

Predictability of stratospheric sudden warmings in the Northern Hemisphere as inferred from ensemble forecast data

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Stratospheric sudden warmings caused by enhanced planetary waves propagating from the troposphere. In some sudden warmings, only planetary waves with zonal wavenumber 1 essentially contribute to their occurrence, while wavenumber 2 and/or 3 components play an important role in the development of other sudden warmings, which are often accompanied with split polar vortices. Such a difference in the course of time evolution would make a difference in predictable periods of the sudden warmings. In this study, we examine 4 warming events occurring in recent five Northern Hemisphere winters and estimate each predictable period using the Japan Meteorological Agency (JMA) ensemble one-month forecast data. We investigate important factors giving rise to each sudden warming event and try to classify the warmings based on the predictable periods along with the time evolution features.

It is found that predictable periods are different depending on the time evolution of the warmings; the lead time for the prediction of the wavenumber-1 warmings is relatively long, say, 2-3 weeks in advance, compared with that of the warmings contributed to by wavenumber-2 and/or 3, say, 7-10 days. The short predictability of the latter might be connected to the difficulty in the prediction of wavenumber-2 and 3 evolution compared with that of wavenumber-1 evolution.