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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.

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A few comments and questions for clarification:

1. It's not clear which canopy environment model has been used. You suggest on p6986 that you have used the dePury/Farquhar model, but you also describe the sun-lit/shaded fraction algorithms from the Guenther 1995 (G95) paper, which is rather confusing - does this mean that you used the fractions from G95 in conjunction with DePury/Farquhar? If so, are the two canopy structures compatible?

Your statement in the introduction on p6985 that neither G95 nor MEGAN account for differences between diffuse and direct radiation was also confusing. G95 contained

algorithms for sunlit/shaded fractions and my understanding is that the canopy environment model that is used by NCAR with the full MEGAN algorithms does consider diffuse/direct PAR (as it's based on the BEIS canopy model). You perhaps need to clarify that the models have not been used/developed explicitly to investigate the effect of altering diffuse/direct radiation.

2. MEGAN algorithms: Which "MEGAN" are you using? On p6986 lines 8-9, you state you have used an existing isoprene emissions model and reference both the 1995 and 2006 Guenther et al papers - yet these described different models. Sure, the 2006 model MEGAN builds on the earlier G95 algorithms but they are distinct. Just reference the one you have used in this study (MEGAN).

If I have understood the method description on p6986-6987 correctly, you've used the gamma-p activity factor from MEGAN (which is appropriate as it is the taken from the full MEGAN algorithms that are designed to beused with a canopy environment model) BUT the gamma-T activity factor from the PCEEA version (ie the MEGANv2.04 coded version). The PCEEA versions of the algorithms incorporates a a simplified canopy model and was specifically developed for use without a canopy model as the effects of a canopy are already included to a certain extent. It is different from the gamma-T activity factor in the full MEGAN algorithm and the two gamma-T factors do give different results , although I have no idea how significant these differences would be in the context of diffuse/direct PAR. However I would speculate that changes in the diffuse fraction of light would also affect the temperature profile in the canopy.

This seems to me to be a major, and unecessary inconsistency. Do you have any idea how significant the differences would be? It may be that the overall conclusions are robust but the magnitude of the changes may be under or overestimated.

3. Inconsistencies between Case 1 and Case 2: It concerns me that Case 1 and Case 2 have been modelled at different latitudes (55N vs 42.5N) as this would presumably affect the penetration of light into the canopy as the solar angles are different for the

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two locations. While the two scenarios are intended to be distinct, it does lead to lack of comparability between the two. What difference would it make to the changes seen if Case 1 was also run at 42.5N (I presume you chose this location for Case 2 as it is the location of the Gu observations).

You state that Case 1 was run at a temperature of 290K - isn't clear what is meant by temperature here - daily average?

4. Diurnal cycle: The biggest difference between the two cases is the application of a diurnal cycle to the change in diffuse/direct PAR in Case 2. This also seems to be the factor that has the biggest overall effect on total changes in isoprene emissions in Case 2. This cycle is not included in Case 1 and yet it could be expected to have a major impact on the results in this situation too. While I realise that they were modelling different future projections a complete study would include a third case that either kept total PAR constant but applied the diurnal cycle as Case 2, or allowed PAR to drop as in Case 2 but did not have a diurnal cycle to the ratio of direct to diffuse PAR. This would allow a comparison between the two projections and also give some measure of attribution (ie is it the overall change in diffuse/direct or is the diurnal cycle in the changes that has the biggest effect).

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