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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A scaling analysis of ozone photochemistry: II Investigation of the similarity relationship" *by* B. Ainslie and D. G. Steyn

Anonymous Referee #1

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Review of "A scaling analysis of ozone photochemistry: II Investigation of the similarity relationship" by Ainslie and Steyn for Atmospheric Chemistry and Physics

I reviewed Parts I and II. This is the second review submitted but I have chosen to write it without looking at the first. This study meets all the criteria for publication and indeed could be published as is. Which is not to say that it could not be improved upon. My review of Part I mostly gives suggestions as to how to make this material more accessible and easier to follow.

I like the idea of the toy models giving Properties for P(O3). Figure 1 and 3 give P(O3)'s

that follow from specified Properties. What I really want to see are the PO3)'s that follow from the third model that incorporates the need for a change in functional form to produce a scaling break. A change in functional form is not a stand-alone concept without an example.

There are 2 other major items that are missing: 1). A sense of how P(O3) integrated over time yields points on an O3 isopleth diagram. I think this would require explicit P(O3) diagrams. There has been modeling and field work directed at examining P(O3) in the limiting cases of high NOx and high VOC environments, so I would expect, the P(O3)s to match up with those limiting cases. I hope at the least that this will be in Part III.

2). A discussion of what chemical features in the mechanism cause the scaling break. Is there any way to relate the scaling break to compounds that one measures? If so, there will be an additional community of researchers who will follow up on your ideas. There is a speculation that "the change can be understood in terms of the strength of NOx inhibition occurring within a VOC-NOx mixture." That and following discussion are not very illuminating.

Symbols written out to avoid LATEX

Other Comments

Regarding notation: Part I deals with maximum O3, and Part II mainly with time dependent O3. An unambiguous notation to denote time dependent quantities would help.

p12987 referring to model results " - an imperfect representation of the actual atmosphere - which may differ from the (also imperfect) representation of the atmosphere given by smog chambers" Very well put.

p12987 "As such, the net chemical production, P(O3), provides a fundamental framework for studying ozone - precursor relationships" This is an excellent thought and the standard to which I hold this paper.

ACPD

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Interactive Comment

p 12988 definition of Pj(O3) as the sensitivity of ozone concentration to the integrated NO2 photolysis rate constant. Maybe its obvious, but it can't hurt adding that at constant j, Pj(O3) is the ordinary O3 production rate. This is a very meaningful quantity to the community as it is routinely calculated from precursor observations or from measured peroxy radicals and NO.

p12988 "most precursor mixtures are initially radical limited" True for urban mixtures, but not true in general.

p12990 typo - should be dependence of Pj(O3) on [VOC]0 and j(t).

p 12992 R * j(t)c (with c=1.2) where did 1.2 come from? Also where does Beta = 9.4 come from?

p 12994 "s-shaped" profile for the similarity relation like Fig. 1 of Part I? - which I had already remarked, does not look very S-shaped

p12995, Equation (4) It is not apparent to me where the P(O3) functional form change is in this equation. Do I have to differentiate with respect to time?

Figure 4. Would scaled O3/scaled NOx0.6 curves lie on top of each other for the 3 NOx values?

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 12985, 2005.