Predictability of Sudden Stratospheric Warming Events

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The predictability of sudden stratospheric warming (SSW) events, that occurred on January 5th, 2004 and January 7th, 2013, is examined by integrating an operational weather prediction model of Korea Air Force. The model is initialized 30 to 0 days before the onset of each event and integrated for 30 days. The prediction skill is then evaluated by computing both mean square error and anomaly correlation coefficient with respect to the reanalysis data. The 2004 SSW event, which is characterized as a vortex displacement event, was preconditioned by the vertical propagation of wavenumber-one wave in the lower stratosphere, while the 2013 SSW event, a vortex split event, was driven by the amplification of wavenumber-one followed by wavenumber-two waves. These two different events are reliably predicted with a maximum lead time of 9 days and 7 days, respectively. However, their nature is quite different. For the 2004 displacement SSW event, zonal-mean errors account for a great part of the forecast errors, whereas the forecast errors of the 2013 split SSW event are highly influenced by the zonally asymmetric components. This result indicates that the predictability of SSW events may be dependent on the morphology of the polar vortex. To confirm this finding, five most recent displacement and split SSW events are further investigated. On average, the model shows a better prediction skill for the displacement SSW events than the split SSW events with about 1-day longer lead time. Moreover, all displacement events show a smaller ratio of zonally asymmetric errors to zonal-mean errors than the split events. The implication of this result to the tropospheric prediction skill is discussed.

Key words: predictability, sudden stratospheric warming, operational model