Geophysical Research Abstracts
Vol. 18, EGU2016-8093, 2016
EGU General Assembly 2016

Identifying emission source regions and transport pathways of very short-lived halogens over the Western Pacific

Robyn Butler (1), Paul Palmer (1), Liang Feng (1,2), Neil Harris (3), Lucy Carpenter (4), Steve Andrews (4,5), Elliot Atlas (6), Ross Salawitch (7), Laura Pan (8), Valeria Donets (6), and Sue Schauffler (8)

(1) School of GeoSciences, University of Edinburgh, Edinburgh, UK, (2) National Centre of Earth Observation, University of Edinburgh, Edinburgh, UK, (3) Department of Chemistry, University of Cambridge, Cambridge, UK, (4) Department of Chemistry, University of York, York, UK, (5) National Institute for Environmental Studies, Tsukuba, Japan, (6) Rosentiel School of Marine and Atmospheric Science, University of Miami, Miami, FL, USA, (7) Department of Chemistry and Biochemistry, University of Maryland, College Park, MD, USA, (8) National Center for Atmospheric Research, Boulder, CO, USA

Deep, tropical convective systems lead to the rapid transport of very short-lived halogenated substances (VSLS) to the tropical tropopause layer (TTL). They are then subsequently transported to the lower stratosphere and chemically broken down to release the constituent halogens that catalytically destroy ozone. Although the oceans are known to represent the largest VSLS source, the relative contribution of geographical regions through emission and transport is poorly understood. We present a study on the origin and variability of VSLS over the Western Pacific using data collected during the CAST and CONTRAST measurement campaigns, January/February 2014. We have developed a version of the GEOS-Chem atmospheric chemistry transport model that tags emissions of bromoform ($CHBr_3$) and dibromomethane (CH_2Br_2) from different geographical regions. We focus the source regions on land and (coastal and open) oceanic emissions. We have also developed a similar tagged method to calculate the physical age of air parcels from these source regions to quantify the speed of vertical transport. Using this approach we have quantified relative contributions of source regions and show that open oceanic emission regions are the dominant source of VSLS gases during the measurement campaigns. By looking at variability over the region, we see that this is caused by direct convection of marine emissions over the open ocean leading to increased contribution to $CHBr_3$ and CH_2Br_2 mixing ratios from this source region. Open oceanic emissions are transported to the TTL within the average atmospheric lifetime of $CHBr_3$, the shorter lived species, whereas emissions from coastal ocean and land source regions have an older physical age at the TTL. The relative contribution from island land masses in the campaign region have no impact over the vertical profile but does impact local mixing ratios.