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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A simple formulation of the CH₂O photolysis quantum yields" *by* E.-P. Röth and D. H. Ehhalt

Anonymous Referee #1

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This article describes a new formulation to model wavelength dependent photolysis quantum yields for formaldehyde under atmospheric conditions. The new formulation uses parameters closely related to physical quantities intuitively relevant to formaldehyde photochemistry, is amenable to inclusion of temperature and pressure dependences, and should prove useful for atmospheric modeling. Overall, the article is well written and clearly presented. I recommend publication after consideration of the following comments.

General comments.

The authors should make a stronger case earlier in the article for why this formulation is superior to, for example, the current JPL polynomial representation, in particular given

the similarity in the calculated photolysis rates shown in Figure 6.

The reason for not including the most recent IUPAC 2013 recommendation is unpersuasive. The authors explain that they use only the most recent experimental data (page 7242, lines 14–16) where multiple sets are available from the same group; it would be consistent to use also only the most recent recommendations. I suggest the authors either include both the 2006 and 2013 IUPAC recommendations in the figures or use only the most up to date version, which appears to be superior.

There is a degree of redundancy in that the parameters used to model the quantum yields appear in a) the in-text equations, b) in tables 1–3 and 5, and c) yet again in a table of equations (table 4). Some degree of consolidation would be helpful.

Specific comments.

Page 7242, line 5: Express as summation, with the A parameter a signed quantity?

Page 7242, line 13: The criteria for rejecting some measurements are unclear – what do the authors mean by an "obvious bias"? They should expand on this point.

Page 7243, line 12: typo – "wavelength".

Page 7243, line 26: "heat of formation" should be "heat of reaction".

Page 7247, lines 10–15: Invoking a threshold for three-body dissociation does not help to explain the apparent decrease in the photolysis quantum yield.

Page 7247, line 13: "heat of formation" should be "heat of reaction".

Page 7248, line 6: Equation (7) seems superfluous.

Page 7250, line 9: Replace "frequencies" with "rates".

Page 7251, line 5: Equations 11 – 13 do not appear in the manuscript.

Page 7251, lines 15–25: The effect (if any) of the temperature dependence of the absorption cross section should addressed. The variations of –9% and +6% in j_rad and

j_mol are described as a significant effect. This seems inconsistent with the comment on page 7244, lines 19–24 that the –4% change in j_rad attributed to the possible structure is “comparatively small”. Why is –4% small, but +6% significant?

Page 7264: typo – “Gratien” in figure caption

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 7239, 2015.