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Annual cycle of the large scale and the convective transport of water vapor in the tropical UT/LS

R. JAMES (1) and B. LEGRAS (2)
(1) UPMC/CNRS, Physics, Paris, France (james@lmd.ens.fr), (2) CNRS/ENS, Physics, Paris, France

We investigate the respective roles of large-scale transport and convection in determining the water vapour maximum at 100 hPa. The study uses backward trajectories with ECMWF ERA-Interim heating rates. It includes simple microphysics with supersaturation and takes into account convective sources based on CLAUS data with a simple parametrization of overshoots.

We will show results for the full annual cycle, compared with data retrieved from MLS/AURA, showing that a good agreement between reconstructed water vapour and observations is obtained over most regions and most times.

A special emphasis is given to the role of the Asian monsoon. It is found that parcels belonging to the water vapour maximum have been first lifted by convection over the Bay of Bengal and the Sea of China and then transported through the tropical tropopause layer (TTL) via the monsoon anticyclonic circulation towards North-West India, where they are eventually dehydrated, avoiding the coldest temperatures of the TTL.

Convective moistening in the TTL accounts, during Asian monsoon, for 0.3 ppmv of water vapour at 100 hPa and similar values are obtained in other seasons. We present the results of a sensitivity study to parameterized overshoots which show that, except some rare occasions, overshoots do not have a significant impact on the water vapour budget in the TTL and the lower stratosphere.