# OOI Station Papa CTD and Water Sampling Data

**Website**: https://www.bco-dmo.org/dataset/923122
**Data Type**: Cruise Results
**Version**: 1
**Version Date**: 2024-03-21

**Project**
» OOI Discrete CTD and Water Sampling Cruise Data (OOI Cruise Data)

**Program**
» Ocean Observatories Initiative (OOI)

| Contributors | Affiliation | Role |
|---|---|---|
| Plueddemann, Albert | Woods Hole Oceanographic Institution (WHOI) | Principal Investigator |
| Reed, Andrew | Woods Hole Oceanographic Institution (WHOI) | Data Manager |
| Newman, Sawyer | Woods Hole Oceanographic Institution (WHOI BCO-DMO) | BCO-DMO Data Manager |

**Abstract**
The hydrographic sampling performed by OOI-CGSN (the Ocean Observatories Initiative - Coastal and Global Scale Nodes) part of each Array turn represents a significant collection of valuable physical, chemical, and biological information. In addition to the CTD, collected hydrographic data include discrete oxygen, salinity, nutrient (nitrate, nitrite, silicate, phosphate, ammonium), chlorophyll, and carbon system measurements. These data serve several important functions. First, they are necessary for the calibration and evaluation of the moored instrumentation at each Array. Furthermore, the annual (Global) or biannual (Coastal) collection of data at the same locations provides a unique time series of a large set of water properties following established community standards and methods, independent of its association with the OOI moorings. The analyses of collected water samples for the parameters listed above are performed by a number of outside labs on behalf of OOI-CGSN. Consequently, the water sampling data for a given cruise is distributed among a number of different files. The Discrete Sampling Summary integrates the related CTD, metadata, and discrete water sample data into a single file. Additionally, it synthesizes qualitative and quantitative information about the quality of a measurement into data quality flags for each associated parameter which follow WOCE-standards. The final product is the Discrete Sampling Summary spreadsheet which contains the metadata, CTD data and discrete water sample data into a single spreadsheet with data quality flags. This dataset includes hydrographic data from the Global Station Papa Array located in the Gulf of Alaska next to the NOAA Pacific Marine Environmental Laboratory (PMEL) Surface Buoy. The region is extremely vulnerable to ocean acidification, has a productive fishery, and low eddy variability. It is impacted by the Pacific Decadal Oscillation and adds to a broader suite of OOI and other observatory sites in the Northeast Pacific.

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## Coverage

**Location**: Gulf of Alaska

## Dataset Description

### OOI-CGSN CTD Sampling Guidelines

In general, water samples are collected for analysis at depths that correspond to instrumentation making in situ measurements. For example, Near Surface Instrument Frames (NSIFs) have instrumentation that measure dissolved oxygen (DO), salinity (CTD), nitrate (NUTNR), the partial pressure of CO2 (CO2), and chlorophyll a fluorescence, so water samples should be collected at the depth of the NSIF for analyses of all those parameters. Additionally, as noted above, OOI water sampling data are valid long-term datasets in and of themselves. Thus, some measurement locations are driven by broader science questions.

Soak Time – The CTD rosette should be allowed to equilibrate (e.g., the CTD sensor readout stabilizes) at the desired target depth for at least 1 minute or more depending on conditions. Longer soak times may occur to accommodate acoustic release testing or other activities.

### Methods & Sampling

### OOI Global Array Sampling Guidelines

Global Arrays are comprised of 2 sub-surface Flanking Moorings, 1 sub-surface Hybrid Profiler Mooring, and at the Irminger Sea Array 1 Surface Mooring. Open Ocean Gliders and Global Profiling Gliders are also present at the Arrays. Subsections below define the strategy for sampling in the vicinity of each type of platform. Given the number of depths required to be sampled at Global Arrays, a 24-bottle CTD rosette is required.

There are a few general guidelines which also inform the strategies defined below:

- Nutrient data are useful when validating the Carbon system data.
- Should get samples spanning the full water depth at one site at least (typically HYPM).
- Only sample Chlorophyll in the euphotic zone where there is a fluorescence signal detected on the CTD casts. Collect at least one sample per Array where the fluorescence signal is negligible to confirm lack of Chlorophyll.

Sampling at the Global Surface Mooring Location

- Sample the full suite (O2, Salts, Carbon, Nutrients, Chlorophyll) at the surface, 12, 40, 80, 130 m.
- Sample Carbon at additional depths where pH sensors are mounted (at 20, 100 m).
- Also sample O2 and Salts at intervals below 130 where there are CTD sensors.

Sampling at Global Flanking Mooring Locations

- Sample the full suite (O2, Salts, Carbon, Nutrients, Chlorophyll) at 30 m.
- Sample Chlorophyll additionally at surface and the chlorophyll max.
- Sample Nutrients additionally at 130 m.
- Also sample O2 and Salts at 60, 90, 130, 250, 500, 1000, 1500 m

Sampling at the Global Hybrid Profiler Mooring Location

- Sample the full suite (O2, Salts, Carbon, Nutrients, Chlorophyll) at 30 m.
- Sample Chlorophyll additionally at surface and the chlorophyll max, and also at 150 m if there is fluorescence signal.
- Sample O2 and Salts at 150 m, and ~4-6 places along the profiler path(s)

Sampling at Global Profiling Glider Deployment and Recovery Locations

- Sample O2, Salts and Nutrients at the surface, 30, 50, 100 and 200 m.
- Sample Chlorophyll at the surface, 30, 50, 100, and 200 m (if there is a fluorescence signal).

Sampling at Open Ocean Glider Deployment and Recovery Locations

- Sample O2 and Salts at the surface, 30, 50, and every 100 m from 100-1000 m.
- Sample Chlorophyll at the surface, 30, 50, 100, and 200 m (if there is a fluorescence signal).

### Methodology

Salinity

Salinity measurements are performed following the methodology outlined in the WHOI Hydrography Blue Book, *Automated Oxygen Titration and Salinity Determination* (Knapp et al. 1990). Measurements are performed using a Guildline Autosal model 8400B salinometer (Guildline Instruments of Canada). Manufacturer stated accuracy and precision at 35 psu is +/- 0.003 psu and 0.0002 psu. IAPSO standard seawater is used to standardize the Autosal daily before runs.

Oxygen

Dissolved oxygen measurements are performed following the methodology outlined in the WHOI Hydrography Blue Book _Automated Oxygen Titration and Salinity Determination_ (Knapp et al. 1990). Measurements are performed using a Metrohm Model 888 Titrando dosing device, with the titration endpoint determined amperometrically. Stated accuracy is 0.02 ml/l, with a precision of 0.001 ml/l.

Nutrients

All nutrient values are reported as the average of triplicate analysis on a single collected sample.

Carbon System

Carbon system measurements are performed by the Wang lab (Woods Hole Oceanographic Institution). DIC and TA measurements follow the methodology of Wang and Cai (2004) with uncertainties of 2 umol/kg. DIC measurements are performed with an Apollo Sci-Tech AS-C3. TA measurements are performed with an Apollo Sci-Tech AS-ALK2 and ROSS electrode. pH measurements follow the methodology of Clayton and Byrne (1993) with an uncertainty of 0.002 pH units using an Agilent 8453.

Chlorophyll and Phaeo

Analysis was completed using a Turner Designs Aquafluor Handheld 800446.

**Data Processing Description**

**File/row Representation of Water Samples**

There should be one row for each station-cast-niskin bottle. Multiple samples for the same parameter from a single niskin bottle are split into separate rows, with the associated CTD data copied to the new row. The first row of the file is the column headers.

**Data Fill Values and Flag Description**

The data flags are presented in the summary sheet as a 16-bit array, read from right-to-left, where a 1 in a particular bit position indicates a particular flag meaning applies. For example, a flag of 0000000000000010 for the column **CTD_File_Flag** indicates that the cast was a data cast only.

Additionally, these data flags an assessment of the collection and processing of the relevant data or samples, and are not an assessment of the *accuracy* of the data. For example, a conductivity sensor which has the correct calibration coefficients and functions normally will receive a quality flag of 0000000000000100 (acceptable measurement). However, the calibration coefficients may be out of date and off with respect to the discrete salinity results; this does not affect the assigned flag.

For full details about flag meanings, refer to the Readme files available for download in the Supplemental Files section of this metadata page.

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## Related Publications

Clayton, T. D., & Byrne, R. H. (1993). Spectrophotometric seawater pH measurements: total hydrogen ion concentration scale calibration of m-cresol purple and at-sea results. Deep Sea Research Part I: Oceanographic

Research Papers, 40(10), 2115–2129. doi:10.1016/0967-0637(93)90048-8
*Methods*

Knapp, G. P., Stalcup, M. C., & Staney, R. J. (1990). Automated oxygen titration and salinity determination. https://doi.org/10.1575/1912/1020
*Methods*

Wang, Z. A., & Cai, W.-J. (2004). Carbon dioxide degassing and inorganic carbon export from a marsh-dominated estuary (the Duplin River): A marsh CO2pump. Limnology and Oceanography, 49(2), 341–354. doi:10.4319/lo.2004.49.2.0341
*Methods*

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## Parameters

*Parameters for this dataset have not yet been identified*

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## Instruments

| | |
|---|---|
| **Dataset-specific Instrument Name** | Apollo Sci-Tech AS-ALK2 and ROSS electrode |
| **Generic Instrument Name** | Apollo SciTech AS-ALK2 total alkalinity titrator |
| **Dataset-specific Description** | Carbon system measurements are performed by the Wang lab (Woods Hole Oceanographic Institution). DIC and TA measurements follow the methodology of Wang and Cai (2004) with uncertainties of 2 umol/kg. DIC measurements are performed with an Apollo Sci-Tech AS-C3. TA measurements are performed with an Apollo Sci-Tech AS-ALK2 and ROSS electrode. pH measurements follow the methodology of Clayton and Byrne (1993) with an uncertainty of 0.002 pH units using an Agilent 8453. |
| **Generic Instrument Description** | An automated acid-base titrator for use in aquatic carbon dioxide parameter analysis. The titrator provides standardisation and sample analysis, using the Gran titration procedure for alkalinity determination of seawater and brackish waters. It is designed for both shipboard and land based laboratory use. The precision of the instrument is 0.1 percent or higher, and sample volumes may range from 10-25 ml. Titration takes approximately 8 minutes per sample, and the repeatability is within plus or minus 1-2 micromoles per kg. |

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|---|---|
| **Dataset-specific Instrument Name** | Metrohm Model 888 Titrando dosing device |
| **Generic Instrument Name** | Automatic titrator |
| **Dataset-specific Description** | Dissolved oxygen measurements are performed following the methodology outlined in the WHOI Hydrography Blue Book _Automated Oxygen Titration and Salinity Determination_ (Knapp et al. 1990). Measurements are performed using a Metrohm Model 888 Titrando dosing device, with the titration endpoint determined amperometrically. Stated accuracy is 0.02 ml/l, with a precision of 0.001 ml/l. |
| **Generic Instrument Description** | Instruments that incrementally add quantified aliquots of a reagent to a sample until the end-point of a chemical reaction is reached. |

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|---|---|
| **Dataset-specific Instrument Name** | 8400B salinometer (Guildline Instruments of Canada) |
| **Generic Instrument Name** | Autosal salinometer |
| **Dataset-specific Description** | Salinity measurements are performed following the methodology outlined in the WHOI Hydrography Blue Book _Automated Oxygen Titration and Salinity Determination_(Knapp et al. 1990). Measurements are performed using a Guildline Autosal model 8400B salinometer (Guildline Instruments of Canada). Manufacturer stated accuracy and precision at 35 psu is +/- 0.003 psu and 0.0002 psu. IAPSO standard seawater is used to standardize the Autosal daily before runs. |
| **Generic Instrument Description** | The salinometer is an instrument for measuring the salinity of a water sample. |

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|---|---|
| **Dataset-specific Instrument Name** | Niskin |
| **Generic Instrument Name** | Niskin bottle |
| **Dataset-specific Description** | Niskin bottles on CTD rosette used to collect water samples. |
| **Generic Instrument Description** | A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc. |

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|---|---|
| **Dataset-specific Instrument Name** | SBE 43 |
| **Generic Instrument Name** | Sea-Bird SBE 43 Dissolved Oxygen Sensor |
| **Dataset-specific Description** | SBE used to determine CTD oxygen values. |
| **Generic Instrument Description** | The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. more information from Sea-Bird Electronics |

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|---|---|
| **Dataset-specific Instrument Name** | WL CSTAR Trans |
| **Generic Instrument Name** | WET Labs {Sea-Bird WETLabs} C-Star transmissometer |
| **Dataset-specific Description** | Wet Labs CSTAR Transmissometer was used to determine Beam Attenuation and Beam Transmission values. |
| **Generic Instrument Description** | The C-Star transmissometer has a novel monolithic housing with a highly intgrated opto-electronic design to provide a low cost, compact solution for underwater measurements of beam transmittance. The C-Star is capable of free space measurements or flow-through sampling when used with a pump and optical flow tubes. The sensor can be used in profiling, moored, or underway applications. Available with a 6000 m depth rating. More information on Sea-Bird website: https://www.seabird.com/c-star-transmissometer/product?id=60762467717 |

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## Deployments

**MV1309**

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|---|---|
| **Website** | https://www.bco-dmo.org/deployment/923137 |
| **Platform** | R/V Melville |
| **Start Date** | 2013-07-15 |
| **End Date** | 2013-07-30 |
| **Description** | Project: Ocean Observatories Initiative (OOI): Station Papa Array, Leg 1 Start Port: Seattle, Washington End Port: Seattle, Washington |

**TN323**

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|---|---|
| **Website** | https://www.bco-dmo.org/deployment/923141 |
| **Platform** | R/V Thomas G. Thompson |
| **Start Date** | 2015-05-29 |
| **End Date** | 2015-06-14 |
| **Description** | Project: Ocean Observatories Initiative (OOI): Station Papa Array, Leg 3 Start Port: Seattle, Washington End Port: Dutch Harbor, Alaska |

**MV1404**

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|---|---|
| **Website** | https://www.bco-dmo.org/deployment/923139 |
| **Platform** | R/V Melville |
| **Start Date** | 2014-06-10 |
| **End Date** | 2014-06-29 |
| **Description** | Project: Ocean Observatories Initiative (OOI): Station Papa Array, Leg 2 Start Port: Seattle, Washington End Port: Seattle, Washington |

**RB1605**

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|---|---|
| **Website** | https://www.bco-dmo.org/deployment/923877 |
| **Platform** | NOAA Ship Ronald H. Brown |
| **Start Date** | 2016-06-22 |
| **End Date** | 2016-07-08 |
| **Description** | Start Port: USCG base in Seattle, Washington End Port: USCG base in Seattle, Washington Project: Project: Ocean Observatories Initiative (OOI): Station Papa Array, Leg 4 |

**SR1710**

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|---|---|
| **Website** | https://www.bco-dmo.org/deployment/923880 |
| **Platform** | R/V Sally Ride |
| **Start Date** | 2017-07-07 |
| **End Date** | 2017-07-22 |
| **Description** | Start Port: Alameda, California End Port: Alameda, California Project: Papa Global Site of the OOI Coastal and Global Nodes |

**SR1811**

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|---|---|
| **Website** | https://www.bco-dmo.org/deployment/923883 |
| **Platform** | R/V Sally Ride |
| **Start Date** | 2018-07-17 |
| **End Date** | 2018-08-03 |
| **Description** | Start Port: Newport, Oregon End Port: Seattle, Washington Project: Ocean Climate Station Papa |

**SKQ201920S**

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|---|---|
| **Website** | https://www.bco-dmo.org/deployment/923887 |
| **Platform** | R/V Sikuliaq |
| **Start Date** | 2019-09-18 |
| **End Date** | 2019-10-05 |
| **Description** | Start Port: Newport, Oregon End Port: Newport, Oregon Project: OOI Papa-Newhall |

**SKQ202111S**

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|---|---|
| **Website** | https://www.bco-dmo.org/deployment/923897 |
| **Platform** | R/V Sikuliaq |
| **Start Date** | 2021-07-18 |
| **End Date** | 2021-08-02 |
| **Description** | Start Port: Seward, Alaska End Port: Seward, Alaska Project: OOI Global Station Papa Deployment 8 |

**SKQ202208S**

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|---|---|
| **Website** | https://www.bco-dmo.org/deployment/923900 |
| **Platform** | R/V Sikuliaq |
| **Start Date** | 2022-05-11 |
| **End Date** | 2022-05-30 |
| **Description** | Start Port: Seward, Alaska End Port: Seattle, Washington Project: OOI Global Station Papa Deployment 9 |

**SKQ202308S**

| | |
|---|---|
| **Website** | https://www.bco-dmo.org/deployment/923904 |
| **Platform** | R/V Sikuliaq |
| **Start Date** | 2023-05-13 |
| **End Date** | 2023-05-28 |
| **Description** | Start Port: Seward, Alaska End Port: Seward, Alaska Project: OOI Global Station Papa |

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## Project Information

**OOI Discrete CTD and Water Sampling Cruise Data (OOI Cruise Data)**

**Website**: https://oceanobservatories.org/

The hydrographic sampling performed by the Ocean Observatories Initiative (OOI) as part of each research array turn represents a significant collection of valuable physical, chemical, and biological information. The collected hydrographic data include oxygen, salinity, nutrient (nitrate, nitrite, silicate, phosphate, ammonium), chlorophyll, and carbon system (dissolved inorganic carbon, total alkalinity, pH and partial pressure of $CO_2$) measurements. These data serve several important functions. First, they are necessary for the validation and evaluation of the moored instrumentation at each Array. Furthermore, the annual (Global Arrays and the Regional Cabled Array (RCA) or biannual (Coastal Arrays and the Endurance Array) collection of data at the same locations provides a unique timeseries of a large set of water properties following established community standards and methods, independent of its association with the OOI instrumentation.

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## Program Information

**Ocean Observatories Initiative (OOI)**

**Website**: http://oceanobservatories.org/

The Ocean Observatories Initiative (OOI) is a science-driven ocean observing network that delivers real-time data to address critical science questions regarding the world's oceans. Funded by the National Science Foundation to encourage scientific investigation, OOI data are freely available online to anyone with an Internet connection. OOI was designed as a long-term project to collect ocean data for up to 30 years. This longevity makes it possible to measure and directly observe both short-lived episodic events and longer-term changes

occurring in the ocean. Such data make it possible to better understand ocean processes and how the ocean is changing.

The OOI has five active research arrays that comprise the three major observatory elements linked together by instrument, infrastructure, and information management systems. Global Ocean Arrays consist of moored arrays and autonomous vehicles that provide time-series observations and mesoscale spatial sampling at sparsely sampled, high-latitude regions critical to our understanding of climate, the carbon cycle, and ocean circulation. The Regional Cabled Array consists of fiber-optic cables off the Oregon coast that provide unprecedented power, bandwidth, and communication to seafloor instrumentation and profiler moorings, enabling monitoring of volcanic and hydrothermal activity, methane seeps, earthquakes, and myriad ocean processes in coastal and blue water environments. Coastal Arrays consist of cross-shelf moored arrays and autonomous vehicles that observe the dynamic coastal environment, enabling examination of upwelling, shelf break fronts, and cross-shelf exchanges.

These marine arrays are outfitted with more than 900 instruments — of 45 different types — measuring more than 200 different parameters. These instruments gather physical, chemical, geological, and biological data – from the air-sea interface to the seafloor. The data collected are transmitted through a cyberinfrastructure, an information management system that allows users to access real- to near real-time data from suites of sensors. The OOI provides annotations and automated quality control for data streams and is working to meet the IOOS Quality Assurance of Real Time Ocean Data (QARTOD) standards.

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## Funding


| Funding Source | Award |
|---|---|
| NSF Division of Ocean Sciences (NSF OCE) | OCE-1026342 |
| NSF Division of Ocean Sciences (NSF OCE) | OCE-1743430 |
| NSF Division of Ocean Sciences (NSF OCE) | OCE-2244833 |


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