

Supplement



Figure S1: 4STAR at Fort McMurray installed on the Convair-580 aircraft; b. 4STAR head and its optical cables sitting inside the aircraft during routine maintenance

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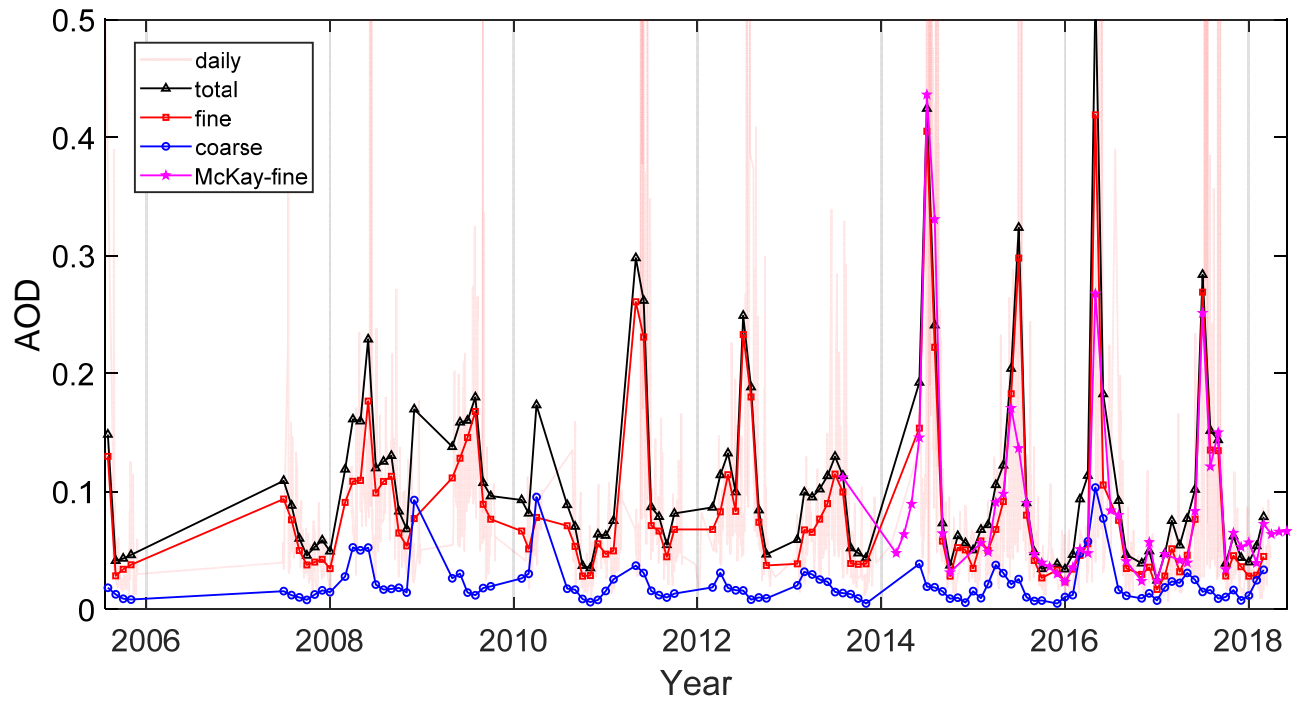


Figure S2: Fort McMurray monthly-averaged AODs (AERONET V3, level 2.0 data) with daily-averaged values shown in shaded pink. Also included is a fine-mode AOD time series for the nearby Fort McKay.



Figure S3: A photo of the Syncrude plume, taken from the eastern side of the box facing approximately southwest.

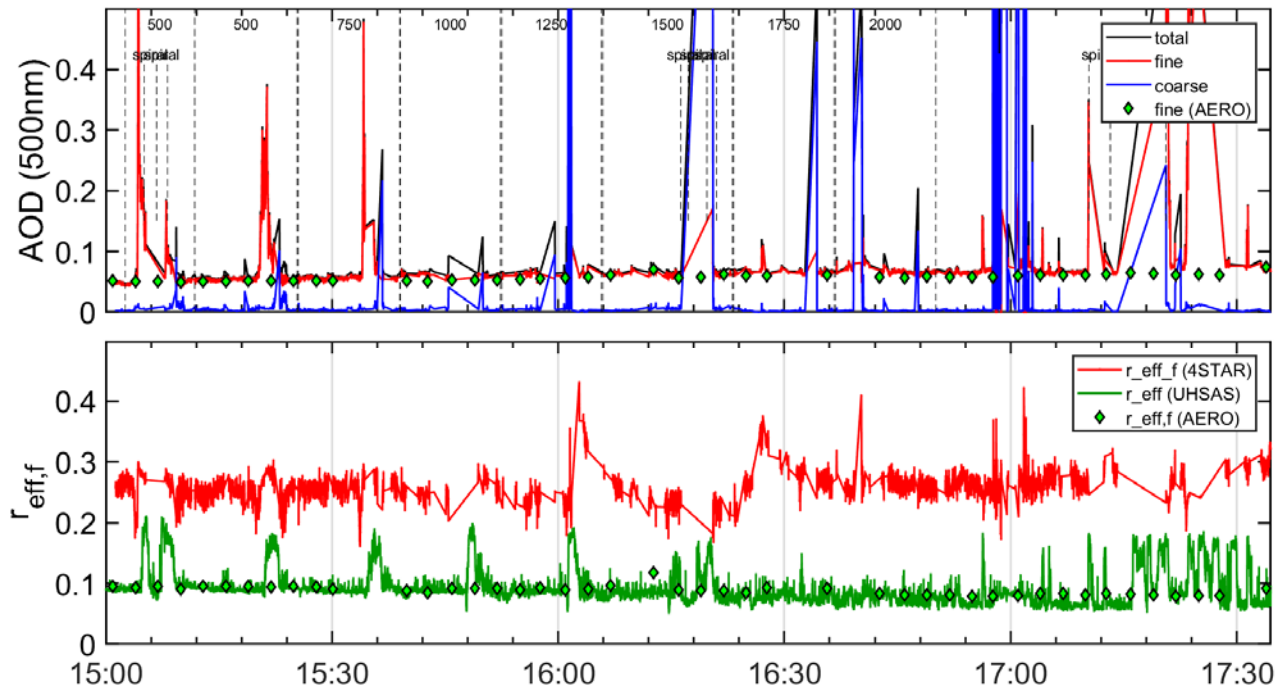


Figure S4: 4STAR and AERONET comparisons for June 18, 2018. Top: total, fine and coarse mode AODs at 500 nm. Also shown (in green) fine-mode AOD from Fort McMurray AERONET station. Bottom: $r_{eff,f}$ values estimated from a) 4STAR data (red), b) Fort McMurray AERONET AOD data (green diamonds) and c) UHSAS particle size data (solid green).

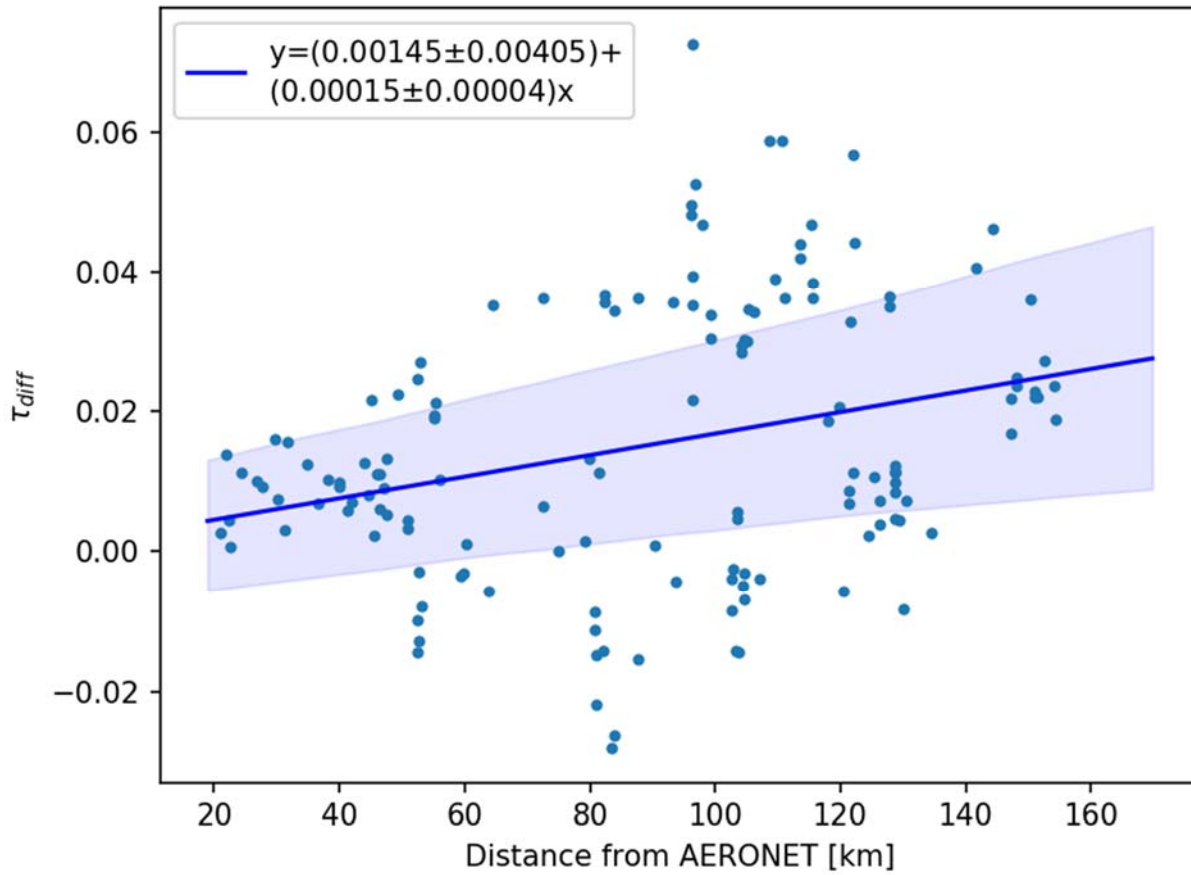


Figure S5: Relative AOD error between AERONET and 4STAR ($\tau_{diff} = \tau_{f,ASTAR} - \tau_{f,AERONET}$) as a function of distance from the Fort McMurray AERONET stations for selected flights. The solid line shows the linear fit to the data with the shaded region representing the 95% confidence interval (p-value of 0.00035). For dataset details see caption to Figure 8

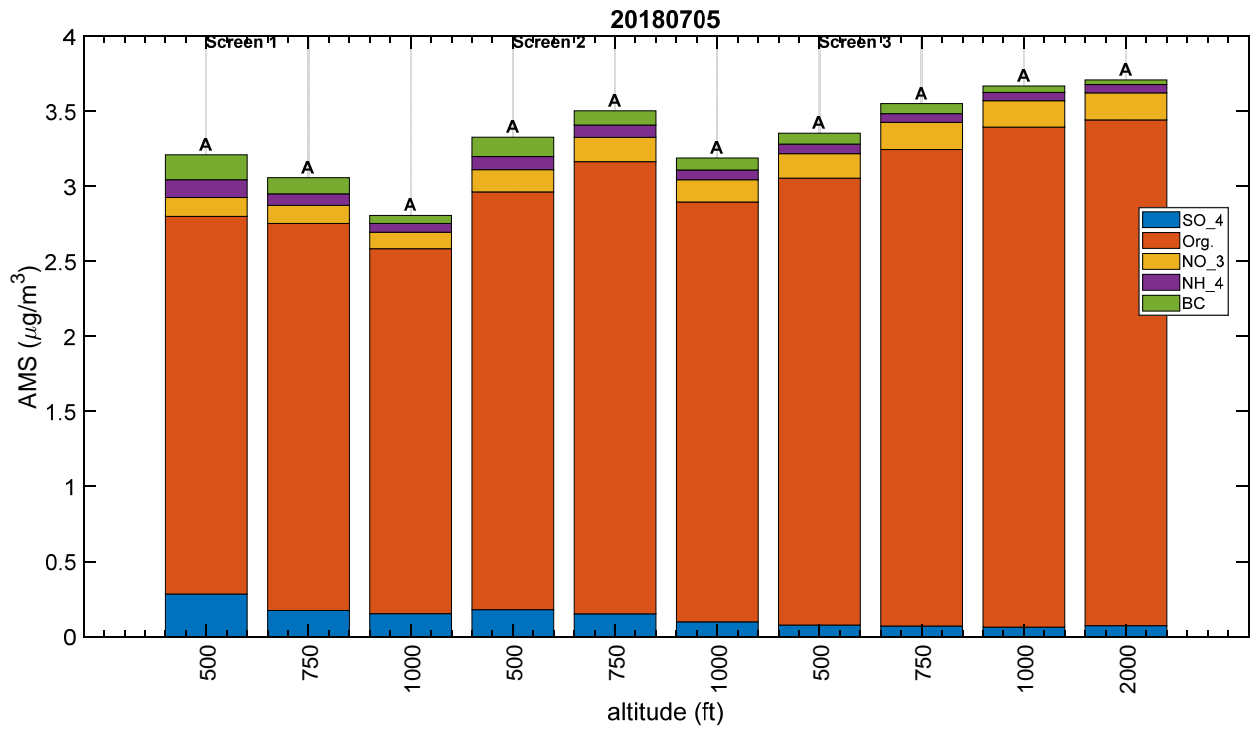


Figure S6: Evolution of particle composition during the transformation flight of July 5.