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TITLE: Source apportionment of circum-Arctic atmospheric black carbon from isotopes and modeling

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ABSTRACT:

Black carbon (BC) contributes to Arctic climate warming, yet source attributions are inaccurate due to lacking observational constraints and uncertainties in emission inventories. Year-round, isotope-constrained observations reveal strong seasonal variations in BC sources with a consistent and synchronous pattern at all Arctic sites. These sources were dominated by emissions from fossil fuel combustion in the winter and by biomass burning in the summer. The annual mean source of BC to the circum-Arctic was  $39 \pm 10\%$  from biomass burning. Comparison of transport-model predictions with the observations showed good agreement for BC concentrations, with larger discrepancies for (fossil/biomass burning) sources. The accuracy of simulated BC concentration, but not of origin, points to misallocations of emissions in the emission inventories. The consistency in seasonal source contributions of BC throughout the Arctic provides strong justification for targeted emission reductions to limit the impact of BC on climate warming in the Arctic and beyond.

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