



Abstract ID : 268

Pervasive deposition of East Asian dust and pollution aerosols in the western Arctic

Content

Toxic metals are emitted into the atmosphere through industrial activities and transported far from their sources, impacting ecosystems and human health. Mineral dust aerosols play a role in Earth's radiative balance and supply micronutrients to iron-limited ecosystems. To evaluate the sources of dust and pollutant aerosols to Alaska following the 2001 phase-out of leaded gasoline in China, we measured Pb-Sr-Nd isotopic compositions of particles collected in 2016 from snow pits across an elevational transect (2180–5240 m-a.s.l) in Denali National Park, USA. Glaciogenic dust from southcentral Alaska dominates the signal of Sr-Nd-Pb isotopes at elevations below 2200 m, while Asian deserts contribute significant dust to higher elevations. Chinese coal-burning and non-ferrous metal smelting account for up to 64% of Pb deposition at our sites, a value consistent across the western Arctic. Pb isotope ratios in the aerosols did not change between 2001–2016, despite the ban on lead additives. Emissions estimates demonstrate that industrial activities have more than compensated for the phase-out of leaded gasoline, with China emitting ~37,000 metric tons year⁻¹ of Pb during 2013–2015, approximately 78% of the Pb from East Asia. The Pb flux to Alaska now exceeds that measured in southern Greenland during peak pollution from North America.

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Track Classification: Pollution records