



Source Contributions to Wintertime Elemental and Organic Carbon in the Western Arctic Based on Radiocarbon and Tracer Apportionment.

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Abstract: To quantify the contributions of fossil and biomass sources to the wintertime Arctic aerosol burden source apportionment is reported for elemental (EC) and organic carbon (OC) fractions of six PM₁₀ samples collected during a wintertime (2012-2013) campaign in Barrow, AK. Radiocarbon apportionment of EC indicates that fossil sources contribute an average of $68 \pm 9\%$ ($0.01\text{-}0.07 \mu\text{g m}^{-3}$) in midwinter decreasing to $49 \pm 6\%$ ($0.02 \mu\text{g m}^{-3}$) in late winter. The mean contribution of fossil sources to OC for the campaign was stable at $38 \pm 8\%$ ($0.04\text{-}0.32 \mu\text{g m}^{-3}$). Samples were also analyzed for organic tracers, including levoglucosan, for use in a chemical mass balance (CMB) source apportionment model. The CMB model was able to apportion 24-53% and 99% of the OC and EC burdens, respectively, during the campaign, with fossil OC contributions ranging from 25 to 74% ($0.02\text{-}0.09 \mu\text{g m}^{-3}$) and fossil EC contributions ranging from 73 to 94% ($0.03\text{-}0.07 \mu\text{g m}^{-3}$). Back trajectories identified two major wintertime source regions to Barrow: the Russian and North American Arctic. Atmospheric lifetimes of levoglucosan, ranging from 50 to 320 h, revealed variability in wintertime atmospheric processing of this biomass burning tracer. This study allows for unambiguous apportionment of EC to fossil fuel and biomass combustion sources and intercomparison with CMB modeling.

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