

# Mercury stable isotope values for precipitation collected around Station ALOHA from 2005 to 2014

**Website:** <https://www.bco-dmo.org/dataset/788727>

**Data Type:** Cruise Results, Other Field Results

**Version:** 1

**Version Date:** 2020-02-21

## Project

» [Collaborative Research: Isotopic insights to mercury in marine food webs and how it varies with ocean biogeochemistry](#) (Hg\_Biogeochemistry)

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## Abstract

This dataset contains the mercury stable isotope ratios collected in precipitation during R/V Kilo Moana cruises around Station ALOHA. These data were published in Motta et al., (2019) with supporting information.

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## Coverage

**Spatial Extent:** Lat:22.75 Lon:-158

**Temporal Extent:** 2005 - 2014

## Dataset Description

This dataset contains the mercury stable isotope ratios collected in precipitation during R/V Kilo Moana cruises around Station ALOHA. For more information about the ALOHA observatory see: <http://aco-ssds.soest.hawaii.edu/>. These data were published in Motta et al., (2019) with supporting information.

## Methods & Sampling

Open ocean precipitation was collected during the summer cruise using a manual collection method. The

samples from the Island of Hawaii were collected in 2005 at the Hakalau Wildlife Refuge and at the Nature Conservancy Ka'u Preserve. Procedural field blanks were collected periodically during the sampling campaign using 1L of de-ionized water.

After collection all the samples were oxidized with 1% BrCl (wt/v) and allowed to react with the water sample in dark, refrigerated storage for a minimum of one month. Then, the samples were analyzed for THg concentrations using cold vapor - atomic fluorescence spectrophotometry.

For THg isotope determination the oxidized precipitation samples were subsequently reduced, purged and trapped into 1% KMnO<sub>4</sub> solution for isotope analysis. The 1% KMnO<sub>4</sub> solution was analyzed for Hg stable isotope composition using a multiple collector inductively coupled plasma mass spectrometer.

All the methods are detailed in Motta et al., (2019).

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## Data Files

File
<b>hg_isotopes_precipitation.csv</b> (Comma Separated Values (.csv), 788 bytes) MD5:bdc103a3cc2a83f6ef1579a89fb04a8b
Primary data file for dataset ID 788727

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## Related Publications

Blum, J. D., Popp, B. N., Drazen, J. C., Anela Choy, C., & Johnson, M. W. (2013). Methylmercury production below the mixed layer in the North Pacific Ocean. *Nature Geoscience*, 6(10), 879–884. doi:[10.1038/ngeo1918](https://doi.org/10.1038/ngeo1918)  
*General*

Motta, L. C., Blum, J. D., Johnson, M. W., Umhau, B. P., Popp, B. N., Washburn, S. J., ... Lamborg, C. H. (2019). Mercury Cycling in the North Pacific Subtropical Gyre as Revealed by Mercury Stable Isotope Ratios. *Global Biogeochemical Cycles*, 33(6), 777–794. doi:10.1029/2018gb006057 <https://doi.org/10.1029/2018GB006057>  
*Results*

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## Parameters

Parameter	Description	Units
Location	Sampling location	unitless
Date	Sampling date (UTC); format: yyyyymmdd	unitless
Sample_ID	Sample ID	unitless
Total_Hg_concentration	Total Hg concentration	nanograms per liter (ng/L)
d202Hg	Stable isotope ratio; $\delta^{202}\text{Hg}$	per mil (‰)
D199Hg	Stable isotope ratio; $\Delta^{199}\text{Hg}$	per mil (‰)
D201Hg	Stable isotope ratio; $\Delta^{201}\text{Hg}$	per mil (‰)
D200Hg	Stable isotope ratio; $\Delta^{200}\text{Hg}$	per mil (‰)
D204Hg	Stable isotope ratio; $\Delta^{204}\text{Hg}$	per mil (‰)

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## Instruments

<b>Dataset-specific Instrument Name</b>	cold vapor - atomic fluorescence spectrophotometry
<b>Generic Instrument Name</b>	Cold Vapor Atomic Fluorescence Spectrophotometer
<b>Generic Instrument Description</b>	A Cold Vapor Atomic Fluorescent Spectrophotometer (CVAFS) is an instrument used for quantitative determination of volatile heavy metals, such as mercury. CVAFS make use of the characteristic of mercury that allows vapor measurement at room temperature. Mercury atoms in an inert carrier gas are excited by a collimated UV light source at a particular wavelength. As the atoms return to their non-excited state they re-radiate their absorbed energy at the same wavelength. The fluorescence may be detected using a photomultiplier tube or UV photodiode.

<b>Dataset-specific Instrument Name</b>	MC-ICP-MS
<b>Generic Instrument Name</b>	Inductively Coupled Plasma Mass Spectrometer
<b>Dataset-specific Description</b>	multicollector inductively coupled plasma mass spectrometer (MC-ICP-MS; Nu instruments)
<b>Generic Instrument Description</b>	An ICP Mass Spec is an instrument that passes nebulized samples into an inductively-coupled gas plasma (8-10000 K) where they are atomized and ionized. Ions of specific mass-to-charge ratios are quantified in a quadrupole mass spectrometer.

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## Deployments

### KM1418

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/636002">https://www.bco-dmo.org/deployment/636002</a>
<b>Platform</b>	R/V Kilo Moana
<b>Start Date</b>	2014-08-29
<b>End Date</b>	2014-09-11
<b>Description</b>	Original cruise data are available from the NSF R2R data catalog

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## Project Information

**Collaborative Research: Isotopic insights to mercury in marine food webs and how it varies with ocean biogeochemistry (Hg\_Biogeochemistry)**

**Coverage:** Pacific Subtropical Gyre, Station ALOHA 22.75N 158W; equatorial Pacific (10N 155W, 5N 155W)

*NSF award abstract:*

Mercury is a pervasive trace element that exists in several states in the marine environment, including monomethylmercury (MMHg), a neurotoxin that bioaccumulates in marine organisms and poses a human health threat. Understanding the fate of mercury in the ocean and resulting impacts on ocean food webs requires understanding the mechanisms controlling the depths at which mercury chemical transformations occur. Preliminary mercury analyses on nine species of marine fish from the North Pacific Ocean indicated that intermediate waters are an important entry point for MMHg into open ocean food webs. To elucidate the process controlling this, researchers will examine mercury dynamics in regions with differing vertical dissolved oxygen profiles, which should influence depths of mercury transformation. Results of the study will aid in a better understanding of the pathways by which mercury enters the marine food chain and can ultimately impact humans. This project will provide training for graduate and undergraduate students, and spread awareness on oceanic mercury through public outreach and informal science programs.

Mercury isotopic variations can provide insight into a wide variety of environmental processes. Isotopic compositions of mercury display mass-dependent fractionation (MDF) during most biotic and abiotic chemical reactions and mass-independent fractionation (MIF) during photochemical radical pair reactions. The unusual combination of MDF and MIF can provide information on reaction pathways and the biogeochemical history of mercury. Results from preliminary research provide strong evidence that net MMHg formation occurred below the surface mixed layer in the pycnocline and suggested that MMHg in low oxygen intermediate waters is an important entry point for mercury into open ocean food webs. These findings highlight the critical need to understand how MMHg levels in marine biota will respond to changes in atmospheric mercury emissions, deposition of inorganic mercury to the surface ocean, and hypothesized future expansion of oxygen minimum zones. Using field collections across ecosystems with contrasting biogeochemistry and mercury isotope fractionation experiments researchers will fill key knowledge gaps in mercury biogeochemistry. Results of the proposed research will enable scientists to assess the biogeochemical controls on where in the water column mercury methylation and demethylation likely occur.

*Related background publication with supplemental data section:*

Joel D. Blum, Brian N. Popp, Jeffrey C. Drazen, C. Anela Choy & Marcus W. Johnson. 2013. Methylmercury production below the mixed layer in the North Pacific Ocean. *Nature Geoscience* 6, 879–884.

[doi:10.1038/ngeo1918](https://doi.org/10.1038/ngeo1918)

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## Funding

Funding Source	Award
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1433846</a>

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