modified model is then run at a single site during the post Mont Pinatubo eruption period and lower simulated isoprene emissions are obtained when accounting for the above mentioned effects. The main findings of this study obtained from simulations at a single site (without providing any data that confirms the main results or any model evaluation) are presented in the abstract and summary of the

manuscript as if they were typical for all terrestrial vegetation types and therefore valid globally.

The methodology could be clearer for the non specialist in isoprene modelling. It would be good to see how the additions to the model affect the gamma functions, in order to better understand the obtained results for sunlit and shaded fractions of the canopy under clear and dusty conditions.

For instance, case 2, if diffuse radiation is higher under a dusty atmosphere, shaded leaves must be receiving higher radiation, why are isoprene emissions then lower?

Can this result be model dependent on how the response of isoprene emissions to light is described? A change of radiation levels on an hyperbolic light response (steep and linear at low radiation levels, and saturating at high radiation levels (Niinemets et al. 1999)), might have a very different effect on both sunlit and shaded leaves than a non light saturating response (with perhaps not a steep linear increase at low radiation levels).

According to the gamma P, used in this study , what is the threshold of diffuse fraction at which isoprene emissions start decreasing with increasing diffuse fraction (i.e. plot of isoprene emissions against diffuse fraction, case 2)?

Most importantly, what are measurements showing? This study would greatly benefit from looking & showing the effects of diffuse radiation on isoprene emissions from eddy correlation at some sites. Just by separating isoprene emissions under high, intermediate and low diffuse fraction conditions, would give an idea of the differences in fluxes under the different conditions and it would potentially confirm the obtained modelling results.

This is a relevant subject for Earth system science that has not been taken into account in vegetation modelling before. In general, this is a well written and structured paper with proper citations to previous work. The authors need to explain better their

modifications to the model in order to clarify their main results to the non expert reader in isoprene modelling, and also they need include some data that can confirm their findings. Additionally, obtained results from this study, should be presented in their abstract and summary as a sensitivity study on a single site and care should be taken to avoid implying that the obtained results are globally valid.

Specific comments:

-On what time step is the model run for case 1 and case 2?

-For a non specialist on isoprene modelling, it is not straight forward to understand what Lai sun, Lai shade, Par sun, Par shade are doing to the given equations. For instance, in equations 5, 6, and 7, where are sunlit and shaded PAR going? is it the P term? Or P24 and P240 as well? Some clarification is needed.

-Plots of gamma Lai sun and Gama Lai shade, gamma Psun and gamma P shade would be quite useful to understand the effects of the modifications done to the model.

-what is f in equation 3?

-Legend in Figure 1 mentions 4 panels, however there are only two.

Figure 3, what are Isun and Ishade used to produce Figure 3? that would help to explain this figure. Do the coloured areas correspond to the total fluxes, i.e. sunlit leaves in black have much higher emissions (total black area) than shaded leaves (total grey area), so, total emissions are shown as the area under the top curve?

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 6983, 2011.