



## **Predictability of a Polar Vortex Splitting Event in the Stratosphere: An Ensemble Reforecast Experiment for January 2009**

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The breakdown events of the stratospheric polar vortex are roughly classified into the following two types based on the synoptic structure of the stratospheric circulation: vortex displacement type characterized by a shift of the polar vortex off the pole, and vortex splitting type in which the polar vortex breaks up into two pieces. The occurrence mechanism and predictability of the splitting type breakdown of the polar vortex has not been fully examined in comparison with those of the vortex displacement type breakdown in which the sustaining upward propagation of planetary waves from the troposphere has a decisive role for the occurrence of the vortex breakdown.

We have conducted a series of ensemble reforecast experiments by using the MRI-EPS (Meteorological Research Institute-Ensemble Prediction System) to elucidate the occurrence mechanism and the predictability characteristics of a typical splitting type breakdown event of the stratospheric polar vortex in January 2009. The reforecast has been carried out every day from 24 perturbed and 1 unperturbed initial conditions. The perturbations are generated by the breeding of growing modes method implemented in the MRI-EPS.

The reforecast experiments reveal that this vortex splitting event is predicted for forecasts initialized after 8 days before the vortex break up. The predictable period for this event is as half as that of the displacement type breakdown reaching at least two weeks. It is also found that in the failed forecast for the vortex splitting, the upward propagating planetary waves from the troposphere are reflected by the preexisting polar night jet and propagate downward into the troposphere. Thus, this study indicates that the propagating property of planetary waves in the stratosphere would be another important control factor for the occurrence of the splitting type breakdown of the polar vortex, besides the sustaining upward propagation of planetary waves from the troposphere.