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Predictability of the major stratospheric sudden warming in the Southern Hemisphere for September 2002

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A lot of attention has been drawn to dynamically coupled variability between the extratropical troposphere and stratosphere including stratospheric sudden warmings (SSWs) as an outstanding example. Existing studies have investigated such variability through diagnostic analyses of observational (reanalysis) and model simulation data as well as numerical experiments. Extensive studies using forecast data have been recently made in terms of predictability of SSWs. However, predictability of SSWs of a wavenumber 2 type (vortex split) has been relatively unexplored. This study seeks to investigate predictability of the major SSW in the Southern Hemisphere for September, 2002 using hindcast experiment data of one-month ensemble predictions conducted by Japan Meteorological Agency (JMA).

We use the JRA/JCDAS reanalysis data as a reference for the real world. We compare, to the reanalysis data, the JMA hindcast experiment data of one-month ensemble predictions. The experiment covers the period from 1979 to 2009. The predictions are initialized on the 10th, 20th, and last day of each month, with an ensemble size of 5. The polar night jet reverses its direction in late September of 2002, with an easterly wind peak on 9/27, accompanied by increased wave activity entering the stratosphere. We mainly focus on the predictions from (A) 8/31, (B) 9/10, and (C) 9/20 of 2002 to investigate these variations.

Our comparison between the reanalysis and prediction data shows the following features: Predictions initialized later forecast the wind variability better. The predictions of A and B do not at all show zonal wind reversals, whereas some of C do; The predictability of the zonal wind well corresponds to that of wave activity in the lower stratosphere. The predictions B underestimate the magnitude of the increased wave activity, whereas those C does the persistence; The predictability of the wave activity is further related to that of upper tropospheric anomalies. A blocking ridge over the South Atlantic, contributing to the increase in the wave activity, is likely the key for the above features.

We will also examine SSWs of the wave 2 type (2009 and 1989 cases) in the Northern Hemisphere.