Comment on gmd-2021-149

Anonymous Referee #2

Referee comment on "The Simplified Chemistry-Dynamical Model (SCDM V1.0)" by Hao-Jhe Hong and Thomas Reichler, Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-149-RC2, 2021

This paper describes a simplified chemistry-dynamical model (SCDM), which consists of a dry dynamical core, a simple linear ozone scheme, and an ozone shortwave parameterization. In the SCDM, stratospheric chemistry couples with dynamics through ozone shortwave absorption. Ozone concentrations are determined by transport and photochemical tendencies calculated from the linear ozone scheme. Changes in ozone affect temperature and dynamics through shortwave absorption. SCDM climatology is validated against MERRA2 in terms of ozone, shortwave radiation, and dynamical fields. In addition, ozone and dynamical variability associated with the Arctic stratospheric sudden warming (SSW) events in SCDM are compared to that in MERRA2. Overall, the SCDM simulates reasonably well the climatology and variability of stratospheric ozone and dynamics.

Interactive stratospheric ozone chemistry has been shown to play a key role in stratosphere-troposphere coupling. Given its simplicity and computational efficiency in relative to the comprehensive chemistry-climate models, the SCDM provides a potentially useful tool to understand the stratospheric chemical-dynamical coupling. The paper is well written. The description of the model is clear. I recommend publication after my comments are addressed.

Comments:

The SCDM simulates well the Arctic SSWs. Does it also capture the Antarctic temperature and wind variability? I suggest adding a figure like Figure 9 for wind and temperature.

Following up the above question, does interactive ozone improve the simulation of stratospheric dynamical variability in SCDM? In order to answer this question, an additional simulation without interactive ozone is required. If such simulation is available, I suggest adding a section to discuss this topic.

Line 310. I wonder what specific topics the authors plan to investigate (or have already investigated). And how do they plan to use the SCDM model to get a better understanding of these topics?