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A case study of aerosol depletion in a biomass burning plume over Eastern Canada during the BORTAS field experiment

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Wild fires started by lightning are a significant source of carbonaceous aerosols and trace gases to the atmosphere. Careful observations of biomass burning plumes are required to quantify the long range transport and chemical evolution of the outflow from these fires. During the summer of 2011 an international effort – the Quantifying the impact of BOReal forest fires on Tropospheric oxidants over the Atlantic using Aircraft and Satellites (BORTAS) project – led by the University of Edinburgh, evaluated the chemistry and dynamics of Boreal biomass burning plumes through aircraft, satellite, and ground-based measurements. The Dalhousie Ground Station (DGS), located in Halifax, Nova Scotia, provided ground support to the BORTAS campaign. Two Fourier Transform Spectrometers (FTSs) provided solar absorption measurements of trace gases while two photometers provided aerosol optical depths.

On 20 July 2011 a plume of elevated carbon monoxide and other trace gases was detected by the FTS instruments at the DGS; however, particulate data gathered from the co-located sun photometer and the Dalhousie Raman Lidar system showed no enhancement of fine-mode aerosol for the initial 7 hours of the event. After that time, particulates increased in abundance and a peak aerosol optical depth of 2.3 was measured on 21 July.

FLEXPART trajectory analyses suggest that this plume originated in fires that were burning in Northwestern Ontario and Eastern Manitoba from 17 to 19 July. Despite the sparse observing network in the region, there is ample evidence of a significant lofting event via the same meso-scale convective system that tempered the burning on the 19th. We will provide an overview of this event and present evidence that precipitation scavenging was the most likely mechanism for the observed aerosol/trace gas anomaly.

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