Assessing Transport Pathways of Canadian Wildfire Smoke in June 2023

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In the summer of 2023, Canada experienced an unprecedented wildfire season with the total burned area reaching 15 million hectares– over 6 times the average area per year. Notably, smoke plumes from Eastern Canada were transported to the Northeast United States, resulting in record-breaking measures of poor air quality in early June 2023. Our analysis of Moderate Resolution Imaging Spectrometer (MODIS) aerosol optical depths (AODs) shows transatlantic transport of wildfire smoke, leading to record high June 2023 AOD values not only in North America, but also above the Northern Atlantic and in Western Europe. As wildfires continue to increase in intensity and severity, it is crucial to understand the mechanisms underlying long-range aerosol transport from wildfire events. Specifically, we use the Stochastic Time-Inverted Lagrangian Transport (STILT) Model to simulate transport pathways of wildfire smoke and assess their sensitivity to injection time and injection height. Preliminary model results show substantial sensitivity to injection time, with particles released during the daytime exhibiting longer-range and distinctly different transport paths compared to those released in the evening, suggesting that diurnal variability in wildfire emissions may play a role in particle transport. Crucially, daytime-release particles reached Southeastern Greenland, which may impact ice sheet albedo. We further examine satellite observations of surface albedo, single scattering albedo, and angstrom exponents along the identified smoke plume trajectories, which can provide insight into the deposition and particle aging processes during transport.