EMS Annual Meeting Abstracts
Vol. 13, EMS2016-91, 2016
16th EMS / 11th ECAC

Predictability of a vortex splitting type stratospheric sudden warming in January 2009

Hitoshi Mukougawa (1), Shunsuke Noguchi (2), Yuhji Kuroda (2), Ryo Mizuta (2), Shoukichi Yabu (3), and Hiromasa Yoshimura (2)

(1) Disaster Prevention Research Institute, Kyoto University, Uji, Japan (mukou@dpac.dpri.kyoto-u.ac.jp), (2) Meteorological Research Institute, Tsukuba, Japan, (3) Japan Meteorological Agency, Tokyo, Japan

A series of ensemble reforecast experiments is conducted to investigate the predictability and the occurrence mechanism of a stratospheric sudden warming in late January 2009, associated with the polar vortex splitting. The reforecast experiment is carried out every day using the MRI-EPS (Meteorological Research Institute-Ensemble Prediction System) based on the MRI-AGCM with 25 ensemble members.

The vortex splitting event is reliably predicted by forecasts initialized after 6 days prior to the vortex breakup. It is also found that the propagating property of planetary waves within the stratosphere is a key to the successful prediction. Planetary waves incoming from the troposphere are reflected back into the troposphere for failed forecasts, whereas they are absorbed within the stratosphere for succeeded forecasts. Composite analysis furthermore reveals the following occurrence mechanism of the planetary wave reflection for the failed forecast: Upward propagation of planetary wave packets from a tropospheric blocking over Alaska is weaker during initial prediction periods; then, the deceleration of upper stratospheric zonal winds becomes weaker over Europe, which would be preferable for the wave reflection; hence, subsequently incoming wave activity from the troposphere over Europe is reflected back over Siberia with the eastward phase tilt of planetary waves, which shuts down the further upward propagation of planetary waves leading to the vortex splitting.

Thus, this study shows that the stratospheric condition would be another important control factor for the occurrence of the vortex splitting besides anomalous tropospheric circulations enforcing upward propagation of planetary waves.