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MLS observations of pollutants from a forest fire in British Columbia

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On 12 August, 2017, smoke and other combustion products from intense wildfires in British Columbia and Washington state were lofted to the tropopause by pyroconvection and then rapidly advected northward. This plume, which was first observed by the Microwave Limb Sounder (MLS) on the Aura satellite the next day over northwest Canada, was extraordinary both in the unprecedented MLS trace gas mixing ratios observed and in its persistent coherence as a relatively compact airmass as it was radiatively lofted to an altitude of 23 km (31 hPa) and advected around the globe over the ensuing three months. CO mixing ratios of 1600 ppbv at 215 hPa and 1100 ppbv at 147 hPa in the days immediately following the injection event are the highest seen at these levels in the 13-year MLS record. Water vapor mixing ratios of 19 ppmv at 100 hPa are also as high as any at this level in the MLS record. The persistence of extremely high water vapor and CO in the plume as it evolved simplifies the tracking of the airmass and facilitates investigation of the evolution of correlated signatures in the plume of numerous trace gases measured by MLS, including ozone (O_3), methyl cyanide (CH3CN), methyl chloride (CH3Cl), methanol (CH3OH), hydrogen cyanide (HCN), and chlorine monoxide (ClO). Here, we compare observations from the plume of the 2017 fire with observations of outflow 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.