Transport across the TTL and convective sources

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Transit properties across the TTL are studied using extensive forward and backward Lagrangian trajectories between cloud tops and the reference surface 380K. The tropical domain being subdivided into 11 sub-regions according to the distribution of land and convection, we estimate the contribution of each region to the mass flux across the 380K surface, the vertical distribution of convective sources and of transit times over the period 2005-2008. The excellent agreement between forward and backward statistics shows the robustness of the results presented here.

It is found that about 80% of the tropical parcels at 380K originate from convective sources all along the year. From November to April, the sources are dominated by the warm pool which accounts for up to 70% of the flux. During summer, Asian monsoon region is the largest contributor with similar contributions from oceanic regions and Asian man land, although the signature in vertical distribution and transit time is very different, Asian main land displaying higher sources and smaller transit times. The Tibetan plateau, although a minor overall contributor, is found to be the region with the highest proportion of convective parcels reaching 380K due to its central location beneath the Asian upper level anticyclone.

A simple 1D model ignoring horizontal transport is shown to reproduce very well the vertical regional source distribution but not the transit times. The reason is that the source distribution depends on local detrainment and transport near the zero level of heating rate while the transit depends a lot of the recirculation by horizontal transport. This 1-D model is used to perform a comparison of source distributions using several reanalysis, finding good agreement between ERA-Interim and JRA-55, that differ both from MERRA.