



## **Vortex dynamics of stratospheric sudden warmings: a reanalysis data study using PV contour integral diagnostics**

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The dynamics of the polar vortex behind stratospheric sudden warming events is investigated in a data-based study. Potential vorticity contour integral diagnostics of mass and circulation are calculated from ERA-40 reanalysis data for the stratosphere. The edge of the vortex is easily identifiable in these diagnostics as a high gradient of potential vorticity, and the warming events are clearly visible. The amount of air stripped from the vortex as part of a preconditioning leading up to the warming events is determined using the balance equation of the mass integral. Significant persistent removal of mass from the vortex is found, with several such stripping events identifiable through the winter, especially in those during which a major sudden warming event occurred. These stripping episodes are visible in corresponding potential vorticity maps, where tongues of potential vorticity can be seen to be stripped from the vortex and mixed into the surrounding surf zone of turbulent air.