Isentropic transport outside, inside and across the Antarctic stratospheric polar vortex

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The jet stream at the Antarctic stratospheric polar vortex edge is a natural, effective barrier for transport of air masses. The isolation of air masses inside the Antarctic vortex has important implications on the formation of the so-called 'ozone hole' and the slow recovery of ozone content every austral spring.

The presentation focuses on quasi-horizontal (isentropic) transport outside, inside and across the vortex edge by means of a new Lagrangian descriptor M, which has already been shown to be a powerful technique to studies of ocean flows. Specifically, from an initial time t, the function M measures the length of the parcel trajectories advected by the wind field over the interval $[t-\tau, t+\tau]$. The focus of this work is on the southern springs of 2005 and 2010, which allows for a comparison with observations of quasi-Lagrangian drifters in the lower stratosphere gathered during the Vorcore and Concordiasi field campaigns. Hyperbolic trajectories are visualized on both sides of the jet stream, and are associated to irreversible deformation of material contours due to Rossby wave breaking. Routes of large-scale isentropic transport across the vortex edge are successfully captured. Our results highlight the importance of lobe dynamics as transport mechanism across the Antarctic polar vortex.