Arctic aerosol Be7 concentrations from the MOSAIC expedition on the R/V Polarstern in the Central Arctic Ocean from December 2019 to June 2020

Website: https://www.bco-dmo.org/dataset/875869
Data Type: Cruise Results
Version: 1
Version Date: 2022-06-23

Project
» Collaborative Research: Defining the Atmospheric Deposition of Trace Elements Into The Arctic Ocean-Ice Ecosystem During The Year-Long MOSAiC Ice Drift (MOSAiC)

Contributors	Affiliation	Role
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Abstract
This is a dataset of arctic aerosol Be7 concentrations from the MOSAIC expedition on the R/V Polarstern in the Central Arctic Ocean from December 2019 to June 2020.

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Coverage

Spatial Extent: **N**:88.3961 **E**:116.8658 **S**:80.6593 **W**:8.190467
Temporal Extent: 2019-12-20 - 2020-06-02

Methods & Sampling

Aerosol samples were obtained with a Tisch TE-5170V-BL high volume aerosol sampler, modified to collect 12 replicate samples on acid-washed 47mm diameter Whatman-41 (W-41) filters, using procedures of the US GEOTRACES aerosol program (Morton et al., 2013; Marsay et al., 2018). The aerosol sampler was mounted on the Polarstern p-deck.

For 7Be, three of the 47mm aerosol samples were stacked in a plastic Petri dish and counted by gamma spectroscopy. Be-7 has a readily identifiable gamma peak at 478 keV. The counting system was calibrated for all samples by preparing a commercial standard in geometry identical to the samples.

Data Processing Description

BCO-DMO Processing:
- Converted dates to ISO8601 format (YYYY-MM-DDThh:mmZ)
- Adjusted field/parameter names to comply with BCO-DMO naming conventions
- Added a conventional header with dataset name, PI names, version date

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Data Files

File
aerosols.csv (Comma Separated Values (.csv), 2.82 KB) MD5:ce866bab8793c8e9804e08b8b3ce1474 Primary data file for dataset ID 875869

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Related Publications

Marsay, C. M., Kadko, D., Landing, W. M., Morton, P. L., Summers, B. A., & Buck, C. S. (2018). Concentrations, provenance and flux of aerosol trace elements during US GEOTRACES Western Arctic cruise GN01. Chemical Geology. doi:10.1016/j.chemgeo.2018.06.007
Methods

Morton, P. L., Landing, W. M., Hsu, S.-C., Milne, A., Aguilar-Islas, A. M., Baker, A. R., ... Zamora, L. M. (2013). Methods for the sampling and analysis of marine aerosols: results from the 2008 GEOTRACES aerosol intercalibration experiment. Limnology and Oceanography: Methods, 11(2), 62–78. doi:10.4319/lom.2013.11.62
Methods

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Parameters

Parameter	Description	Units
SAMPLE_ID	Sample Identifier	unitless
MOSAIC_EVENTNO	Event number	unitless
ISO_DateTime_Start_UTC	Sample collection start time in UTC, format: YYYY-MM-DDTHH:MMZ	unitless
ISO_DateTime_End_UTC	Sample collection end time in UTC, format: YYYY-MM-DD HH:MM	unitless
START_LATITUDE	Latitude at start of collection, North	decimal degrees
START_LONGITUDE	Longitude at start of collection, East (West is negative)	decimal degrees
END_LATITUDE	Latitude at end of collection, North	decimal degrees
END_LONGITUDE	Longitude at end of collection, East (West is negative)	decimal degrees
AIR_VOL	Volume of air sampled	cubic meters (m3)
Be_7_A_T_CONC_HIVOL	Be-7 concentration	milli Becquerels per cubic meter (mBq/m3)
Be_7_A_T_CONC_HIVOL_ERR	Error associated with Be-7 concentration	milli Becquerels per cubic meter (mBq/m3)

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Instruments

Dataset-specific Instrument Name	Tisch TE-5170V-BL high volume aerosol sampler
Generic Instrument Name	Aerosol Sampler
Generic Instrument Description	A device that collects a sample of aerosol (dry particles or liquid droplets) from the atmosphere.

Dataset-specific Instrument Name	High purity germanium (HPGe) gamma detector
Generic Instrument Name	Gamma Ray Spectrometer
Generic Instrument Description	Instruments measuring the relative levels of electromagnetic radiation of different wavelengths in the gamma-ray waveband.

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Deployments

PS122

Website	https://www.bco-dmo.org/deployment/861601
Platform	R/V Polarstern
Report	https://datadocs.bco-dmo.org/docs/305/MOSAiC/data_docs/Expeditionsprogramm_PS122_leg2.pdf
Start Date	2019-09-20
End Date	2020-10-14
Description	MOSAiC (Multidisciplinary Drifting Observatory of the Study of Arctic Climate) was Polarstern expedition PS122, which started on September 20th 2019 in Tromsø (Norwegian). PS122 was a year-around expedition in the central Arctic Ocean and was divided into six legs (PS122/1 – PS122/6). The expedition finished on October 14th 2020 in Bremerhaven. Additional information can be found at: https://mosaic-expedition.org/ https://epic.awi.de/id/eprint/50082/

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Project Information

Collaborative Research: Defining the Atmospheric Deposition of Trace Elements Into The Arctic Ocean-Ice Ecosystem During The Year-Long MOSAiC Ice Drift (MOSAiC)

Coverage: Central Arctic Ocean

NSF Award Abstract:
This project will use a Beryllium 7 (7-Be) method in a year-long expedition as part of the international Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC) expedition to assess the seasonal variability of aerosol deposition. This is the first modern opportunity for such a comprehensive study of the yearly depositional flux of trace elements (TEs) into the Arctic ocean/ice ecosystem. The combination of 7-Be and aerosol TE measurements has been shown to be an effective tool for estimating the atmospheric input of TEs in remote ocean regions where nearby land-based collection sites do not exist. The data generated in this work will be available to allow ground-truthing of models of aerosol deposition and atmospheric input of TEs. Atmospheric deposition is the dominant pathway by which anthropogenically-derived trace elements, especially mercury (Hg), enter the Arctic Ocean, and recent literature suggests that atmospheric deposition of biologically-essential trace elements such as iron (Fe) could play a major role in controlling biological productivity in the Arctic.

Atmospheric transport and deposition of aerosols is an important delivery mechanism of natural and contaminant trace elements (TEs) to the Arctic. Existing data show that atmospheric deposition of contaminant elements like Hg, Pb, and Se may be a major input of these elements to the Arctic, with likely sources being anthropogenic - industrial or power plant emissions associated with fossil fuel combustion in Europe, Russia, and Asia. The atmospheric input of biologically-essential trace elements (e.g. Mn, Fe, Co, Ni, Cu, Zn) plays a key role in controlling biogeochemical processes in the ocean, and recent work suggests this might be true in the Arctic as well. These inputs have strong implications for the ecosystem, and even human health. Assessment of this input is difficult because measurements of deposition rates in remote ocean regions are scarce, and are particularly daunting to take in the Arctic because harsh conditions and limited research platforms make it difficult to obtain quality-controlled precipitation and aerosol chemistry measurements on a routine basis. This research will provide estimates of the yearly atmospheric deposition flux of aerosol TEs (total and soluble), including those of biogeochemical importance as well as pollutant species. The seasonal evolution of partitioning of trace element deposition among the various catchments (ice, water, snow, melt ponds) will also be assessed. The work will involve measurements of 7-Be inventories, 7-Be aerosol activities, and aerosol concentrations of TEs. Field work will be during a year-long ice drift of the MOSAiC expedition through the

central Arctic Ocean.

This project will be a component of the MOSAiC expedition, an international initiative motivated by the rapidly evolving Arctic climate system, with thinning sea ice, warming ocean and atmosphere temperatures, strong climate feedbacks, and dramatic implications for society. MOSAiC has broad international support and has been endorsed by international and US institutions as a project that is critically needed to provide foundational information on the changing central Arctic system required to support coupled model development. The ability to provide estimates of the atmospheric input of relevant TEs to the Arctic Ocean will contribute widely to the field of chemical oceanography, including understanding anthropogenic impacts on the region and the role atmospheric input of TEs plays in Arctic Ocean ecology. The lead institution is one of the country's leading minority serving universities, and the lead researcher has undertaken a mentoring program for students involved in its research activities. The team will record short lectures and video logs that can be used in future iterations of his courses to introduce important oceanographic concepts and give his students a first-hand account of life aboard an oceanographic vessel. Other scientists will be asked to grant interviews to add to the breadth of perspectives, and the outreach will emphasize the role of basic scientific research in improving our understanding of natural phenomena and the planet's response to anthropogenic stressors.

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Funding

Funding Source	Award
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1753408
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1753423
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1753418

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