Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC2
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# review of gmd-2021-119

Anonymous Referee #2

Referee comment on "Improvements to the representation of BVOC chemistry–climate interactions in UKCA (v11.5) with the CRI-Strat 2 mechanism: incorporation and evaluation" by James Weber et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-119-RC2, 2021

This paper presents a comprehensive description of the implementation of the CRI v2.2 tropospheric chemistry mechanism into the UKCA model, and provides detailed comparisons to earlier chemistry versions of UKCA. UKCA is one of the leading global chemistry-climate models, a participant in CMIP6 and widely used by the community, thus it is important to publish documentation such as this. The focus of this work is on the isoprene oxidation updates, and the impacts on the ozone and nitrogen budgets, as well as discussion of potential implications on secondary organic aerosols although the current implementation was not directly coupled to SOA. Appropriate comparisons are made to observations for the evaluation of the chemistry schemes.
The paper is well written, and clearly organized. It is quite appropriate for publication in GMD. While the results are specific to the UKCA model the results will be of value to other chemistry-climate model developments and interpretation of their results and limitations. I recommend publication with only minor corrections as noted below.

Technical comments:

l.273: Should 'new' be 'near'?

l.346: Section S_? (number missing)

Table S3: SE4C4RS -> SEAC4RS

l.464: Should 'latitude' be 'altitude'?

l.492: Instead of 'well-known', it would be more appropriate to say 'major' or 'most significant'. In general, the PTRMS measurements are reported as the sum of MVK+MACR+ISOPOOH. Please clarify whether or not that is the case here. This paragraph is not clear.

l.579: there are 2 Table S3.

Section 5.5:

Are lightning NO emissions identical in all simulations? Figure 9a looks like it could show a difference in lightning emissions, though I do not doubt it could be explained by the chemistry difference. It would be good to confirm that it was not caused by an inadvertent change in lightning NO.