Atmos. Chem. Phys. Discuss., 9, C9419–C9425, 2010
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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.

K. Ashworth et al.

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The applied diurnal cycle is described as "a sinusoidal function", but its description remains a bit unclear. I presume it applies daily minimum and maximum temperature to give the amplitude, but is it a "pure" sinusoidal, or is there any correction accounting for e.g. changes in daylength? And given the deviation shown for the Amazon (Fig. 2, middle right), how good is this applied diurnal cycle? Could you suggest improvements to the algorithm for those cases where hourly data are not available?

It might add to the understanding if the authors would be able to provide insight in when in the diurnal cycle the decrease is taken place: is it equally distributed over the day, or is it predominantly around (local) noon? If this information is easy to extract from their results, I would recommend to analyse this and add the information to the manuscript.

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In order to address the issues raised by Referee 2 regarding the diurnal cycles applied to the daily and monthly average temperature and radiation data we have reproduced here the equations used to generate the hourly data. We have also included two figures that illustrate how the profiles of temperature and radiation data generated by these equations compare with the original data. We do not feel that either the equations or the figures need to be included in the paper as there is no evidence of a systematic bias in the profiles that would affect the results presented. The paper does acknowledge the goodness of fit between the hourly climate data generated using these diurnal cycles and the original data. In response to Referee 2's comments a further description of the method used to apply the diurnal cycles has been included in the Model Runs section of the paper.

The diurnal cycles for temperature and radiation are given below:

Temperature: When deriving the daily (or monthly) average temperatures we also calculate the diurnal temperature range.

We assume that the range is symmetrical about the mean and that the minimum temperature occurs at 06:00 LT and the maximum at 14:00 LT everywhere. The profile is then calculated from:

$$\theta = (\theta_m + \Delta\theta) \times \sin^2\theta_T + (\theta_m - \Delta\theta) \times \cos^2\theta_T \quad (1)$$

where θ_m is the daily (or monthly) mean temperature, $\Delta\theta$ is the amplitude of the profile (taken to be half of the daily temperature range) and θ_T is the temperature variation angle, given by:

$$\theta_T = \frac{\phi_T}{8} \times \frac{\pi}{2} \quad (2)$$

for times between 06:00 and 14:00, and:

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$$\theta_T = \frac{\phi_T + 8}{16} \times \frac{\pi}{2} \tag{3}$$

for times between 14:00 and 06:00, where ϕ_T is the time elapsed since 06:00.

Radiation: We use the daily (or monthly) average radiation and determine the local times of dawn and dusk for each grid cell. The radiation is set to zero for times between dusk and dawn; during daylight hours the radiation is calculated from:

$$R = (R_m \sin R_T) \times \frac{12\pi}{\Delta T} \tag{4}$$

where R_m is the daily (or monthly) mean radiation, ΔT is the length of time between dawn and dusk, and R_T is the radiation variation angle, given by:

$$R_T = \phi_R \times \frac{\pi}{\Delta T} \tag{5}$$

where ϕ_R is the time elapsed since dawn (LT).

We have analysed the profiles generated from our diurnal cycles for temperature and radiation to investigate why the consistent decrease in emissions occurs when average climate input data were used. Although the temperature and/or radiation values are not always a precise match, there is no evidence of a systematic bias in the profiles. Rather, the discrepancies appear to arise as a result of the presence of clouds, as shown in Figures A and B below.

Figure A shows typical temperature and radiation profiles generated by the algorithms described above, against the original hourly or 3 hourly data. The plots show good agreement between the timing and magnitude of the maximum and minimum temperature radiation values from the different data sets.

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Figure B illustrates the effect of clouds on the profiles (at the same location as above). In this instance, in January, a front moved through causing both temperature and radiation to fall sharply in a way not predicted by the simple diurnal cycle. The temperature in the second air mass is notably higher, a feature that is not captured by our profile. The drop in radiation resulted in a low average value for the day which led to a significant underestimation in radiation values in the morning and early afternoon from our diurnal cycle. Cloud effects cannot easily be included in a simple diurnal model of temperature and radiation and we are satisfied that for the most part our algorithms generate data that fits closely with the original hourly data.

Table 1 provides a convenient overview of the set of simulations performed, and I would recommend to refer to the numbers in there more often to avoid confusion, e.g. in the figure caption of Figure 1.

The Run numbers have been included in the caption of Figure 1 and referred to more often in the Results section of the paper.

Figure 1: The values mentioned as total global average below the figures (-7%, -3%) seem to be very unlikely given the spatial distributions. Please check whether the numbers and the spatial distributions match. Also, the colour scale of the upper figurecould be improved to show more contrast.

We would like to thank the referee for spotting that we had in fact used the wrong emissions map in the lower panel of Figure 1 (monthly average data without an applied diurnal cycle). We have replaced this with the correct map (monthly average data with an applied diurnal cycle). We have also slightly stretched the colour scale on the upper figure to allow more contrast but not to the extent that comparison with the lower figure is lost.

Figure 2: I was a bit confused about the two upper panels. It is mentioned to show emissions "in comparison with...", but I am not sure whether the two figures show different runs. Is the top right figure a detail of the top left, or do the two figures show

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two different runs? Please phrase the figure caption more clearly. Apart from that, it is not clear to me what the lower left panel is showing: It mentions Run 1, but is the comparison not made relative to Run 1?

The top right panel is a detail from the global run shown in the top left panel. The caption of the figure has been altered to clarify this. The lower left panel has been replaced with one showing the instantaneous flux for an average day in January over the region. This allows the monthly average emissions shown in the bottom right panel to be compared with those generated from the original hourly data.

Please rephrase one of the three sentences starting with "Table 1 shows ..." on page 23553 to smoothen the text

Lines 19-21 have been reworded.

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

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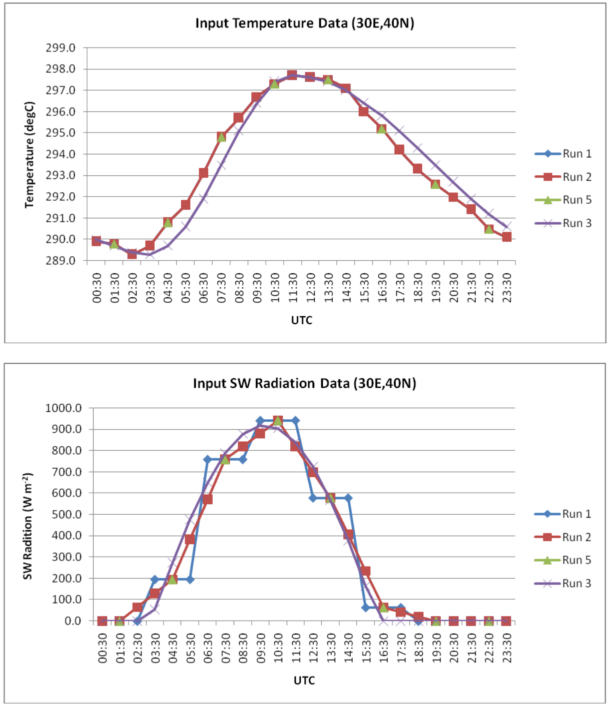

Fig. 1. Figure A. Typical temperature (top) and radiation (bottom) values for the original data as used in Runs 1, 2 and 5 together with the profiles generated from daily average data (Run 3)

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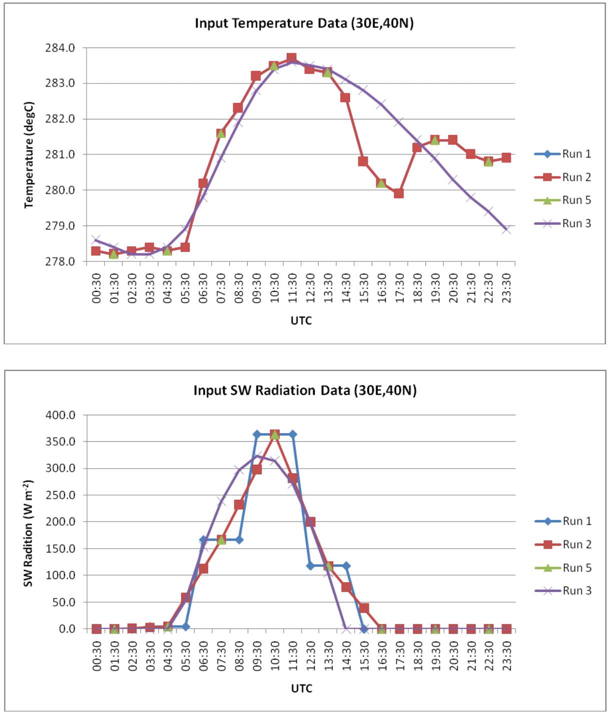

Fig. 2. Figure B. Temperature (top) and radiation (bottom) profiles as described in Figure A above for a day in January that demonstrates the problems associated with clouds

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