QOS2016-223, 2016
Quadrennial Ozone Symposium of the International Ozone Commission

NAME-modelled interannual variability in convective influence of the air mass transport to the Tropical Tropopause Layer in the Pacific Ocean

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The work presented shows the analysis of the Numerical Atmospheric dispersion Modelling Environment (NAME) model runs made from the Tropical Tropopause Layer, TTL, altitude levels over the Pacific region. For each box (10 x 10 x 2 deg2km, covering the area of 80oE-100oW, 15oS-15oN), 10,000 particles are released from the 14-16 km and 16-18 km altitude levels, corresponding to the lower and upper TTL regimes, and followed 12 days backwards to identify the origin, location and timescales of the air mass reaching the TTL. The spatial and temporal variability in the convective influence in the Pacific region, and subsequently the variability in the air mass transport and the low-level air mass contribution to the TTL, is investigated. The attempt is made to relate results of this study to the fluctuating Madden Julian Oscillation activity and El Nino Southern Oscillation regimes: La Nina (DJFM 2008), El Nino (DJFM 2016) and neutral ENSO (DJFM 2013, 2014). This study investigates the presence of convective influence in the Pacific, which provides a dominant transport mechanism for very short lived halogenated organic species of natural origin to reach the TTL and lower stratosphere, and consequently affect the stratospheric ozone budget in the tropical lower stratosphere.

This work follows up on the previous NAME studies on the analysis of the model runs made from the NASA ATTREX-2 flight campaign over the East Pacific in January-February, 2013, and the NASA ATTREX-3 flight tracks over the West Pacific in January-March, 2014. Cases presented are for flights with evident high and low degree of convective influence. Fractions of trajectories are calculated according to particles which crossed certain levels in the low troposphere such as 5 and 1 km. Then, initial concentrations for Very Short Lived Species (VSLS), in particular bromoform, methyl iodide and dibromomethane are assigned, based on (i) NERC CAST/NCAR CONTRAST observations and (ii) WMO (2014) boundary layer concentrations – to particles which originated from below 5/1 km. The contributions of low altitude air masses to the high altitude samples can then be estimated. These NAME modeled results are then compared with ATTREX VSLS flight measurements. Flights from the ATTREX-2 and ATTREX-3 are used to assess the spatial and temporal variability within the vertical transport in deep convection which is one of the crucial factors in redistributing chemicals within the Pacific tropical troposphere.