

Geosci. Model Dev. Discuss., referee comment RC2
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Comment on gmd-2021-295

Anonymous Referee #2

Referee comment on "Simulation of organics in the atmosphere: evaluation of EMACv2.54 with the Mainz Organic Mechanism (MOM) coupled to the ORACLE (v1.0) submodel" by Andrea Pozzer et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-295-RC2>, 2021

This paper provides a description of a new configuration of the global EMAC chemistry-climate model using the detailed Mainz Organic Mechanism which includes 700 compounds and 2000 reactions. The model configuration is briefly described and the comparison of the simulation to satellite, aircraft and surface observations is presented for several VOCs, OH, AOD and aerosol composition. The differences between the model and observations are suitably quantified and the discussion of agreement and differences is reasonable. However, I feel 2 major aspects are lacking from this work.

1. No comparisons are made to previous model versions. The authors have made no arguments for which conditions such a complex mechanism is needed. This work ought to show what difference, and particularly improvement, is achieved with this complex chemistry scheme over standard, more reduced schemes.

2. The VOC measurements used for evaluation of the model are really not adequate and numerous additional observations could have been used to evaluate the VOCs. The Emmons compilation of aircraft observations only includes data through 2000, and the quality and quantity of in-situ (aircraft) measurements of VOCs have increased dramatically since then. For example, the ATom missions provide global coverage of the compounds presented here (HCs, CH₃CHO, CH₃COCH₃, etc.). Numerous other aircraft campaigns led by NASA, NOAA and NSF in the U.S. provide measurements over polluted regions (e.g., INTEX-NA, DISCOVER-AQ, SEAC4RS, SENEX, KORUS-AQ, FIREX-AQ, etc., etc.). These datasets are all freely available and in standard, similar formats which making them fairly easy to use, though it does require a bit more effort than taking the single profiles provided by the Emmons climatology.

The IASI retrievals are used extensively, but much more should be included about their accuracy and the results of published validation results. Perhaps they have much greater uncertainty at high latitudes, or remote regions - this should be discussed here.

Thus, I recommend that these 2 aspects be addressed before the paper is accepted for publication.