Geophysical Research Abstracts
Vol. 18, EGU2016-15194, 2016
EGU General Assembly 2016

The fate of stratospheric potential vorticity cutoffs

Raphael Portmann (1), Bas Crezee (1), Julian Quinting (1,2), and Heini Wernli (1)

(1) Institute for Atmospheric and Climate Science, ETH Zürich, Zürich, Switzerland (bas.crezee@env.ethz.ch), (2) School of Earth, Atmosphere & Environment, Monash University, Melbourne, Australia

Stratospheric cutoffs of potential vorticity (PV) frequently form through non-linear breaking of Rossby waves in mid-latitudes. Through destabilisation of the tropospheric layers beneath, they can trigger convection. Alternatively, through their induced horizontal advection they can produce intense precipitation events near topography and in regions with a background baroclinicity. PV cutoff lifecycles show high variability: their lifetime ranges between 1 and more than 10 days and the end of the lifecycle can occur through diabatic decay – leading to stratosphere-troposphere exchange - or re-absorption by the polar stratospheric reservoir. The relative frequency of these two processes is however unclear, as is the quantitative link between cutoffs and convective and large-scale precipitation.

Two case studies are performed by using ECMWF analysis data, backward trajectories and radio soundings to look in detail at the processes involved in the diabatic decay. It is found that latent heating in convective updrafts - and the associated cross-isentropic transport of low PV air - largely explains the diabatic decay of the cutoffs.

Using a tracking algorithm we produce an ERA-Interim cutoff climatology that provides information about the statistics of the cutoff lifetime and the relative frequency of stratospheric re-absorption versus diabatic decay. In addition, we track atmospheric stability and total column water beneath the cutoffs in order to investigate why certain cutoffs decay faster than others. The results contribute to a better understanding of the lifecycle of PV cutoffs and a particular process of stratosphere-troposphere exchange.