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Interactive comment on "A scaling analysis of ozone photochemistry: I Model development" *by* B. Ainslie and D. G. Steyn

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Review on the manuscripts by B. Ainslie and D.G. Steyn: *"A scaling analysis of ozone photochemistry: I Model delevopment"* and *"A scaling analysis of ozone photochemistry: II Investigation of the similarity relationship"*

Both papers are closely related and a simultaneous review seems to be appropriate.

General comment

Paper I presents a scaling analysis of box model results for the maximum ozone as function of solar radiation and initial burdens of NOx and VOCs. The scaling is based on a transformation to dimensionless variables. It is assumed that seven variables are sufficient to describe maximum ozone. In eq(11) an example of such a "universal"

relationship is shown. It applies to OLT(a RADM2 surrogate that stands for a number of rather fast reacting VOCs). The parameters are derived from extensive fitting to the results of box model simulations. The calculations have to been repeated for other classes of fast reacting VOCs with similar results. Due to the non-additivity of the impact of different VOCs they have to be redone for every mixture of an initial burden of VOCs.

I have difficulties to see the relevance of the results. From the numerical point of view eq(11) or related equations are of no advantage with respect to box model calculations. From a more fundamental point of view the scaling approach could be a potentially interesting, but that has not been discuss in the paper. To name a few of the questions I have in mind: 1) Is the approximate validity related to the fact the chemistry consists of first and second order reactions only? 2) To what extend are the scaling properties caused the close relation between J(NO2) and J(O3 –> O(1D)) [limiting rate for OH-production], since degradation of VOCs by OH is in turn the rate limiting step for ozone production. 3) Is the fact that the scaling is successful merely a consequence of the numerical flexibility of the fit expression with 8 parameters? 4) What is the reason for lack of success for the slow reacting HCs? 5) Can the relation be used to analyse measured data?

Recommendation:

[1] The paper should focus on the discussion of the existence of the universal relationship and its possible chemical reasons. [2] As mentioned above the scaling approach is no useful tool if numerical values are desired. The straight forward way to compute maximum ozone is to invoke a numerical model calculation solving the balance equations. There is no need for simplifications like eq(11). Therefore numerical aspects related to the calculation maximum ozone should be substantially shortened and limited to strengthen arguments under [1]. [3] The manuscript should be combined with the paper II. It continues the discussion on a scale break which has already been addressed in paper I and is associated with a change of the temporal development of the

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ozone mixing ratio.

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