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## On the predictability of a vortex-splitting sudden warming in January 2009

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A major vortex-splitting stratospheric sudden warming (SSW) event occurred in January 2009 with the extraordinary predominance of the planetary-scale wave of zonal wavenumber (WN) 2. Our former studies showed the relatively low predictability of SSW events contributed to by WN 2 and/or 3. Hence, the predictability of the SSW is examined by the use of ensemble one-month forecast data operationally produced by the Japan Meteorological Agency (JMA), along with the JMA stratospheric assimilated data. Detailed analyses are performed using all ensemble members of 1-month forecasts, and it is found that the predictability limit of the prediction just before the warming maximum is at most 5 days; this value is fairly small in comparison with the mean predictability limit of the stratospheric circulation in winter, i.e., 10 days. Furthermore, it is also revealed that the warming occurrence is significantly related to the prior blocking phenomenon over the northwestern part of North America. In addition, other prominent meanders developed over Siberia after the blocking event also contributed to a breakup of the polar night jet in the stratosphere. The contribution of such rather smaller-scale disturbances in the troposphere probably makes the low predictability of the occurrence of the SSW.

Keywords: stratospheric sudden warming, predictability, blocking, planetary wave