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Plain Language Summary: Previous diagnostics for the breakup of stratospheric polar vortex have used prescribed key parameters based on potential vorticity and zonal wind in the lower stratosphere. This study defines a new diagnostic for the polar vortex formation and breakup by using the abrupt changes in the equivalent latitude, potential vorticity, and wind speed at the vortex edge. The new definition of the polar vortex formation and breakup can be applicable to the whole stratosphere.

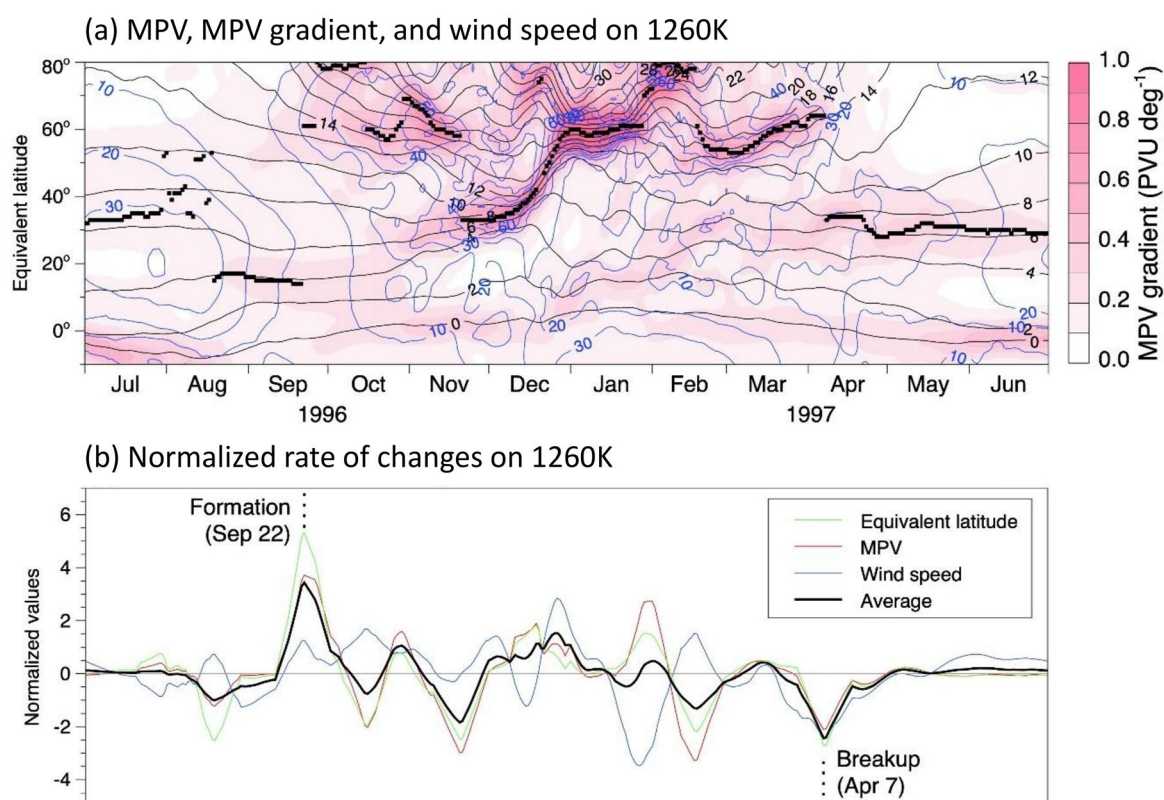


Figure 1. (a) Potential vorticity (black contours) and its meridional gradient (color scale), wind speed (blue contours), and vortex edge (black squares) on time and equivalent latitude on 1260K in 1996–1997 NH winter. (b) Normalized rate of changes on equivalent latitude, potential vorticity, wind speed, and their average at the vortex edge.

- Polar vortex formation and breakup are newly defined by the maximum peak days in average rates of change in the equivalent latitude, potential vorticity, and wind speed at the vortex edge.
- The newly defined vortex formation and breakup dates match well the changes in concentrations of trace gases in the stratosphere.
- The new diagnostic for the vortex formation and breakup appears to be applicable to the whole stratosphere.