

Impact of ozone on tropical tropospheric circulation change after a stratospheric sudden warming event

Makoto DEUSHI ¹

¹*Meteorological Research Institute, Tsukuba, Japan*

In this study, we examine impact of ozone on the tropical tropospheric circulation change after the stratospheric sudden warming (SSW) event in the winter of 2003–4. Concentration of ozone in the tropical lower stratosphere decreased rapidly due to the enhanced Brewer-Dobson circulation right after the SSW. To investigate dynamical feedbacks from this rapid ozone decrease, the following ensemble hindcast experiments were performed for the winter of 2003–4, using a chemistry-climate model (CCM) and an atmospheric general circulation model (AGCM).

Exp.1: CCM (interactive ozone) ensemble hindcast

Exp.2: AGCM (with prescribed climatological ozone) ensemble hindcast

These ensemble hindcast experiments were performed using the Lagged Averaged Forecasting method. The ensemble member was 32 in each experiment. The CCM used in this study resolves well a full stratospheric and tropospheric chemistry with dynamical feedbacks from ozone through radiative processes in the atmosphere.

In the Exp.1, negative ozone anomalies in the tropical lower stratosphere are simulated for several months after the SSW. The negative ozone anomalies decrease solar short-wave heating rates in the tropical lower stratosphere, leading to cooling by several kelvins. Impact of the lower stratospheric cooling on the tropical tropospheric circulation and convective activity are investigated in detail.

Key words: chemistry-climate model, ensemble hindcast, stratospheric sudden warming, ozone