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Dataset name: **iCUPE Dataset (DS) from Deliverable 2.2.3:**

Dataset of Arctic atmospheric Hg(0) isotope observations

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The produced dataset (in MS Excel format) contains the concentration and stable isotope composition of gaseous elemental mercury, Hg(0) in air samples collected at the Zeppelin Observatory in Ny-Alesund (ZEP, Svalbard - Norway) (78.92° N, 11.93° E) and at Villum Research Station in North-Greenland, (VRS, 81°36' N, 16°40' W). Hg(0) concentrations are reported in nanograms per cubic meter of air, ng/m^3; at standard pressure (1 atm) and temperature (0^{o}C). The isotopic composition is reported following international accepted nomenclature (Blum and Bergquist, 2007), using the δ^{202}Hg, Δ^{199}Hg, Δ^{200}Hg and Δ^{201}Hg notation referenced to the NIST SRM (National Institute of Standards and Technology Standard Reference Material) 3133 Hg standard. The samples were collected as follows: air was pumped for 1 week, at 1 liter per minute nominally, through a 47 mm diameter Millipore polyethersulfone cation exchange membrane (ref# HPWP04700) in order to quantitatively remove aerosol Hg(II) and gaseous divalent Hg(II) forms; after the filter, Hg(0) in the remaining air was passed through a sulfur-

impregnated activated carbon trap (250 mg of Calgon Carbon Corp. HGR-AC in a 10 cm long, 6 mm outer diameter, 4 mm inner diameter pyrex glass tube, with quartz wool plugs). Sampling was conducted from 16/3/2018 to 18/6/2019 at Zeppelin, and from 1/5/2019 to 29/7/2019 at Villum. Samples were stored and transported frozen at -20°C at all times, until processing and isotope analysis at CNRS-GET (Centre National de Recherche Scientifique - Géosciences Environnement Toulouse). Carbon traps were desorbed using a standard dual tube furnace decomposition method (Sun et al., 2013). Carbon powder was removed from the trap tube and placed in a quartz tube inside the first tube furnace that was ramped from 25°C to 900C during 6 h. An oxygen carrier gas, scrubbed for Hg using a gold trap, carried the combustion products and Hg(0) vapor through the 2nd pyrolizing tube furnace, held at 1000C at all times. Hg(0) vapor, in oxygen carrier gas, at the 2nd furnace outlet was bubbled in a 7.5 mL 40 vol.% HNO3:HCl (2:1) oxidizing acid trap and quantitatively converted to dissolved Hg(II) in the acid solution. The solution was then diluted to 20 vol.% and analysed directly by cold-vapor multi-collector inductively coupled plasma mass spectrometry (CV-MC-ICPMS) at the Observatoire Midi-Pyrenees, Toulouse, France, following standard procedures (Fu et al., 2016). Carbon trap blanks were on average 3% of the total amount of Hg(0) sampled. Certified Hg isotope reference materials do not exist for atmospheric gaseous Hg(0). We therefore processed procedural Hg isotope quality control standard NIST SRM 1632d (Hg in coal powder) for combustion, and analysed also the secondary reference standards UM-Almaden and ETH-Fluka by CV-MC-ICPMS. Results are included with the dataset, and are comparable to previously published values. Expanded uncertainties of Hg(0) isotope signatures in the dataset are based on duplicate analyses of solution trap samples, and secondary reference materials.

This Dataset will be published in the scientific, peer-reviewed literature in 2021. Data users are requested to cite the publication.

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