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Satellite Observation of Rapid Transport of Polluted Compositions in UTLS During the Beijing 7.21 Torrential Rainfall Event

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Transport of air from the troposphere to the stratosphere plays an important role in changing atmospheric vertical distribution in UTLS (Upper Troposphere and Lower Stratosphere). In the past years, many studies have paid great attention to the Troposphere-to-Stratosphere Transport (TST) at different places. However, how does the tropospheric pollution enter the stratosphere, and what is the difference for different latitude regions, need more support from satellites or in situ observations. In Asian tropics, Asian summer monsoon circulation is an effective pathway for surface industrial emissions enter to global stratosphere with satellite measurements [Randel et al., 2010]. But, in mid- latitudes, how the tropospheric pollution enter the lower stratosphere is still not very clear.
Beijing is a heavy polluted metropolis and located at north mid- latitudes. On 21July 2012, Beijing was hit by an unprecedented extreme torrential rainfall event. Satellite observations showed a very strong and rapid vertical transport during the event. In this oral presentation, we monitored the vertical distribution changes in UTLS for several components with satellite remote sensing data from AIRS, OMI and other instruments. Comparisons of profiles at 21 July with pre- and post- the event showed that remarkable increase of water vapor and decrease of ozone for layers in UTLS. The AIRS water vapor data showed an approximate increase of 20 to 100% compared with these days pre- and post- the event, and an increase of 35 to 75% compared with the July mean water vapor at layers from 700 to 100 hPa. The OMI ozone profiles showed a layer decrease of 10 to 30% on 21 July compared with other days at height from 300 to 70 hPa. Remarkable changes of CO and NO_2 profiles in UTLS were also monitored with satellite data. To estimate the vertical transport mass of water vapor, CO and NO_2 during the event, we first calculated the vertical transport area with the FY-2 high temporal resolution OLR data. The aim of the estimation is to evaluate how much pollution can be transported from the troposphere to the stratosphere during a typical deep convective event transport in north mid- latitudes. In the future, we will try to estimate the annual mean transport of pollution by convective events but this requires more research.