



Characteristics of the flow field associated with stratosphere-troposphere exchange based upon ERA40

E. B. Jaeger and M. Sprenger

Institute for Atmospheric and Climate Science, ETH Zurich

The stratosphere and the troposphere are separated by the tropopause, which dynamically can be defined by an iso-surface of potential vorticity. Since potential vorticity (PV) is conserved in adiabatic and frictionless flow, the tropopause acts as a dynamical barrier to stratosphere-troposphere exchange (STE). Therefore, any transport across this barrier is necessarily associated with diabatic processes. Most of these processes are linked with distinct flow patterns, hence distinct signatures of the velocity field. The aim of this study is to shed further light on the dynamical processes associated with STE. The decomposition of the velocity field into its three invariant components (deformation, vorticity and divergence) is considered. We show that all three components exhibit a distinct feature right at the time of the tropopause crossing. Stratosphere to troposphere exchange (STT) for instance is associated with maxima of deformation, vorticity and divergence, whereas for troposphere to stratosphere exchange (TST) the signal is less extreme. The behaviour of the three wind field components in regions of STT and TST is spatially and temporally very robust. An explicit link between the three flow components and the underlying meteorological phenomena will be presented in the frame of a case study. The main focus is especially on climatological aspects of this link.