

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2021-144

Anonymous Referee #1

Referee comment on "GCAP 2.0: a global 3-D chemical-transport model framework for past, present, and future climate scenarios" by Lee T. Murray et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-144-RC1>, 2021

This manuscript presents a description and evaluation of the second generation one-way offline coupling between NASA GISS E2.1 GCM and GEOS-Chem CTM (GCAP 2.0). This is an update of the on the initial GCAP framework, with improved GISS meteorology and GEOS-Chem emissions/chemistry.

The authors include a thorough presentation of the meteorological fields and emissions, with a comparison of three types of meteorology: MERRA-2, E2.1 nudged to MERRA-2, and E2.1. The model simulations are intercompared and evaluated against observations for atmospheric constituents (O₃, NO₂, HCHO, CO, PM_{2.5}; lifetimes of CH₄ and CH₃CCl₃; AOD) and transport tracers (SF₆ and radionuclides). This enables a detailed evaluation of transport as well as chemistry and deposition. This paper is a substantial contribution to modeling science and provides a new tool for the community. The paper is well written and well organized. I recommend publication.

Technical corrections:

Please check the figure captions of Figures 15 onwards as some have a typo "The number in the **lower left** shows the mean bias of the model with respect to the observations", which should be **lower right**.

Line 612: The MODIS instrument is onboard the Aqua satellite (not Aura). Also line 616 should be corrected by adding Aqua.