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Atmospheric Chemistry and Physics Discussions

Interactive comment on "VOC reactivity in central California: comparing an air quality model to ground-based measurements" *by* A. L. Steiner et al.

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1. I also wonder why it is necessary to integrate the model over the first 250 m and not use the lowest level of the model outcome for comparison with the ground based measurements. This could have a quite important effect for the concentrations of reactive VOCs. As shown by Boy and co-authors (ACP, 4, 2004) the concentrations of monoterpenes can in rural areas decrease up to 50 % from the ground to the top of the mixed layer and this should be the same for reactive compounds emitted from the surface.

We note a correction to the text, where the averaging height for the boundary layer should 500m instead of 250 m. This height was selected to represent an average

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boundary layer height, and we used concentrations integrated over the boundary layer in order to account for the vertical and horizontal mixing of species. With the exception of highly reactive species (such as terpenes, noted by the reviewer), the concentrations of NOx and VOCs should be relatively constant throughout the boundary layer. While there is the possibility that some urban sites are located too close to transportation corridors (e.g., Sacramento, Murphy et al., 2006a), the use of several sites within each urban region represents an average urban concentration, providing the closest match for the modeled vertical and horizontal resolution.

We evaluated the differences in NOx cumulative distribution functions for three different averaging heights in Fresno and Sacramento: a) CDFs that include the surface layer only (first 20m), b) CDFs (as shown in manuscript Figure 2) averaged over the first 11 layers (˜500m) and c) CDFs averaged over the first 1000m (first 15 layers). When comparing the surface layer only to observations, there is a slight improvement in the top 90% of the distribution, however, in both locations, the model still under predicts most of the measured distribution. As we include more layers in the averaging, there is only a slight shift in the modeled distribution, indicating that the averaging is not particularly sensitive to the inclusion of layers above 500m.

Therefore, in order to represent the average boundary layer concentrations, we show concentrations averaged over the first 500m of the atmosphere. We have included additional text to explain this decision more completely on page 5 lines 7-10, page 12 lines 25-28, and page 20 lines 14-17 (addressing the highly reactive Blodgett species).

2. I do not complete agree with the authors to use the word measured for the OH-reactivity based on calculations regarding a certain number of VOCs (depending on the station), methane (only estimated), CO and NO2. There are instruments which are able to measure OH reactivity but in the context of this manuscript I would prefer to use calculated and modeled values.

In light of new measurement techniques that can directly measure OH reactivity,

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we agree that the use of this term is confusing. We have changes “measured” OH reactivity to “calculated” OH reactivity throughout the manuscript, to reflect the calculation of OH reactivity based on ground-based measurements.

3. The last point for this in general very good manuscript is to include one more figure at the end of the manuscript showing equal like in Figure 9a the whole model area but the contributions of the single modeled R(OH) values.

To address this concern, we have added additional panels to Figure 9 to include the contribution from individual VOC categories. References to these figures are included in the text when appropriate.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 13077, 2007.