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Quantifying black carbon deposition to Greenland surface snow from forest fires in Canada

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Black carbon (BC) concentrations has been observed in 22 snowpits sampled in the northwest sector of the Greenland ice sheet in April 2014. The pits contain a strong and widespread BC aerosol deposition event, which accumulated in the pits during two snow storms between 27 July and 2 August 2013. This event comprises a significant portion (57% on average across all pits) of total BC deposition measured in the snowpits (~10 month record). We link this deposition event to forest fires burning in Canada during summer 2013 using modeling and remote sensing tools. Specifically, we use high-resolution regional chemical transport modeling (WRF-Chem) combined with high-resolution fire emissions (FINNv1.5) to study aerosol emissions, transport, and deposition to Greenland snow during this event. The model captures the timing of the BC deposition event and shows that fires in Canada were the main source of deposited BC. The implications for understanding the influence of BC originating from fires on the optical properties of snow is discussed.

Significance statement

The 57% of black carbon aerosol deposition in 2013 in northwest Greenland measured in snowpits is linked to a specific event in late July/early August 2013. The origin of this event is emissions from forest fires burning in Canada.

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