Geophysical Research Abstracts
Vol. 20, EGU2018-19547, 2018
EGU General Assembly 2018

An extraordinary plume of stratospheric water vapor from a pyroconvective storm

Michael J. Schwartz (1), Hugh C. Pumphrey (2), and George P. Kablick III (3)

(1) Jet Propulsion Laboratory/California Institute of Technology, Pasadena, CA, USA , (2) The University of Edinburgh, Edinburgh, UK, (3) U.S. Naval Research Laboratory, Washington, D.C., USA

On 12 August, 2017, an extraordinary pyroconvective event associated with intense wildfires in British Columbia and Washington State lofted smoke and other combustion products to the tropopause, resulting in UTLS mixing ratios of carbon monoxide and water vapor unprecedented in the 13-year Microwave Limb Sounder (MLS) record. Over the first several days after the pyroconvective event, as the plume advected rapidly northward and then eastward, it began a steady ascent into the stratosphere through radiative heating, primarily of smoke in the plume. At 100 hPa, water vapor mixing ratios exceeding 15 ppmv were observed August 19-26 with a peak value of 19 ppmv matched only once previously at this level in the 13-year MLS record. As the plume continued to radiatively ascend, H_2O mixing ratios significantly exceeding any previously observed in the global MLS record between 82 hPa and 31 hPa were observed, with peak plume mixing ratios of 17.0 ppmv at 82 hPa on August 18, 17.2 ppmv at 68 hPa on August 30, 16.4 ppmv at 56 hPa on September 2, 13.2 ppmv at 46 hPa on September 4, 11.9 ppmv at 38 hPa on September 19, 10.6 hPa at 31 hPa on September 29. Using correlated observations of MLS water vapor and carbon monoxide, the ascending plume can be tracked for $\sim$100 days, with recognizable traces reaching 26 hPa. The unusual pathway of initial ascent that this plume took through a high-latitude, relatively warm tropopause layer likely played a significant role in the unprecedented transport of water vapor into the stratosphere. Observations from this 2017 plume are compared with plumes from the most significant previous pyroconvective events in the 13-year MLS record, those of the Great Divide fire of December 2006 and of the Black Saturday fire of February 2009.