Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2021-605

Anonymous Referee #2

Referee comment on "Development and evaluation of a new compact mechanism for aromatic oxidation in atmospheric models" by Kelvin H. Bates et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-605-RC2, 2021

Review of Bates et al.

Bates et al. present work on the development of an updated chemical mechanism for aromatic chemistry for use in computational models of atmospheric chemistry. They demonstrate the mechanism performs well as assessed against state-of-the-art laboratory measurements and compare the simulated abundances of compounds like glyoxal, OH, and ozone across different implementations of aromatic chemistry. This work is scientifically sound, and the manuscript is generally well written. Barring one major accessibility issue, I recommend that this paper is accepted for publication following a few minor comments below.

Colour blindness and Figures 4-9

Figures 4-9 are not intelligible to colour blind readers. I strongly suggest the authors remake these figures to make them more accessible. There are a range of tools available online to explore if a given colour palette or figure is "colour blind friendly".

Computational Impact

A major component of this work relates to the development and justification of the simplified mechanism, which is well justified in the manuscript given the described issues associated with computational limitations. It is thus surprising that the authors do not quantify the impact of the mechanism on global model simulation times. While this work likely improves the representation of chemistry in GEOS-Chem, what is the computational cost associated with the increased transport and chemistry demands? If I were a model developer, what are the costs of using this mechanism?

Other Comments

P20 L5: Why are these results different from previous glyoxal simulations in GEOS-Chem (Silva et al 2018), which do not show a large change in glyoxal from aromatic oxidation over the Middle East?

Citation: Silva, Sam J., Colette L. Heald, and Meng Li. "Space-Based Constraints on Terrestrial Glyoxal Production." Journal of Geophysical Research: Atmospheres, https://doi.org/10.1029/2018JD029311.

P9 L27 & P10 L5: "Environmental chamber simulations" and "Continental boundary layer simulations" seem to be subtitles but aren't formatted as such.

P10 L30: $[NO_x]_0$ is not defined in the manuscript.

P18 L7: Does Kwon et al. 2021 differ from earlier implementations of C_2H_x chemistry into GEOS-Chem (e.g. Safieddine et al. 2017)?

Citation: Safieddine, S. A., C. L. Heald, and B. H. Henderson (2017), The global nonmethane reactive organic carbon budget: A modeling perspective, Geophys. Res. Lett., 44, 3897–3906, doi:10.1002/2017GL072602.