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Discussions

Interactive comment on "Ozone Production and Its Sensitivity to NO$_X$ and VOCs: Results from the DISCOVER-AQ Field Experiment, Houston 2013" *by* Gina M. Mazzuca et al.

Anonymous Referee #1

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Review of "Ozone production and its sensitivity to NOX and VOCs: results from the DISCOVER-AQ field experiment, Houston 2013"

Mazzuca et al

The authors estimate ozone production efficiency using aircraft and surface measurements from the 2013 Houston DISCOVER-AQ field campaign. The DISCOVER-AQ field campaigns were designed to provide surface and sub-orbital measurements for validation of satellite air quality products. In addition to using ambient data as input to a photochemical box model, a 3D photochemical grid model was also used to estimate ozone production efficiency. The authors find that OPE is lower than in the numerous previous Texas field campaigns and somewhat similar to the Baltimore DISCOVER-AQ

field study. The difference between earlier Texas field studies was attributed to lower NOX and VOC emissions in the Houston area due to emissions control plans.

Overall the information about ozone production efficiency is well presented and well articulated by the authors. This work does not present a lot of new information about the Houston area or present any clear implications about emissions control plans. Should Texas implement morning VOC controls and area wide day-long NOX controls to decrease ozone production in the area? The authors state several times that these results have important emissions control policy implications but it is not clear what type of program implementation would be needed based on the diurnal ozone production efficiencies presented here.

The estimates of O3 production efficiency and comparison with previous Houston field experiments and the Baltimore campaign are the most interesting aspects of the study. Given that this paper is focused on NOX and VOC contribution to O3 production the authors should provide NOX and VOC measurements from this study and also compare those with previous Houston field studies to provide more context about how these pollutants are decreasing and for VOC how total VOC and VOC reactivity is decreasing to support conclusions about ozone production efficiency. Also, a comparison with another area like Baltimore would be useful.

The authors provide CMAQ simulated ozone production efficiency but provide no information about the emission inventory used for the simulation and how well the model predicted NOX, NOZ, VOC, and O3 compared with the aircraft and surface measurements made during the field study. Is it ok that the model predicts a similar OPE to the box model but not capture the magnitudes of the precusors or ozone correctly? The information presented about OPE is useful, but additional work is needed for this to provide a more comprehensive understanding of ozone production in Houston with respect to the models used by regulators for decision support and context from the many previous Houston field studies.

Specific comments:

The last half of the introduction section reads like a white paper on the Houston DISCOVER-AQ field study. Since this paper does not present any information relevant to the mission of that field study which was to validate satellite measurements the discussion of the DISCOVER-AQ campaign could be de-emphasized in favor of more time spent on the multitude of historical field studies in the Houston area. Also, the authors never clearly state in the introduction what they are presenting and why that information is novel.

The authors do not need to explain why CB05 is used rather than CBIV, but an explanation about why CB05 was used rather than the newer version CB6 is necessary. At several points in the manuscript the authors note than organic nitrate fate can confound OPE interpretation so the choice of an older Carbon Bond mechanism that has a less realistic treatment of organic nitrates is needed. Also, it is not clear why all species have the same 2 day deposition lifetime. Species like O3 and HNO3 deposit out of the atmosphere and very different rates.

Please provide information about the emission inventory and modeling used as input to the CMAQ simulation and the source of the initial and boundary conditions.

In the results section, please provide some comparison of CMAQ estimated VOC, speciated VOC, NO, NO2, HNO3, PANs, HNO3, and O3 with measurements.

The authors suggest one difference in OPE between Houston and Baltimore is due to reactivity. Please provide speciated VOC concentrations from each field study by reactivity so this relationship is clearer.

The authors make a lot of strong conclusions about trends in OPE when NOX is greater or less than 1 ppb as shown in Figure 14. The points in Figure 14 do not show a distinct relationship above or below any level of the NOX concentrations. Perhaps box plots binned by NOX concentration would be a better way to show this type of relationship (if

C3

it really exists).