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Impact of typhoons on the UTLS ozone and water vapor distribution within the Asian summer monsoon anticyclone during the SWOP campaign in Lhasa 2013

Dan Li (1,2), Bärbel Vogel (2), Jianchun Bian (1), and Rolf Müller (2)

(1) Key Laboratory of Middle Atmosphere and Global Environment Observation (LAGEO), Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China, (2) Institute for Energy and Climate Research - Stratosphere (IEK-7), Forschungszentrum Jülich, Jülich, Germany

During the sounding water vapor, ozone, and particle (SWOP) campaign during the Asian Summer Monsoon (ASM) organized by the Institute of Atmospheric Physics, Chinese Academy of Sciences, ozone and water vapor profiles were measured by balloon-borne sensors in Lhasa (29.66°N, 91.14°E, elevation 3,650 m), China in August 2013. Totally, 23 soundings were launched, half of which show some deviations from the typical relationship between ozone and water vapor in the tracer-tracer correlation in the upper troposphere and lower stratosphere (UTLS). 20-day backward trajectories of each sounding were calculated using the trajectory module of the Chemical Lagrangian Model of the Stratosphere (CLaMS) to analyse these deviations. Our results demonstrate that during this period three typhoons (Jebi, Utor, and Trami) occurred over the Northwest Pacific Ocean, which have impacts on the vertical structure of ozone and water vapor by transporting the maritime airmasses from the boundary layer. These airmasses with poor ozone were transported to the UTLS by the strong uplift associated with the typhoons, and then entered the ASM anticyclone. Thereafter, air parcels arrived at the observation site through two main pathways: first rotational subsidence, during which air parcels decend slowly along a circle following the anticyclone flow with a timescale of one week, and second direct horizontal transport from the location of the typhoon to the station, where air parcels are transported directly towards the station within approximately three days.