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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A new diagnostic for tropospheric ozone production" *by* Peter M. Edwards and Mathew J. Evans

Anonymous Referee #2

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General Comments

This paper presents a new method for diagnosing ozone production based on the processing of chemical bonds. The authors show that this new diagnostic changes our view of the relative importance of different hydrocarbon emissions, which is an improvement over previous methods using a simple total carbon-based approach. The authors also quantify the ozone-producing efficiency of the emitted bonds. The ability of this diagnostic to separate the difference between shifting the NO/NO_2 ratio and its impact on ozone production vs. the increase in the fraction of RO_2 reacting with NO is valuable. Overall, the discussion of the diagnostic and model sensitivities is quite lengthy and could be shortened by spending less time on the discussion of methane, per the comment below. This paper should be published after addressing the com-

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ments below, in particular, how this diagnostic could be relevant to our understanding of the differences in ozone production across models without actually implementing the diagnostic in every single chemical transport model.

Specific Comments

The discussion of methane and isoprene is confusing due to the model implementation of methane as a fixed concentration. It might be better to focus the discussion on evaluating perturbations to isoprene emissions, and contrast that to methane, as opposed to the way it is presented now, with the caveat about model treatment of methane. Then the discussion of the dependence of methane 'emission' on OH would not be needed (i.e. Figure 7) which is difficult to follow.

This analysis would also be strengthened by presenting the types of information that global model comparisons of ozone production should include to take advantage of this type of diagnostic. For example, it seems that if all models presented their total methane, isoprene, CO, and NO_x budgets, this diagnostic would help interpret the resulting impact on ozone production without actually implementing the diagnostic in each model. This might increase the scientific contribution of this paper.

The paragraph starting on line 341 needs clarification. What do you mean by "the final 20% due to the increased OH competing for the available oxidisable bonds." Doesn't this just mean that with higher NO_x, you get higher OH concentrations and thus you increase the concentration of RO_2 as well and NO?

Technical Corrections

Is discussing SO_2 oxidation relevant to ozone in any way? If not, it is confusing and should be removed.

You say that over a long enough timescale, the global atmosphere can be considered to be in steady-state, and thus equation (1) applies. Please clarify the conditions where this diagnostic is useful/applicable. For example, could it be used for a daily analysis

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of ozone production.

Please be consistent with the use of CH_3O_2 or MO_2.

On line 438, the sentence that starts with “With the majority” is not a full sentence.

On line 440, remove the comma after OH.

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