Relationship among SSW, VI, PJO and AO in an idealized stratosphere-troposphere coupled model

Shigeo Yoden[1]; Masashi Kohma[1]; Seiya Nishizawa[2]

[1] Dept. of Geophysics, Kyoto Univ.; [2] Dept. Earth and Planetary Sciences, Kobe Univ.

http://www-mete.kugi.kyoto-u.ac.jp/yoden/

Internal intraseasonal variability in the stratosphere-troposphere coupled system contains multiple time-scale variations from stratospheric sudden warming (SSW) and polar vortex intensification (VI) to polar-night jet oscillation (PJO) and Arctic oscillation (AO) in the northern hemisphere winter. Relationship among SSW, VI, PJO and AO is investigated with a 14,000-year dataset originally obtained by Nishizawa and Yoden (2005), who performed numerical time integrations of an idealized global circulation model with sinusoidal surface topography of zonal wavenumber one under a purely periodic annual forcing.

Statistics of the events of SSW and VI are studied and their seasonal dependence is clarified. As for PJO and AO, EOF analyses are made for the polar temperature from the surface to the lower mesosphere and the zonal mean sea-level pressure in the northern hemisphere, respectively, after applying a low-pass filter of 15 days. Events of PJO, which is identified as a large amplitude event in a normalized PC1-PC2 phase space, are classified into two groups based on the time variation of phase: (1) typical PJO as reported by Kodera and Kuroda (2000) with downward propagation of warm signal to the tropopause and (2) short period event without slow downward propagation. Another group (3) is the cold event related to VI. The first two has significant relationship to SSW: an SSW event occurs (1) over 10 days before the maximum of PJO or (2) nearly the same timing of the maximum of PJO. Downward propagation of warm signals with time is largely different between the two groups.