



*Supplement of*

## **Airborne and ground-based measurements of aerosol optical depth of freshly emitted anthropogenic plumes in the Athabasca Oil Sands Region**

**Konstantin Baibakov et al.**

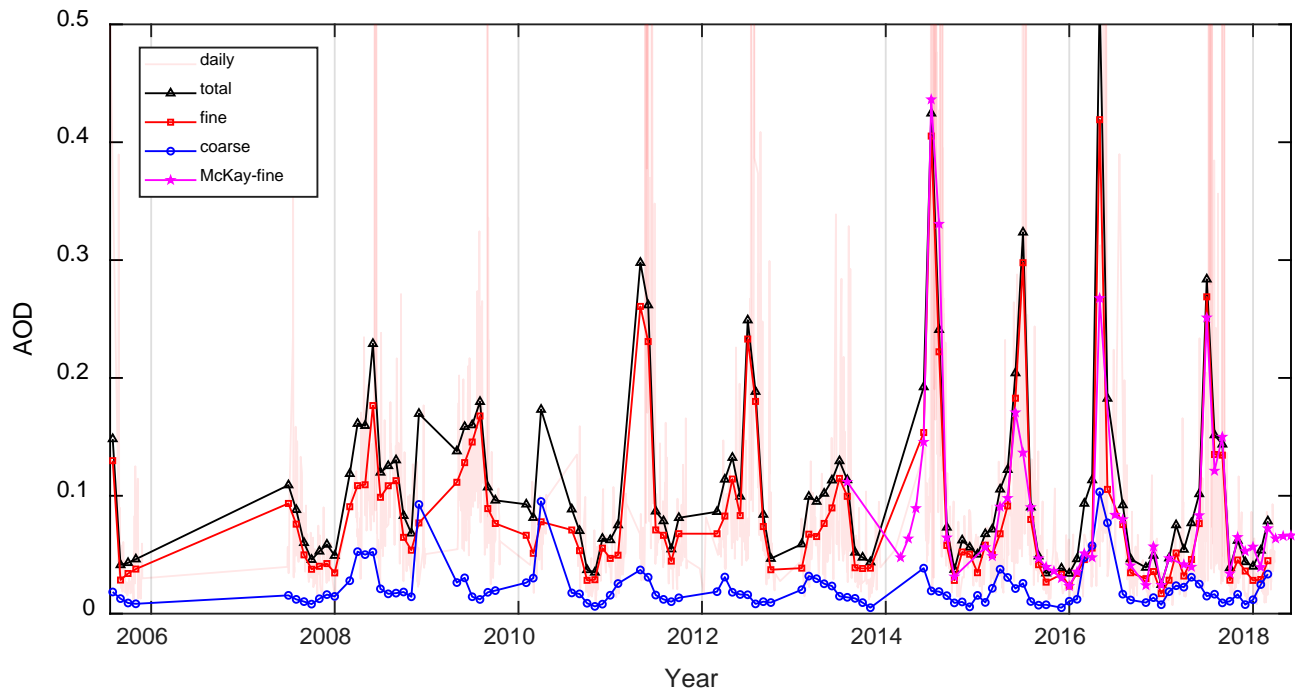
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## Supplement



**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**



**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.**

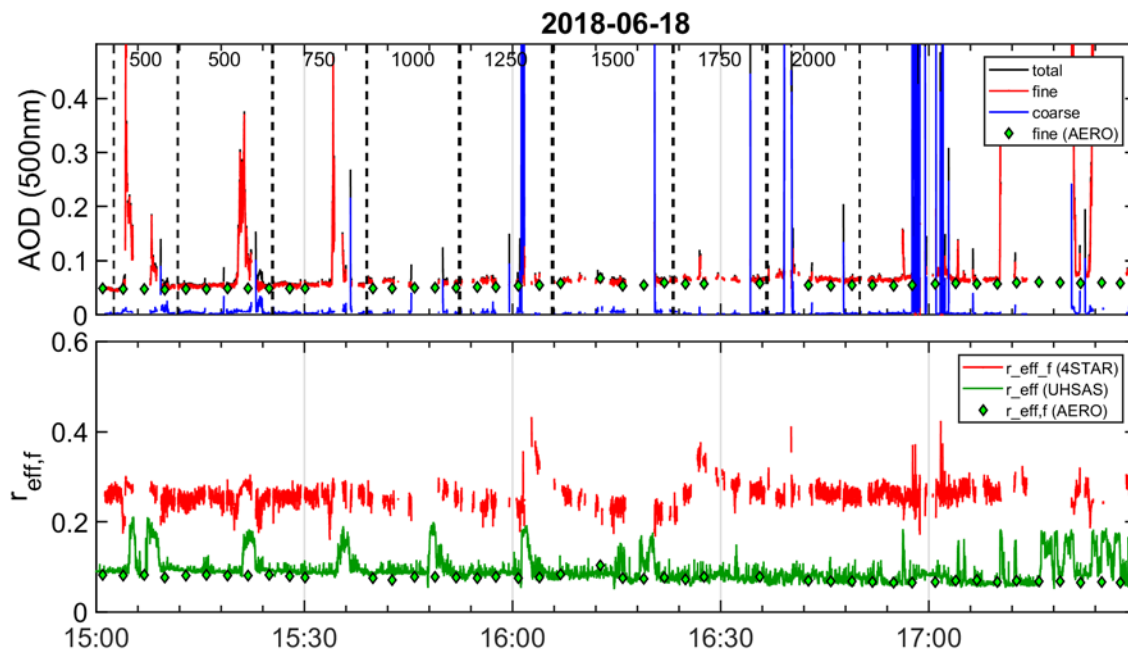
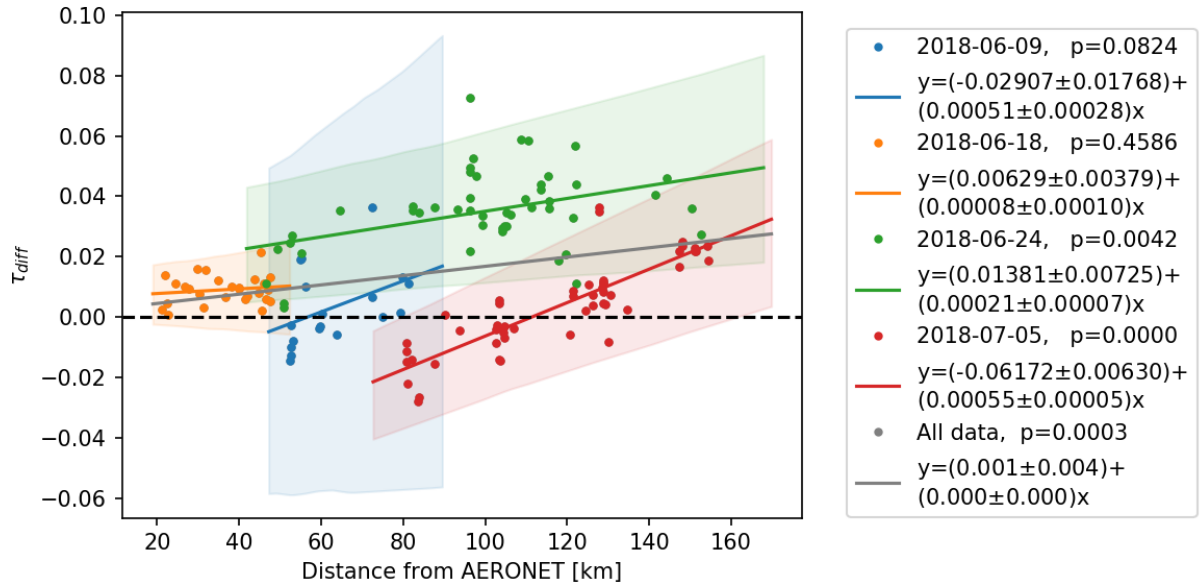
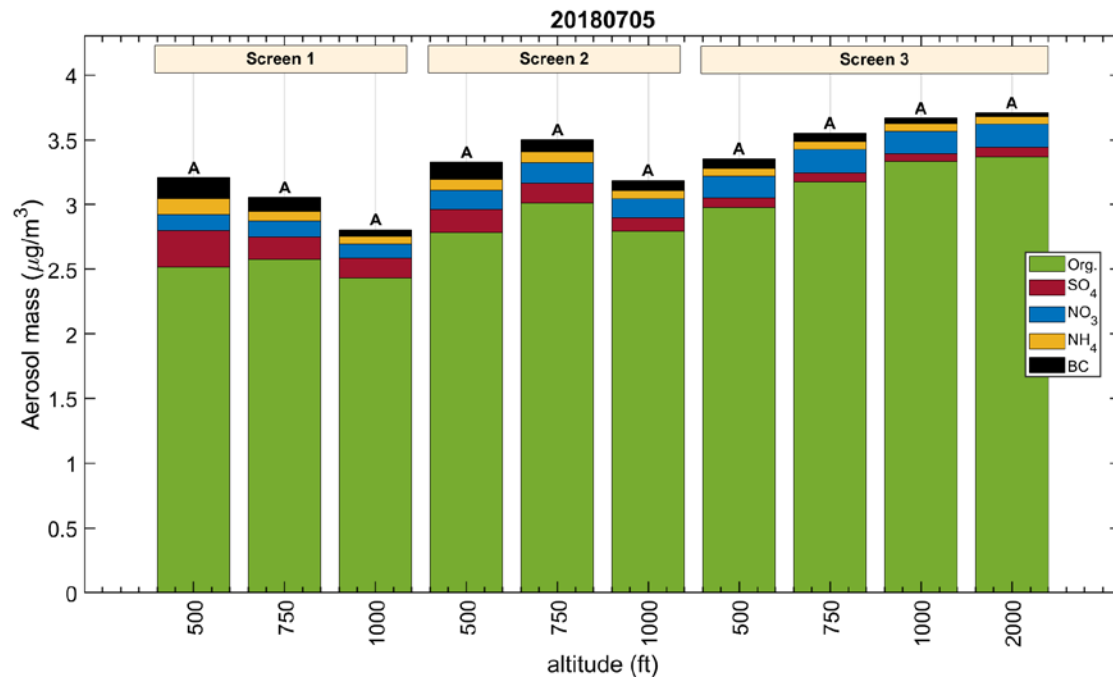


Figure S4: 4STAR and AERONET comparisons for June 18, 2018. Top: total, fine and coarse mode AODs at 500 nm. Also shown (in green) fine-mode AOD from Fort McMurray AERONET station. Bottom:  $\tau_{eff,f}$  values estimated from a) 4STAR data (red), b) Fort McMurray AERONET AOD data (green diamonds) and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



**Figure S5:** Relative fine mode 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 (each color denotes a different flight). The solid line shows the linear fit to the data with the shaded region representing the 95% confidence interval, p-value indicated in the legend and calculated for each flight day separately, while all the data is computed with the grey solid line and shading. For June 9th, and June 18th, the slope is not statistically different (p-value greater than 0.02) than the null hypothesis of no change in AOD with respect to distance, while the two other flights, with more samples, show a statistically different slope. For dataset details see caption to Figure 9.



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