



Supplement of

Characterization of atmospheric water-soluble brown carbon in the Athabasca oil sands region, Canada

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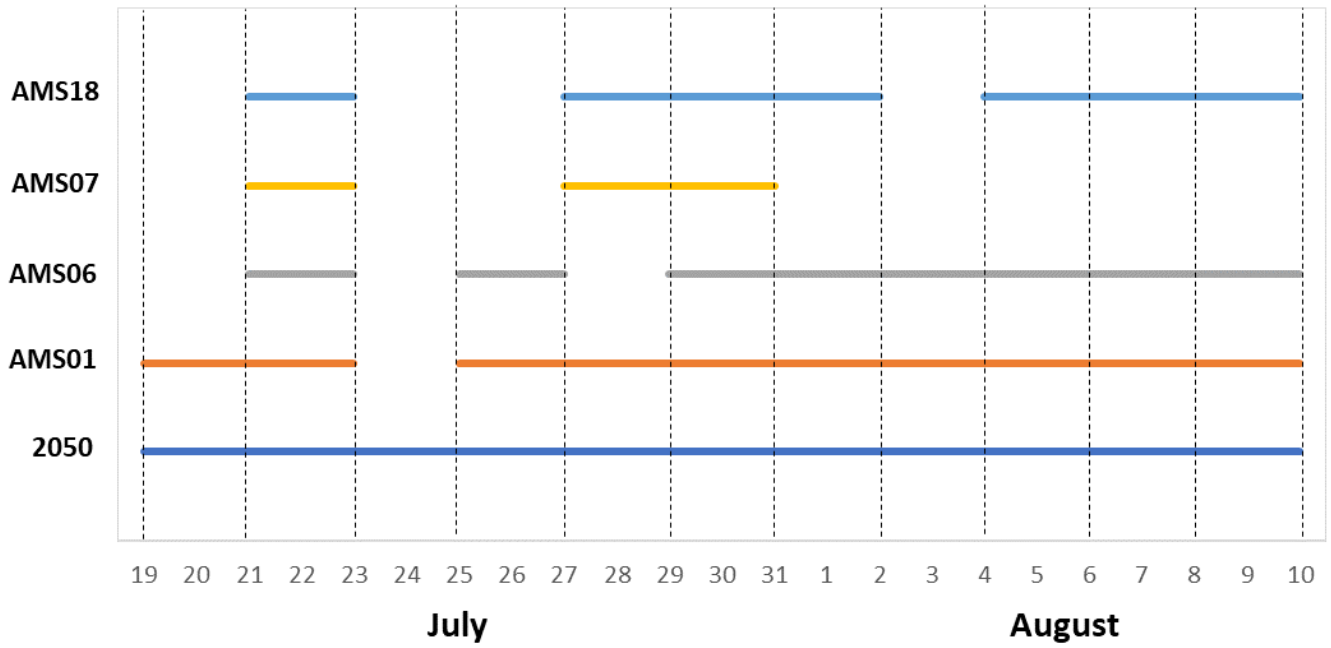


Figure S1: Temporal distribution of active sampler exposures (demarcated by the vertical dotted lines) at each of the WBEA monitoring sites during the field study (July 19–August 10, 2023).

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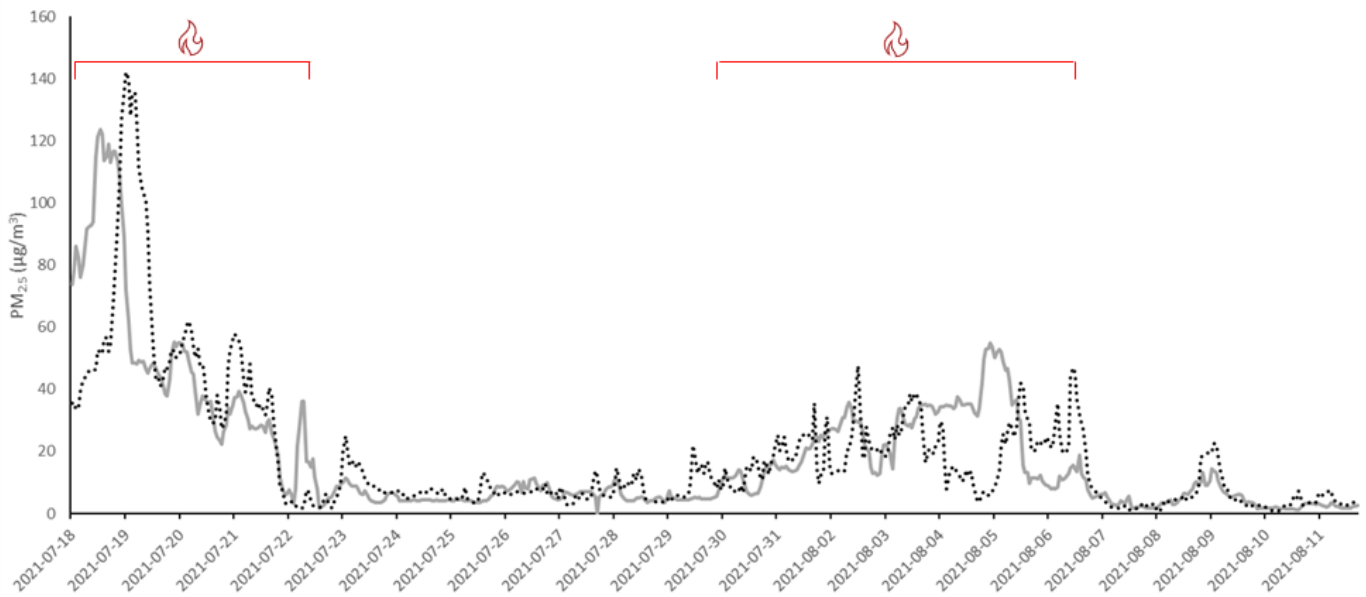
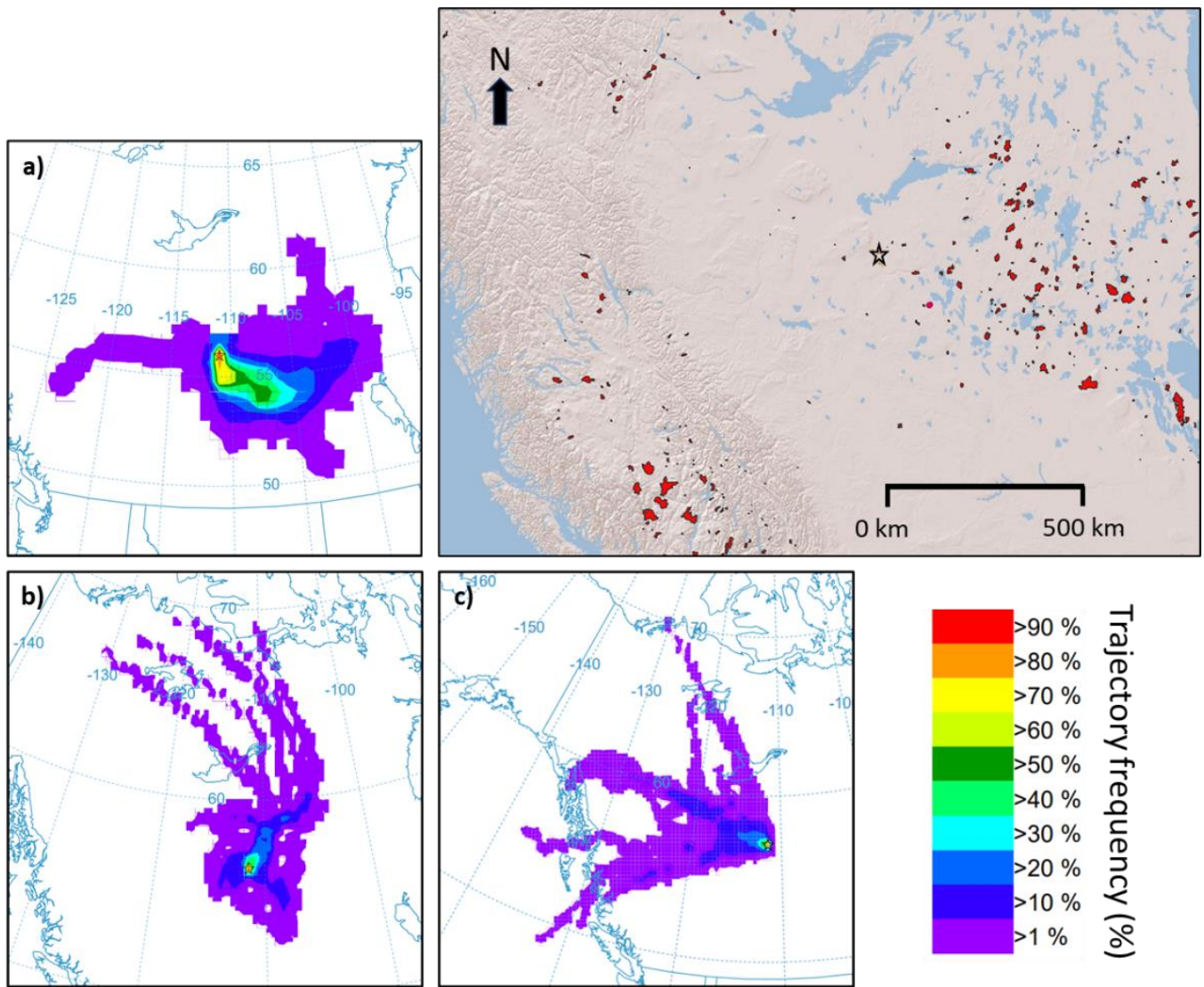


Figure S2: Hourly average PM_{2.5} (µg m⁻³) measured at a) AMS01 (black dotted line) and b) AMS18 (grey line) continuous monitoring stations during the study period (July 19–August 10, 2021). Approximated wildfire smoke events have been outlined in red.



10 Figure S3: Back-trajectory (48 h) frequency (%) plots displaying atmospheric transport to AMS01 (black outlined star) during high $PM_{2.5}$ periods a) July 19 - 22, b) July 31 – August 7), and the low $PM_{2.5}$ period, c) July 23 – 30. The top-right map displays the spatial distribution of wildfire-affected areas (red polygons) throughout western Canada during the study period (July 19 – August 10) (ESRI 1995-2024). Note that the spatial scale of the trajectory plots and wildfire map are not equal.

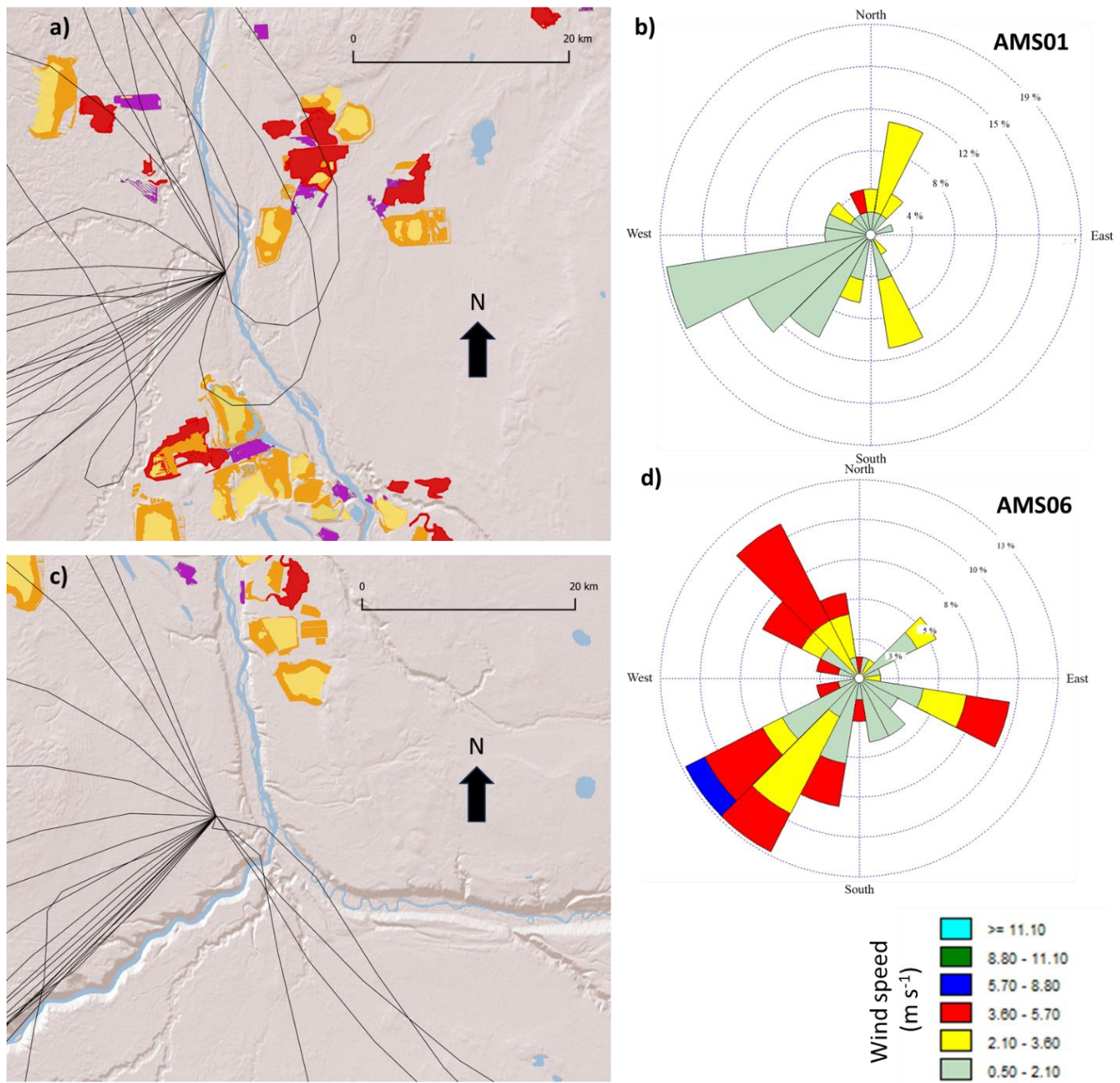
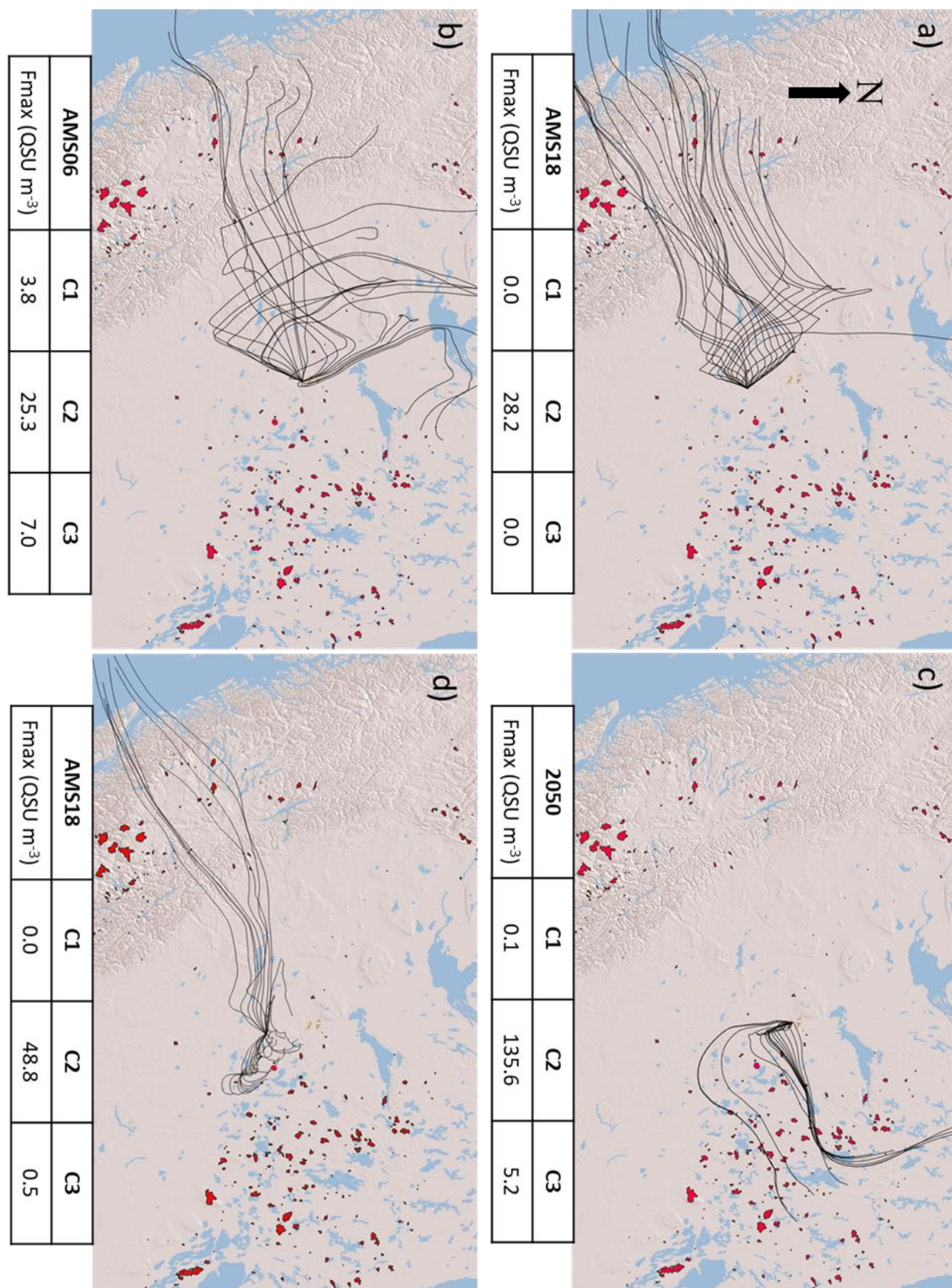


Figure S4: Comparison of HYSPLIT 48 h back-trajectories and continuous wind direction measurements corresponding to the July 25-27 and August 6-8 exposures at AMS01 (a & b) and AMS06 (c & d) continuous monitoring stations, respectively (ESRI 1995-2024).



20 **Figure S5: Spatial distributions of 48 h atmospheric back-trajectories (black lines) converging at sampling locations during selected exposure periods, including: a) AMS18; August 7-9, b) AMS06; July 21-23, c) DP2050; July 19-20, and d) AMS18; August 5-7. Normalized F_{MAX} values of C1 – C3 (QSU m⁻³) measured during each exposure are shown beneath the corresponding trajectory plots (ESRI 1995-2024).**