



Lower-stratospheric control of the frequency of sudden stratospheric warming events

Patrick Martineau (1), Gang Chen (2), Seok-Woo Son (3), and Joowan Kim (4)

(1) Research Center for Advanced Science and Technology, The University of Tokyo, Tokyo, Japan, (2) Department of Atmospheric and Oceanic sciences, UCLA, Los Angeles, California, (3) School of Earth and Environmental Sciences, Seoul National University, Seoul, South Korea, (4) Department of Atmospheric Sciences, Kongju National University, Gongju, South Korea

The sensitivity of stratospheric polar vortex variability to the basic-state stratospheric temperature profile is investigated by performing a parameter sweep experiment with a dry dynamic core GCM where the equilibrium temperature profile in the polar lower and upper stratosphere is systematically varied. It is found that stratospheric variability is more sensitive to the temperature distribution in the lower stratosphere than in the upper stratosphere. In particular, a cold lower stratosphere favors a strong time-mean polar vortex with a large daily variability, promoting frequent sudden stratospheric warming events in the model runs forced with both wavenumber-1 and wavenumber-2 topographies. Although a warm polar upper stratosphere favors a relatively weak polar vortex, it does not have a large impact on variability. This result suggests that the lower stratosphere, through the meridional gradient of temperature, acts as a valve for the upward propagation of planetary-scale waves, thus controlling stratospheric variability and the frequency of sudden stratospheric warming events.