Convective influence and transport pathways controlling the tropical distribution of carbon monoxide at 100 hPa

Eric Jensen, John Bergman, Leonhard Pfister, Rei Ueyama, and Doug Kinnison

Trajectory calculations with convective influence diagnosed from geostationary-satellite cloud measurements are used to evaluate the relative importance of different Tropical Tropopause Layer (TTL) transport pathways for establishing the distribution of carbon monoxide (CO) at 100 hPa as observed by the Microwave Limb Sounder (MLS) on board the Aura satellite. Carbon monoxide is a useful tracer for investigating TTL transport and convective influence because the CO lifetime is comparable to the time require for slow ascent through the TTL (a couple of months). Offline calculations of TTL radiative heating are used to determine the vertical motion field. The simple trajectory model does a reasonable job of reproducing the MLS CO distributions during Boreal wintertime and summertime. The broad maximum in CO concentration over the Pacific is primarily a result of the strong radiative heating (indicating upward vertical motion) associated with the abundant TTL cirrus in this region. Sensitivity tests indicate that the distinct CO maximum in the Asian monsoon anticyclone is strongly impacted by extreme convective systems with detrainment of polluted air above 360 K potential temperature. The relative importance of different CO source regions will also be discussed.