4.141 Benchmarking 9.6-µm ozone band top-of-atmosphere flux in chemistry-climate models using AURA TES instantaneous radiative kernel.

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Abstract:

The IPCC chemistry-climate models estimate the tropospheric ozone (O_3) radiative forcing (RF) to the climate with large uncertainties, ranging from +0.2 to +0.6 Wm^{-2}. The previous studies show that about 80% of O_3 RF comes from O_3 longwave absorption and 97% of this longwave absorption is in the 9.6-micron O_3 band [Rothman et al., 1987]. The satellite observations of this O_3 band TOA fluxes by NASA AURA-TES, suggests strong geographic and seasonal variations globally. The variations in the fluxes highly depend on the distributions of ozone, water vapor, air temperature, and surface temperature. The biases of these quantities in the model are sources of the biases in both the O_3 band TOA flux and O_3 RF. Benchmarking present day O_3 band flux is the first step for understanding climate feedbacks from O_3 forcing.

The products of 9.6-mm ozone band IRK for ozone, water vapor, temperature, and etc., have been developed by AURA TES and this record could be extended by MetOP-IASI and SNPP-CrIS Fourier Transform spectrometer (FTS) measurements. In this study, we demonstrate the method of using the reanalysis data together with TES IRK to attribute the biases of the fluxes in a suite of CCMI models to these key parameters. In this way, we show the TOA flux biases differs significantly between models for different reasons. We find the principle contributors governing the variation for each model are under different processes or over different regions. We also provide quantitatively estimates of the influence from ozone, water vapor, and temperature bias in models. This study helps to understand the differences between the models and would provide the insights to reduce the spread of model estimates of ozone radiative forcing.