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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Sensitivity of isoprene emission estimates to the time resolution of input climate data" *by* K. Ashworth et al.

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One major issue is there is not any discussion of sub-hourly effects on the emissions

Sub-hourly effects were not treated in this paper as the maximum resolution of the input climate data available to us at the start of the study was hourly. Our work demonstrated that the non-linearity of the response of bVOC emissions to fluctuations in temperature and PAR makes emissions estimates highly susceptible to methods of interpolating these data between known values and it was therefore not felt appropriate to explore emissions at a smaller time interval. Any attempt at generating sub-hourly data from that available would not be increasing the resolution of the input data although it may appear that this was our conclusion - data interpolated to half hourly intervals cannot be deemed to be genuinely half hourly data. However, in response to the request

made by Anonymous Referee 1, we returned to both the original data and the daily averaged data and re-sampled at both 30 and 15 minute intervals. It was found that when compared with the appropriate hourly runs from the original study (ie half-hourly and quarter-hourly emissions estimates generated from the original UM data files compared against Run 1, etc) the percentage differences in the global total annual isoprene emission estimate were mostly between -0.5 and +0.5%, rising to a maximum of 1.5% for one quarter-hourly model run. Both the size and the inconsistent change in sign between runs suggest that these results are down to the level of noise within the model. Global maps of the emissions show that the changes are consistent across the world rather than displaying strong regional differences as seen in the original hourly study. We acknowledge the issue that Referee 1 has raised, particularly in light of the drive to increase the resolution (both spatial and temporal) of climate and Earth system models. It is certainly an issue that should be considered by the developers of the next-generation of coupled models but one that the authors feel is implicit in the final conclusion that model developers should seek to drive MEGAN at every climate time step within the coupled model.

We have not made any changes to the paper in regard to this issue as explained above.

Page 23548, Line 23: Please quantify "high mixing ratios of isoprene"; please add references accordingly.

The mixing ratios of isoprene have been quantified using data from a recent field campaign.

Page 23548, Line 25: Why do the authors write "particularly in NOx rich atmospheres"

This sentence has been altered to remove references to NO_x.

Page 23549, Line 10: As pointed out by the Arneth et al (2008) paper, just because global isoprene emissions seem to be converging towards 450-600 Tg/yr it does not mean that we have reached an "accepted" global total.

We acknowledge the point made by Referee 1 (with which we agree) and have re-worded this section to make this clear.

Page 23551, Section 2, Method: Please note that "MEGAN-EZ" is not mentioned in the Guenther et al. (2006) paper. Do the authors mean the PCEEA model instead? I would like the authors to explicitly briefly state (possibly in appendix) which formulae they used to calculate the isoprene emissions.

All references to MEGAN-EZ have been replaced with PCEEA. However, we do not feel that it is necessary to reproduce the algorithms in this paper as it is our contention that the results of the study are independent of the version used and a full description of the algorithms is available from other sources which are cited. The two differences in the MEGAN v2.04 algorithm and PCEEA (namely that the canopy production and loss factor, ρ, and the soil moisture activity factor, γ_{SM}, are both set to 1) are explicitly stated. In addition, readers are referred to the supporting documentation on the NCAR website which provides further details of the algorithms used in MEGANv2.04.

Page 23554, Lines 4-15: I had to re-read this paragraph a few times to before I finally understood what the authors meant. Also it would be interesting to include an extra plot, in the same format as Figure 2, for another region (e.g., southeast USA) and include some more discussion, by comparing and contrasting the two locations.

This paragraph has been re-worded to make it clearer; Figure 2 and its caption have also been slightly altered for clarity.

An additional plot, in the format of Figure 2, has been included to allow comparison between the two locations. This plot focuses on an area of the northwest USA. This region has been selected as it represents an area of much lower (but still significant) isoprene emissions than the Amazon. It is also representative of rural areas over much of the industrialised world where air quality is likely to be an issue. Finally, it is an area that has been the focus of several isoprene field studies which have informed the development of the MEGAN empirical algorithms.

Page 23554, Lines 15-16: I have a slight issue when the authors state that "the results cannot be considered robust." Surely, this depends on the type of model simulation and its computational cost (i.e. a 1 year versus 1000 years model run). For detailed coupled Earth system models, I agree that high temporal resolution input data is very important. For model simulations that look at the isoprene emissions over several thousand years, then monthly data would probably adequate to determine past trends and would be less computationally expensive.

We appreciate the point that Referee 1 is making but stand by our assertion that the results obtained from the use of daily or monthly averaged input climate data that has not had a diurnal cycle applied are not robust. We have therefore not altered these lines. While we acknowledge the difficulties that this poses researchers engaged in model simulations over millennial timescales, it is an obvious conclusion from our study. If other studies still wish to run MEGAN using such input climate data due to the computational cost of running an Earth system model hourly over such timescales, the effect of this decision should be quantified for the climate data that they are using.

Page 23554, Line 25: The authors state that using daily averaged radiation (sampled hourly) appears to be adequate for simulating the emissions over the course of the year.

This was not the intended meaning of this sentence. We wished to indicate that we had assessed the re-generated climate data against the original data and found no evidence of a systematic bias in the applied diurnal cycle of either temperature or radiation, but that the temperature profile appeared harder to replicate when the impact on isoprene emissions are considered. We very much wish to make the point that any interpolation of input climate data should be avoided if possible, regardless of whether it is temperature or PAR. The line has been amended to clarify this point.

Page 23557, Line 4: In some ways I think this is an obvious statement to make (irrespective of the results presented here) since if computational power were not an issue,

then most models, would be adapted to using the best available spatial and temporal input data which would be implemented at each model time step.

This line has been re-worded slightly.

Figure 2: Please add a sub-title to each of the six plots as this would make it easier (and quicker) than referring back to table 1.

Subtitles have been added to each plot in this figure, referring to the input data used in each case. The same has been done with the new Figure 3.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 23547, 2009.