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# Data Access: Other Methods

Andrew Reed - OOI Coastal & Global Scale Nodes  
OOI Pioneer MAB Community Workshop  
Wednesday, September 11, 2024



# Accessing OOI Data

## Data Explorer

- Web Interface w/GUI
- Utilizes merged gold copy THREDDS datasets
- Data also accessible via ERDDAP server

## OOINet

- OOI's legacy data access portal
- Queries the THREDDs server
- Has (almost) all instruments and associated data parameters, including engineering and low-level sensor outputs
- Allows access to Annotations, Provenance, and Sensor metadata
- **Only way to get credentials for using OOI's API**

## THREDDS (Thematic Real-Time Environmental Distributed Data Services)

- Co-located instrument(s) if needed for processing
- Files created by OOI either for a user request or daily (Gold Copy)

## M2M (Machine-2-Machine)

- OOI's API
- Allows for programmatic access to OOI data
- Also allows access to metadata: deployment info, calibrations, asset vocab, annotations, provenance

## Raw Data Archive

- Provides access to the raw data
- Only source of PI-added instruments and certain high-volume (e.g. Bio-Acoustic Sonar) datasets

## IFCB Dashboard

- Access to PLIMS data, including ship and discrete datasets
- Hosted on a separate server with direct access to raw data files (.hdr, .adc, and .roi)



# Terminology (Handout: Decoder)

- **Array**
  - One of 5 major research components that make up OOI (e.g. Ocean Station Papa or Coastal Endurance)
- **Site**
  - A specific geographic location within an array (e.g. Global Ocean Station Papa Flanking Mooring A = GP03FLMA)
- **Platform**
  - A set of infrastructure within an array that host a complement of integrated scientific instrument. May be fixed (mooring) or mobile (profilers or gliders)
- **Node**
  - A section of a platform with one or more computers and power controllers. Instruments on platforms are plugged into nodes. (e.g. mooring riser on Global Ocean Station Papa Flanking Mooring A = GP03FLMA-RIS01)
- **Instrument/Sensor**
  - Terms often used interchangeably. An **instrument** is a piece of equipment used to collect data. A **sensor** is a part of an instrument which measures a specific quantity.
  - Each instrument has a **Unique ID (UID)**
- **Reference Designator**
  - Identifies a particular instrument on a particular node/platform at a particular site.
  - Example: **GP03FLMA-RIS01-02-DOSTAD000** = Global Ocean Station Papa Flanking Mooring A - Mooring Riser - Dissolved Oxygen Sensor
- **Method**
  - **Telemetered:** Data returned wirelessly. Often truncated or decimated due to size.
  - **Recovered\_host/Recovered\_inst:** Data downloaded directly from either the mooring computer or from the instrument.
  - **Streamed:** Data accessible nearly instantaneously. Limited to cabled array and Endurance shelf stations
- **Data Stream**
  - Raw data feed from a sensor that has been read, parsed, and separated based on content (e.g. engineering, science, metadata, etc.)
- **Parameters**
  - Also sometimes called data variables.
  - A particular value returned from a sensor (e.g. practical salinity from a CTD). Many parameters are in a given datastream.
- **Annotation**
  - A human-in-the-loop assessment of the data added to the datasets for specified time periods by the operators.
  - Provides info on data quality, performance, issues, and context.





# Raw Data Archive

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- Raw instrument and engineering datasets presented in an Apache file system structure for download
- “Raw” indicates data as they are received from the instrument, in instrument specific formats
  - May contain data for multiple sensors (interleaved), be in engineering units (counts, volts), have some processing already done by the instrument
  - Data often not in familiar vendor formats (e.g. binary/hex data for inductive instruments)
- Going forward, will also provide access to ship data, which includes:
  - Underway data (e.g. ship MET, ADCP, TSG, NMEA, etc.)
  - Independent instrument data sets (CTD – mounted LISST, underway IFCB samples)
  - Discrete sampling data
- This server provides access to the raw data for:
  - SMEs access to assist with quality control of specialized instrumentation
  - Allow users access to perform their own parsing/processing instead of relying on OOI
  - Supports MIO monitoring of deployed instruments and equipment
  - Only source of PI-added instruments and certain high-volume (e.g. Bio-Acoustic Sonar) datasets)



# Raw Data Archive: Finding an instrument

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- Unless you already know the route to the specific platform & instrument you want, you should start on Data Explorer or the OOI website
- Start on the landing page and navigate to the platform, instrument, or parameter
- Next, find the reference designator (*e.g. CP10CNSM-MFD37-03-TURBDA000*)
  - CP10CNSM = Pioneer MAB Central Surface Mooring
  - MFD37 = Seafloor Multifunction Node
  - 03-TURBDA000 = Name of the instrument (turbidity sensor)



# Raw Data Archive: Organization

- The archive is a mirror of the data repository where all raw data enters the system
- Uncabled mooring data are organized by deployment/recovery number for each uncabled platform (e.g., D00001/R00001), with subfolders for each node (control computer), containing another subfolder for each attached instrument which contains all data for that instrument from that deployment
- Cabled data are pulled from two archives and merged. Most cabled data are organized by site and node, which refers to the alphanumeric ID of the junction box attached directly to the undersea cable that aggregates, time-stamps, and routes the data from all instruments connected to that node. Instrument data are then organized by date (yyyy/mm/dd)
- Uncabled mobile assets (i.e., gliders and AUVs) are organized similarly, but the subfolders below the deployment/recovery number are organized based on the glider's internal science computer file structure:
  - Telemetered data folders are titled D0000\*, and contain subfolders called archive, from-glider, logs, and merged from-glider.
  - Recovered data folders (R0000\*) are titled cache, merged, dvl, flight, and science.
  - "Merged" folders contain most of the science instrument and engineering data of interest, although the glider ADCP data is contained in the "dvl" subfolder.



# Raw Data Archive: Access metadata

- Raw instrument and engineering datasets presented in an Apache file system structure for download
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  - Supports MIO monitoring of deployed instruments and equipment
  - Only source of PI-added instruments and certain high-volume (e.g. Bio-Acoustic Sonar) datasets)





CP05MOAS-GL380/	2022-07-27 14:58	- Coastal Pioneer NES - Mobile Asset - Coastal Glider 380
CP05MOAS-GL387/	2021-09-09 18:36	- Coastal Pioneer NES - Mobile Asset - Coastal Glider 387
CP05MOAS-GL388/	2023-02-07 15:59	- Coastal Pioneer NES - Mobile Asset - Coastal Glider 388
CP05MOAS-GL389/	2023-02-07 16:15	- Coastal Pioneer NES - Mobile Asset - Coastal Glider 389
CP05MOAS-GL514/	2023-02-07 16:20	- Coastal Pioneer NES - Mobile Asset - Coastal Glider 514
CP05MOAS-GL559/	2022-11-30 15:58	- Coastal Pioneer NES - Mobile Asset - Coastal Glider 559
CP05MOAS-PG564/	2022-11-30 16:31	- Coastal Pioneer NES - Mobile Asset - Coastal Profiling Glider 564
CP05MOAS-PG583/	2021-09-09 18:36	- Coastal Pioneer NES - Mobile Asset - Coastal Profiling Glider 583
CP10CNSM/	2024-03-13 15:21	- Coastal Pioneer MAB - Central Coastal Surface Mooring
CP11NOSM/	2024-02-26 15:29	- Coastal Pioneer MAB - Northern Coastal Surface Mooring
CP11SOSM/	2024-02-14 23:58	- Coastal Pioneer MAB - Southern Coastal Surface Mooring
CP12CNSW/	2024-04-12 14:03	- Coastal Pioneer MAB - Central Shallow Water Mooring
CP12WESW/	2024-04-12 14:04	- Coastal Pioneer MAB - Western Shallow Water Mooring
CP13EAPM/	2024-03-06 21:39	- Coastal Pioneer MAB - Eastern Coastal Profiler Mooring
CP13NOPM/	2024-03-06 21:40	- Coastal Pioneer MAB - Northern Coastal Profiler Mooring
CP13SOPM/	2024-03-06 21:40	- Coastal Pioneer MAB - Southern Coastal Profiler Mooring
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CP15MOAS-G0913/	2024-07-05 17:24	- Coastal Pioneer MAB - Mobile Asset - Coastal Glider 913
CP15MOAS-GL339/	2024-08-28 13:50	- Coastal Pioneer MAB - Mobile Asset - Coastal Glider 339
CP15MOAS-GL379/	2024-07-05 15:23	- Coastal Pioneer MAB - Mobile Asset - Coastal Glider 379
CP15MOAS-GL380/	2024-08-28 13:50	- Coastal Pioneer MAB - Mobile Asset - Coastal Glider 380
CP15MOAS-GL387/	2024-07-05 18:40	- Coastal Pioneer MAB - Mobile Asset - Coastal Glider 387
CP15MOAS-GL559/	2024-08-28 13:50	- Coastal Pioneer MAB - Mobile Asset - Coastal Glider 559
CP15MOAS-PG564/	2024-08-28 13:49	- Coastal Pioneer MAB - Mobile Asset - Coastal Profiling Glider 564
CP15MOAS-PG583/	2024-07-05 15:27	- Coastal Pioneer MAB - Mobile Asset - Coastal Profiling Glider 583
CP16MOAS-A6263/	2024-04-15 20:40	- Coastal Pioneer MAB - Mobile Asset - AUV 6263
CP16MOAS-A6264/	2024-04-15 20:46	- Coastal Pioneer MAB - Mobile Asset - AUV 6264
GA01SUMO/	2021-09-09 18:36	- Global Argentine Basin - Apex Surface Mooring
GA02HYPM/	2021-09-09 18:36	- Global Argentine Basin - Apex Profiler Mooring
GA03FLMA/	2021-09-09 18:36	- Global Argentine Basin - Flanking Subsurface Mooring A
GA03FLMB/	2021-09-09 18:36	- Global Argentine Basin - Flanking Subsurface Mooring B
GA05MOAS-GL364/	2021-09-09 18:36	- Global Argentine Basin - Mobile Asset - Open Ocean Glider 364
GA05MOAS-GL470/	2021-09-09 18:36	- Global Argentine Basin - Mobile Asset - Open Ocean Glider 470
GA05MOAS-GL493/	2021-09-09 18:36	- Global Argentine Basin - Mobile Asset - Open Ocean Glider 493
GA05MOAS-GL494/	2021-09-09 18:36	- Global Argentine Basin - Mobile Asset - Open Ocean Glider 494
GA05MOAS-GL495/	2021-09-09 18:36	- Global Argentine Basin - Mobile Asset - Open Ocean Glider 495
GA05MOAS-GL496/	2021-09-09 18:36	- Global Argentine Basin - Mobile Asset - Open Ocean Glider 496
GA05MOAS-GL538/	2021-09-09 18:36	- Global Argentine Basin - Mobile Asset - Open Ocean Glider 538
GA05MOAS-PG562/	2021-09-09 18:36	- Global Argentine Basin - Mobile Asset - Profiling Glider 562
GA05MOAS-PG563/	2021-09-09 18:36	- Global Argentine Basin - Mobile Asset - Profiling Glider 563
GA05MOAS-PG578/	2021-09-09 18:36	- Global Argentine Basin - Mobile Asset - Profiling Glider 578
GA05MOAS-PG580/	2021-09-09 18:36	- Global Argentine Basin - Mobile Asset - Profiling Glider 580
GI01SUMO/	2024-07-19 15:28	- Global Irminger Sea - Apex Surface Mooring
GI02HYPM/	2024-07-19 02:03	- Global Irminger Sea - Apex Profiler Mooring
GI03FLMA/	2024-07-19 02:28	- Global Irminger Sea - Flanking Subsurface Mooring A
GI03FLMB/	2024-07-19 02:30	- Global Irminger Sea - Flanking Subsurface Mooring B
GI05MOAS-G0898/	2023-09-07 14:58	- Global Irminger Sea - Mobile Asset - Open Ocean Glider 898
GI05MOAS-GL363/	2021-09-09 18:36	- Global Irminger Sea - Mobile Asset - Open Ocean Glider 363
GI05MOAS-GL365/	2021-09-09 18:36	- Global Irminger Sea - Mobile Asset - Open Ocean Glider 365
GI05MOAS-GL453/	2021-09-09 18:36	- Global Irminger Sea - Mobile Asset - Open Ocean Glider 453
GI05MOAS-GL469/	2023-02-08 16:46	- Global Irminger Sea - Mobile Asset - Open Ocean Glider 469





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Documentation

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Name	Last modified	Size	Description
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cpm3/	2024-03-20 14:10	-	
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dcl26/	2024-03-20 14:05	-	
dcl27/	2024-04-12 16:02	-	
dcl36/	2024-03-20 14:08	-	
dcl37/	2024-03-20 14:09	-	
gps/	2024-03-20 13:48	-	
pwrsys/	2024-09-06 00:00	-	
rsync/	2024-02-23 16:00	-	
superv/	2024-03-20 13:48	-	
syslog/	2024-09-06 00:03	-	
uplink_logs/	2024-03-20 17:06	-	
putlist.bak	2024-03-16 05:30	21K	
putlistRelative.txt	2024-03-16 05:16	16K	

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## Documentation

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 <a href="#">20240403.turbd.log</a>	2024-04-03 23:57	1.3M	
 <a href="#">20240404.turbd.log</a>	2024-04-04 23:59	1.5M	
 <a href="#">20240405.turbd.log</a>	2024-04-05 13:06	844K	
 <a href="#">20240406.turbd.log</a>	2024-04-06 23:57	1.5M	
 <a href="#">20240407.turbd.log</a>	2024-04-07 23:57	1.5M	



2024/07/18 00:00:13.111 [turbd:DLOGP3]:Instrument sampling - Data logger entering data acquisition state			
2024/07/18	00:00:13.148	18/24	00:00:06
2024/07/18	00:00:14.275	07/18/24	00:00:07
2024/07/18	00:00:15.403	07/18/24	00:00:08
2024/07/18	00:00:16.530	07/18/24	00:00:09
2024/07/18	00:00:17.659	07/18/24	00:00:11
2024/07/18	00:00:18.786	07/18/24	00:00:12
2024/07/18	00:00:19.914	07/18/24	00:00:13
2024/07/18	00:00:21.041	07/18/24	00:00:14
2024/07/18	00:00:22.760	07/18/24	00:00:15
2024/07/18	00:00:23.297	07/18/24	00:00:16
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2024/07/18	00:00:25.553	07/18/24	00:00:18
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2024/07/18	00:00:35.722	07/18/24	00:00:29
2024/07/18	00:00:36.832	07/18/24	00:00:30
2024/07/18	00:00:37.960	07/18/24	00:00:31
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2024/07/18	00:00:44.728	07/18/24	00:00:38
2024/07/18	00:00:45.856	07/18/24	00:00:39
2024/07/18	00:00:46.983	07/18/24	00:00:40
2024/07/18	00:00:48.112	07/18/24	00:00:41
2024/07/18	00:00:49.239	07/18/24	00:00:42
2024/07/18	00:00:50.369	07/18/24	00:00:43
2024/07/18	00:00:51.496	07/18/24	00:00:44
2024/07/18	00:00:52.624	07/18/24	00:00:46
2024/07/18	00:00:53.751	07/18/24	00:00:47
2024/07/18	00:00:54.879	07/18/24	00:00:48
2024/07/18	00:00:56.007	07/18/24	00:00:49
2024/07/18	00:00:57.136	07/18/24	00:00:50
2024/07/18	00:00:58.263	07/18/24	00:00:51
2024/07/18	00:00:59.392	07/18/24	00:00:52
2024/07/18	00:01:00.520	07/18/24	00:00:53
2024/07/18	00:01:01.648	07/18/24	00:00:55
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2024/07/18	00:01:03.905	07/18/24	00:00:57
2024/07/18	00:01:05.033	07/18/24	00:00:58
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2024/07/18	00:01:18.567	07/18/24	00:01:11
2024/07/18	00:01:19.696	07/18/24	00:01:13
2024/07/18	00:01:20.823	07/18/24	00:01:14
2024/07/18	00:01:21.951	07/18/24	00:01:15
2024/07/18	00:01:23.079	07/18/24	00:01:16
2024/07/18	00:01:24.207	07/18/24	00:01:17
2024/07/18	00:01:25.335	07/18/24	00:01:18
2024/07/18	00:01:26.463	07/18/24	00:01:19
2024/07/18	00:01:27.591	07/18/24	00:01:21
2024/07/18	00:01:28.719	07/18/24	00:01:22
2024/07/18	00:01:29.850	07/18/24	00:01:23
2024/07/18	00:01:30.975	07/18/24	00:01:24
2024/07/18	00:01:32.189	07/18/24	00:01:25
2024/07/18	00:01:33.232	07/18/24	00:01:26
2024/07/18	00:01:34.360	07/18/24	00:01:27

# THREDDS

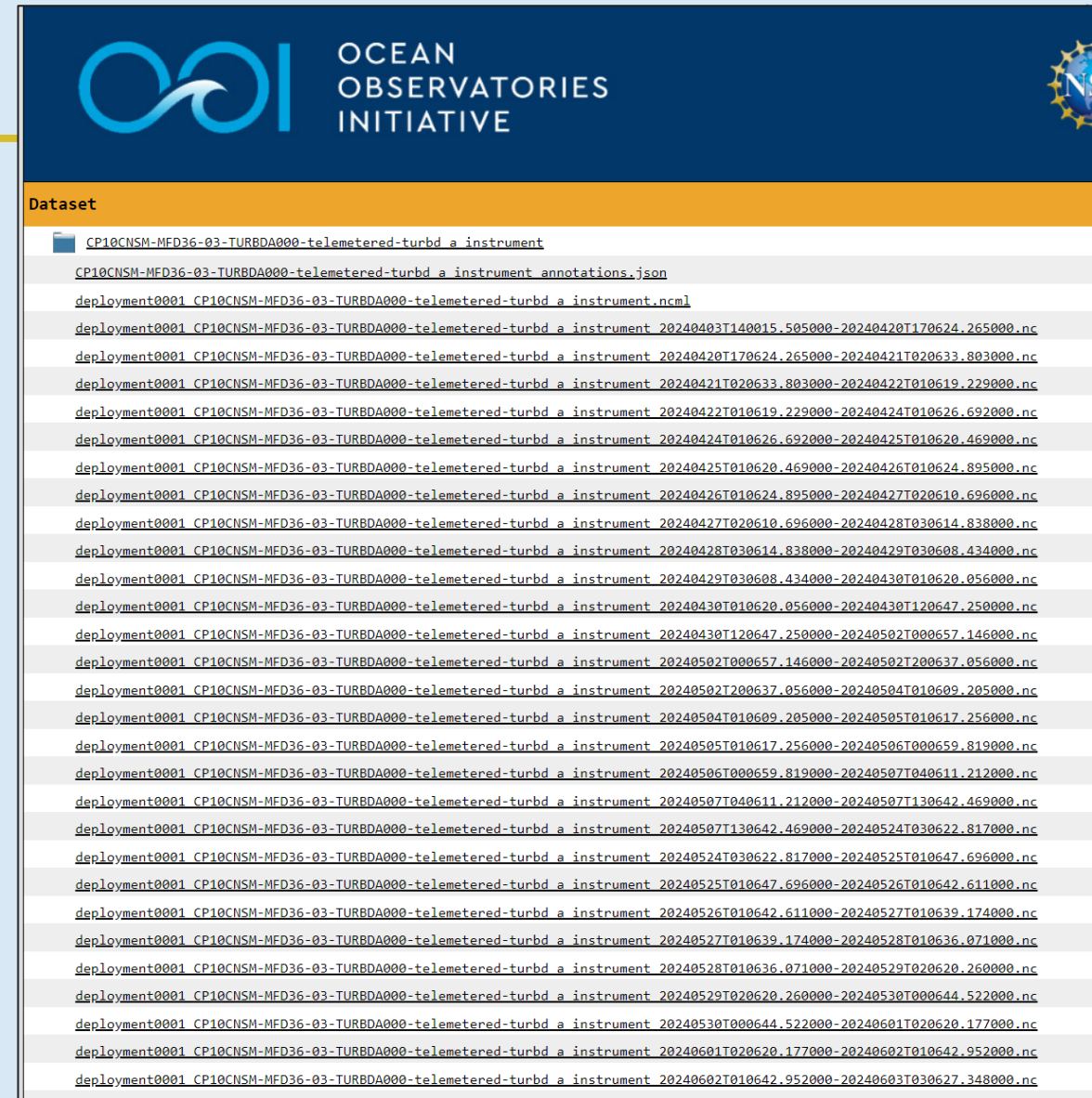
## Thematic Real-Time Environmental Distributed Data Services

### M2M Requests

- User and request specific
- Temporal Organization
- Limited Retention Time

### Gold Copy THREDDS

- Created by OOI processes, updated daily
- Organized by reference designator, delivery method, stream
- Covers **most** datasets provide by OOI through the M2M system except engineering and metadata streams
- ***Basis for the data served by Data Explorer***
- <https://thredds.dataexplorer.oceanobservatories.org/thredds/catalog/ooigoldcopy/public/catalog.html>



Dataset
CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument
CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument annotations.json
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument.ncml
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240403T140015.505000-20240420T170624.265000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240420T170624.265000-20240421T020633.803000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240421T020633.803000-20240422T010619.229000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240422T010619.229000-20240424T010626.692000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240424T010626.692000-20240425T010620.469000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240425T010620.469000-20240426T010624.895000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240426T010624.895000-20240427T020610.696000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240427T020610.696000-20240428T030614.838000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240428T030614.838000-20240429T030608.434000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240429T030608.434000-20240430T010620.056000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240430T010620.056000-20240430T120647.250000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240430T120647.250000-20240502T000657.146000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240502T000657.146000-20240502T200637.056000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240502T200637.056000-20240504T010609.205000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240504T010609.205000-20240505T010617.256000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240505T010617.256000-20240506T000659.819000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240506T000659.819000-20240507T040611.212000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240507T040611.212000-20240507T130642.469000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240507T130642.469000-20240524T030622.817000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240524T030622.817000-20240525T010647.696000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240525T010647.696000-20240526T010642.611000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240526T010642.611000-20240527T010639.174000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240527T010639.174000-20240528T010636.871000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240528T010636.871000-20240529T020620.260000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240529T020620.260000-20240530T000644.522000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240530T000644.522000-20240601T020620.177000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240601T020620.177000-20240602T010642.952000.nc
deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240602T010642.952000-20240603T030627.348000.nc



# THREDDS

## Searching Files

- Organized by deployment number, reference designator, method, stream, and file contents
- File types:
  - Annotations:** Should include all annotations associated w/the reference designator but doesn't. Will need to query for annotations separately.
  - NCML:** Don't use. Bug in backend when they are created
  - NC:** netCDF files time stamped based on time coverage in the file. These contain the instrument data.
  - Provenance:** Dump of metadata. Contains info about every deployment, every calibration coefficient used, the processing path and functions used, etc.
- Co-located instruments, if needed for processing any parameters (e.g. co-located CTD data for oxygen concentrations from oxygen optodes)

Ocean Observatories Initiative logo and name.

Dataset: CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument.ncml

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240403T140015.505000-20240420T170624.265000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240420T170624.265000-20240421T020633.803000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240421T020633.803000-20240422T010619.229000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240422T010619.229000-20240424T010626.692000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240424T010626.692000-20240425T010620.469000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240425T010620.469000-20240426T010624.895000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240426T010624.895000-20240427T020610.696000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240427T020610.696000-20240428T030614.838000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240428T030614.838000-20240429T030608.434000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240429T030608.434000-20240430T010620.056000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240430T010620.056000-20240430T120647.250000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240430T120647.250000-20240502T000657.146000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240502T000657.146000-20240502T200637.056000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240502T200637.056000-20240504T010609.205000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240504T010609.205000-20240505T010617.256000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240505T010617.256000-20240506T000659.819000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240506T000659.819000-20240507T040611.212000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240507T040611.212000-20240507T130642.469000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240507T130642.469000-20240524T030622.817000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240524T030622.817000-20240525T010647.696000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240525T010647.696000-20240526T010642.611000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240526T010642.611000-20240527T010639.174000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240527T010639.174000-20240528T010636.071000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240528T010636.071000-20240529T020620.260000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240529T020620.260000-20240530T000644.522000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240530T000644.522000-20240601T020620.177000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240601T020620.177000-20240602T010642.952000.nc

deployment0001 CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd a instrument 20240602T010642.952000-20240603T030627.348000.nc

# THREDDS

- Downloading data
  - OPeNDAP: An OPeNDAP dataset access form with the OPeNDAP link to the data and metadata. Use this to open data remotely (e.g. with xarray in python, etc)
  - NCML: don't use, bug when generating files
  - UDDC: evaluation of how well the metadata contained in the dataset conform to the netCDF Attribute Convention for Data Discovery (NACDD)
  - ISO: an ISO 19115 metadata representation of the dataset
  - **HTTPServer**: Use this link if you want a direct download of the file to your computer
- Access via code (examples from Chris Wingard – Endurance Array)
  - Matlab:  
[https://matlab.mathworks.com/users/wingardc@onid.oregonstate.edu/Published/nep\\_2022/matlab\\_thredds\\_erddap.html](https://matlab.mathworks.com/users/wingardc@onid.oregonstate.edu/Published/nep_2022/matlab_thredds_erddap.html)
  - Python:  
<https://nbviewer.ipython.org/gist/cwingard/08ed1a10414962d5d51c173b207074e3>

OCEAN OBSERVATORIES INITIATIVE

Dataset: CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd\_a\_instrument

Data size: 477.0 Kbytes  
ID: ooigoldcopy/public/CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd\_a\_instrument

Access:

OPeNDAP: [/thredds/dodsC/ooigoldcopy/public/CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd\\_a\\_instrument](#)  
NCML: [/thredds/ncml/ooigoldcopy/public/CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd\\_a\\_instrument](#)  
UDDC: [/thredds/uddc/ooigoldcopy/public/CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd\\_a\\_instrument](#)  
ISO: [/thredds/iso/ooigoldcopy/public/CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd\\_a\\_instrument](#)  
HTTPServer: [/thredds/fileServer/ooigoldcopy/public/CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd\\_a\\_instrument](#)

Dates:

2024-06-07T06:01:52.812Z (modified)

Viewers:

[NetCDF-Java ToolsUI \(webstart\)](#)

OPeNDAP Dataset Access Form

Action:

Data URL: [http://thredds.dataexplorer.oceanobservatories.org/thredds/dodsC/ooigoldcopy/public/CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd\\_a\\_instrument](http://thredds.dataexplorer.oceanobservatories.org/thredds/dodsC/ooigoldcopy/public/CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd_a_instrument)

Global Attributes:

node: MFD36  
comment:  
publisher\_email:  
sourceUrl: <http://oceanobservatories.org/>  
collection\_method: telemetered  
stream: turbd\_a\_instrument  
featureType: point  
creator\_email:  
publisher\_name: Ocean Observatories Initiative  
date\_modified: 2024-06-07T05:56:31.808537  
keywords:  
cdm\_data\_type: Point  
references: More information can be found at <http://oceanobservatories.org/>  
Metadata\_Conventions: Unidata Dataset Discovery v1.0  
date\_created: 2024-06-07T05:56:31.808535  
id: CP10CNSM-MFD36-03-TURBDA000-telemetered-turbd\_a\_instrument  
requestUUID: 8d2b12a9-a802-45cd-aa1-d96ea3bb5c5f  
contributor\_role:  
summary: Dataset Generated by Stream Engine from Ocean Observatories Initiative  
keywords\_vocabulary:

Variables:

**obs**: Array of 32 bit Integers [obs = 0..12530]  
obs:

**preferred\_timestamp**: Array of Strings [obs = 0..12530]  
obs:

**turbidity**: Array of 64 bit Reals [obs = 0..12530]  
obs:

**raw\_signal\_beta**: Array of 16 bit Unsigned Integers [obs = 0..12530]  
obs:



# OOI's API: Machine-to-Machine (M2M)



- What is M2M?

- M2M is the name for OOI's Application Programming Interface (API)
- M2M allows for the programmatic access (i.e. scripting) to OOI's data and metadata
- Allows for download of data in **JSON**, **netCDF**, and **csv** formats from OOI's THREDDS server
- Language agnostic:
  - Examples principally utilize either Python or MatLab
  - Developing user base for sharing of code and analysis (<https://github.com/oceanobservatories/ooi-data-explorations>)

- What is accessible?

- Metadata
- Calibrations
- Deployment Information
- Data
  - Fast **synchronous** requests returned as a **JSON** object but limited data (<20,000 data points)
  - Slower **asynchronous** requests returned as either **JSON**, **CSV**, or **netCDF** with no data point limit
- Annotations

- Key Handouts

- API Cheat Sheet
- OOI Decoder Sheet
- OOI Instrument List

# Setup & Requirements



**USER PROFILE**

Home Science Asset Management Status Visit OOI Data Explorer Q Data Catalog Search Help Glossary FAQ areed@whoi.edu

### Profile

Email: areed@whoi.edu

First Name: ANDREW

Last Name: REED

Primary Phone: 8001231567

Secondary Phone:

Email Opt-In:

Organization:

Vocation:

Country:

State:

API Username:

API Token:

Submit Reset Close Refresh API Token

“login” → API Username

“password” → API Token

I recommend you do **NOT** hardcode these values into your scripts/code, especially if you use gitHub or another versioning system that is public.



# Finding Data: Step 1



Endpoint: `m2m/12576/sensor/inv`

API Endpoint: <https://ooinet.oceanobservatories.org/api/m2m/12576/sensor/inv>

Returns the following list of sites:

```
['CE01ISSM', 'CE01ISSP', 'CE02SHBP', 'CE02SHSM', 'CE02SHSP', 'CE04OSBP', 'CE04OSPD', 'CE04OSPI', 'CE04OSPS', 'CE04OSSM', 'CE05MOAS', 'CE06ISSM', 'CE06ISSP', 'CE07SHSM', 'CE07SHSP', 'CE090SPM', 'CE090SSM', 'CP01CNPM', 'CP01CNSM', 'CP01CNBP', 'CP02PMCI', 'CP02PMCO', 'CP02PMUI', 'CP02PMUO', 'CP03ISPM', 'CP03ISSM', 'CP03ISSP', 'CP04OSPM', 'CP04OSSM', 'CP05MOAS', 'CP10CNSM', 'CP11NOSM', 'CP11SOSM', 'CP12CNSW', 'CP12WESW', 'CP13EAPM', 'CP13NOPM', 'CP13SOPM', 'CP14NEPM', 'CP14SEPM', 'CP15MOAS', 'CP16MOAS', 'GA01SUMO', 'GA02HYPM', 'GA03FLMA', 'GA03FLMB', 'GA05MOAS', 'GI01SUMO', 'GI02HYPM', 'GI03FLMA', 'GI03FLMB', 'GI05MOAS', 'GP02HYPM', 'GP03FLMA', 'GP03FLMB', 'GP05MOAS', 'GS01SUMO', 'GS02HYPM', 'GS03FLMA', 'GS03FLMB', 'GS05MOAS', 'RS01OSBP', 'RS01SBPD', 'RS01SBPS', 'RS01SHBP', 'RS01SHDR', 'RS01SLBS', 'RS01SUM1', 'RS01SUM2', 'RS03ASHS', 'RS03AXBS', 'RS03AXPD', 'RS03AXPS', 'RS03AXSM', 'RS03CCAL', 'RS03ECAL', 'RS03INT1', 'RS03INT2', 'SSRSPACC']
```

Select a site, e.g. Coastal Pioneer MAB Central Surface Mooring (CP10CNSM)



# Finding Data: Step 2

---

Endpoint: **m2m/12576/sensor/inv/CP01CNSM**

```
API Endpoint: https://ooinet.oceanobservatories.org/api/m2m/12576/sensor/inv/CP10CNSM
```

```
Returns the following list of nodes on CP10CNSM:
```

```
['MFC31', 'MFD36', 'MFD37', 'RIC21', 'RID26', 'RID27', 'SBD11', 'SBD12']
```

Returns eight nodes:

MFC31/RIC21 – operator engineering data

SBD11/SBD12 – surface mooring data

RID27/RID28 – near surface instrument frame (NSIF) data

MFD36/MFD37 – seafloor multifunction node (MFN)

Select a node: **Coastal Pioneer MAB Central Surface Mooring Multifunction Node (CP01CNSM-MFD37)**



# Finding Data: Step 3 (Handout: Instrument List)

Endpoint: `m2m/12576/sensor/inv/CP10CNSM/MFD37`

```
API Endpoint: https://ooinet.oceanobservatories.org/api/m2m/12576/sensor/inv/CP10CNSM/MFD37
```

```
Returns the following list of sensors on CP10CNSM-MFD37:
```

```
['00-DCLENG000', '01-OPTAAD000', '03-CTDBPC000', '04-DOSTAD000', '07-ZPLSCC000']
```

Returns five sensors:

- 00-DCLENG000 - engineering data
- 01-OPTAAD000 - hyperspectrometer sensor
- 03-CTDBPC000 – SeaBird bottom-pumped CTD
- 04-DOSTAD000 - Aanderaa dissolved oxygen optode
- 07-ZPLSCC000 - Bio-Acoustic sonar

We're going to select the oxygen sensor '04-DOSTAD000'. This also allows us to construct the **Reference Designator**: CP10CNSM-MFD37-04-DOSTAD000



# Finding Data: Step 4

---

Endpoint: **m2m/12576/sensor/inv/CP10CNSM/RIS01/03-DOSTAD000**

```
API Endpoint: https://ooinet.oceanobservatories.org/api/m2m/12576/sensor/inv/CP10CNSM/MFD37/04-DOSTAD000
```

```
Returns the following list of data delivery methods on CP10CNSM-MFD37-04-DOSTAD000:
```

```
['telemetered']
```

Returns the data delivery methods that are currently available:

- **telemetered**: this is data that was transmitted from the mooring back-to-shore. For some instruments it is truncated or decimated.

In the future there will also be **recovered\_host** which is the data recorded by the mooring computer. Instruments which can self-log will also have a **recovered\_inst** data stream.





# Finding Data: Step 5

---

Endpoint: **m2m/12576/sensor/inv/CP10CNSM/MFD37/04-DOSTAD000/telemetered**

```
API Endpoint: https://ooinet.oceanobservatories.org/api/m2m/12576/sensor/inv/CP10CNSM/MFD37/04-DOSTAD000/telemetered
```

```
Returns the following list of streams for CP10CNSM-MFD37-04-DOSTAD000 telemetered:
```

```
['dosta_abcdjm_dcl_instrument']
```

Returns the data stream:

- **dosta\_abcdjm\_dcl\_instrument** - this stream has science data

Now we can go ahead and request data!

Full data request: **m2m/12576/sensor/inv/CP10CNSM/MFD37/04-DOSTAD000/telemetered/dosta\_abcdjm\_dcl\_instrument**



# Requesting Data: Synchronous

---

## Synchronous data request

- Faster
- Returned as JSON
- Request Specifications
  - limit (required): specifies number of data points with a maximum of 20000
  - beginDT (optional): start date as YYYY-mm-ddTHH:MM:SS.fffZ format
  - endDT (optional): end date in same format as beginDT
  - parameters (optional): numeric IDs of which parameters to get



# Requesting Data: Synchronous

---

## Building a request

- Want dissolved oxygen data for the year of 2015 from Ocean Station Papa Flanking Mooring A oxygen sensor
- Specifications
  - limit: 20000
  - beginDT: 2024-06-01T00:00:01.000Z
  - endDT: 2024-09-01T00:00:01.000Z
  - parameters: 7 (time), 14 (dissolved oxygen)
- Example Request
  - **m2m/12576/sensor/inv/CP10CNSN/MFD37/04-DOSTAD000/telemetered/dosta\_abcdjm\_dcl\_instrument?limit=20000&beginDT= 2024-06-01T00:00:01.000Z&endDT= 2024-09-01T00:00:01.000Z&parameters=7,14**
  - **IMPORTANT:** If you specify parameters, you must also specify time (“7”) or it will not be included!





# Requesting Data: Synchronous



## Step 1: Request the data

```
method = "telemetered"
stream = "dosta_abcdjm_dcl_instrument"

# Request the oxygen data from the
data_url = "/" .join((URLS["data"], site, node, sensor, method, stream))

params = {
    "beginDT": "2024-06-01T00:00:01.000Z",
    "endDT": "2024-09-01T00:00:00.000Z",
    "limit": "20000",
}

data = get_api(data_url, params)
data
```

## Step 2: Data as JSON object

```
[{'ctdbp_cdef_dcl_instrument-sea_water_temperature': 14.625783578269637,
'ctdbp_cdef_dcl_instrument-sea_water_practical_salinity': 32.52014920486027,
'dissolved_oxygen': 225.56102503141608,
'time': 3926188810.491,
'ctdbp_cdef_dcl_instrument-depth': 29.613818472278684,
'pk': {'node': 'MFD37',
'stream': 'dosta_abcdjm_dcl_instrument',
'subsite': 'CP10CMSM',
'deployment': 1,
'time': 3926188810.491,
'sensor': '04-DOSTAD000',
'method': 'telemetered'}}],
```

Desired parameter (dissolved oxygen)

## Step 3: Parse JSON

	ctdbp_cdef_dcl_instrument-sea_water_temperature	ctdbp_cdef_dcl_instrument-sea_water_practical_salinity	dissolved_oxygen	time	ctdbp_cdef_dcl_instrument-depth	pk	deployment
0	14.625784	32.520149	225.561025	2024-06-01 00:00:10.491	29.613818	{'node': 'MFD37', 'stream': 'dosta_abcdjm_dcl_...	1
1	14.625784	32.520149	225.543281	2024-06-01 00:00:10.494	29.613818	{'node': 'MFD37', 'stream': 'dosta_abcdjm_dcl_...	1
2	14.625881	32.520163	225.497475	2024-06-01 00:00:12.387	29.613726	{'node': 'MFD37', 'stream': 'dosta_abcdjm_dcl_...	1
3				01 37	29.613628	{'node': 'MFD37', 'stream': 'dosta_abcdjm_dcl_...	1

Data from co-located sensors needed in calculation of desired parameter



# Requesting Data: Asynchronous

---

## Asynchronous data request

- Slower
- Can return data as either JSON, CSV, or as netCDF (default)
- No data point limit
- Request Specifications
  - limit (required): if not specified, defaults netCDF
  - beginDT (optional): start date as YYYY-mm-ddTHH:MM:SS.fffZ format
  - endDT (optional): end date in same format as beginDT
  - parameters (optional): numeric IDs of which parameters to get
  - include\_provenance (optional, default False): include a provenance file which specifies data processing paths
  - include\_annotations (optional, default False): include a file with data annotations



# Requesting Data: Asynchronous

---

## Building a request

- Want dissolved oxygen data for the year of 2015 from Ocean Station Papa Flanking Mooring A oxygen sensor
- Specifications
  - beginDT: 2024-06-01T00:00:00.000Z
  - endDT: 2024-09-01T00:00:00.000Z
  - parameters: 7 (time), 14 (dissolved oxygen)
- Example Request
  - **m2m/12576/sensor/inv/CP10CNSM/MFD37/04-DOSTAD000/telemetered/dosta\_abcdjm\_dcl\_instrument?beginDT=2024-06-01T00:00:00.000Z&endDT=2024-09-01T00:00:00.000Z&parameters=7,14**





# Requesting Data: Asynchronous

## Step 1: Get THREDDS server url from M2M

```
{'requestUUID': 'ba5d1e55-4e7b-4813-803d-21267a4ecf5f',  
  'outputURL': 'https://opendap-west.oceanobservatories.org/thredds/catalog/ooi/areed@whoi.edu/20240909T202602913Z-CP10CNSM-MFD37-04-DOSTAD000-telemete  
red-dosta_abcdjm_dcl_instrument/catalog.html',  
  'allURLs': ['https://opendap-west.oceanobservatories.org/thredds/catalog/ooi/areed@whoi.edu/20240909T202602913Z-CP10CNSM-MFD37-04-DOSTAD000-telemete  
red-dosta_abcdjm_dcl_instrument/catalog.html',  
             'https://downloads-west.oceanobservatories.org/async_results/areed@whoi.edu/20240909T202602913Z-CP10CNSM-MFD37-04-DOSTAD000-telemetered-dosta_abcdjm  
_dcl_instrument'],  
  'sizeCalculation': 1919338,  
  'timeCalculation': 60,  
  'numberOfSubJobs': 12}
```

## Step 2: Get dataset catalog using THREDDS server url

```
['catalog.html?dataset=ooi/areed@whoi.edu/20240909T202602913Z-CP10CNSM-MFD37-04-DOSTAD000-telemetered-dosta_abcdjm_dcl_instrument/deployment0001_CP10C  
NSM-MFD37-03-CTDBPC000-telemetered-ctdbp_cdef_dcl_instrument_20240531T230027.761000-20240806T000027.137000.nc']
```

```
['catalog.html?dataset=ooi/areed@whoi.edu/20240909T202602913Z-CP10CNSM-MFD37-04-DOSTAD000-telemetered-dosta_abcdjm_dcl_instrument/deployment0001_CP10C  
NSM-MFD37-04-DOSTAD000-telemetered-dosta_abcdjm_dcl_instrument_20240601T000010.491000-20240806T000301.207000.nc']
```

# Requesting Data: Asynchronous

– Dimensions: (time: 22919)

▼ Coordinates:

obs	(time)	int32	0 1 2 3 ... 22915 22916 22917 22918		
time	(time)	datetime64[ns]	2024-06-01T00:00:10.491000320 .....		

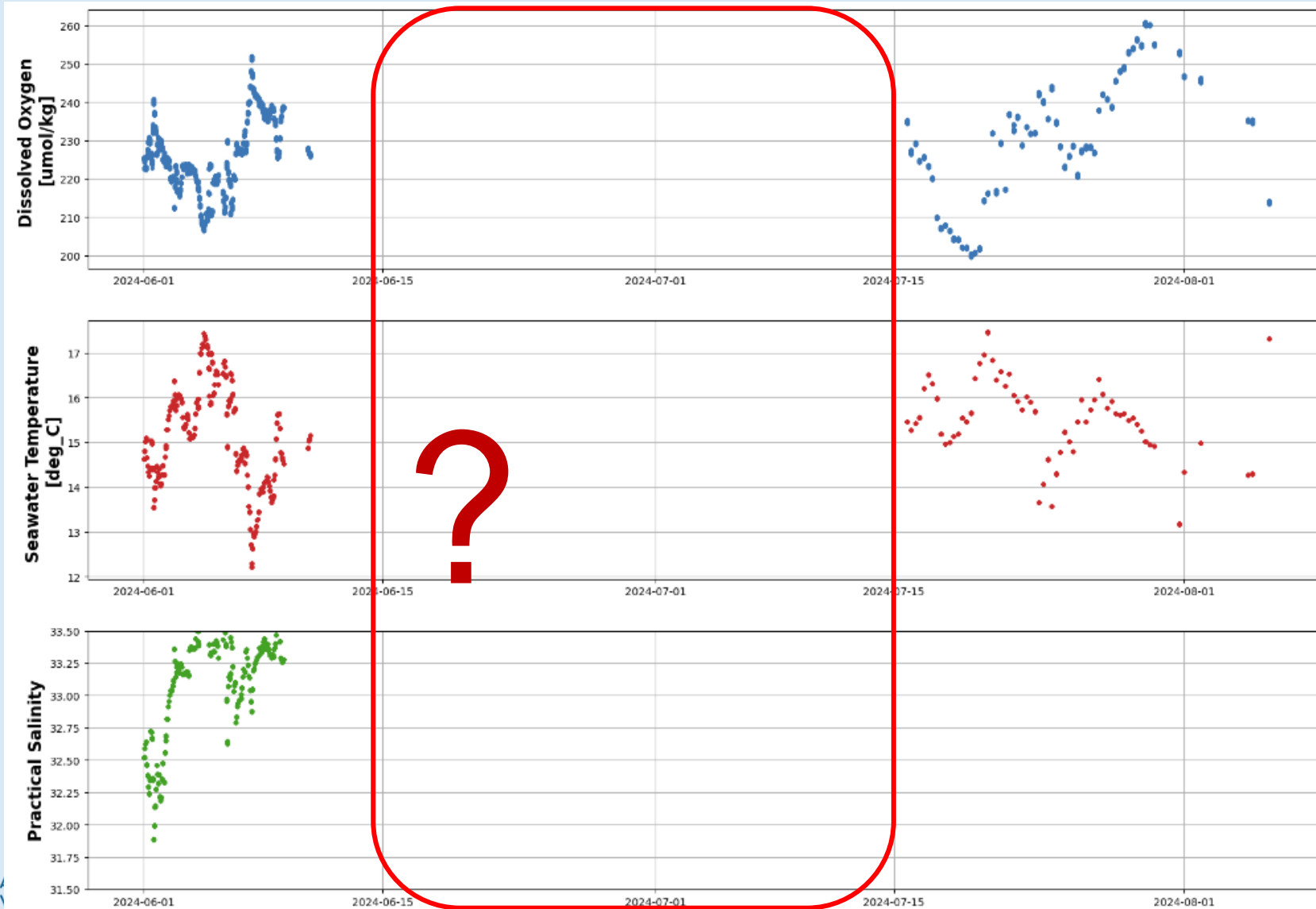
▼ Data variables:

raw_temperature	(time)	float32	...		
red_phase	(time)	float32	...		
dcl_controller_ti...	(time)	object	...		
product_number	(time)	float32	...		
driver_timestamp	(time)	datetime64[ns]	...		
id	(time)	S36	...		
provenance	(time)	S36	...		
internal_timesta...	(time)	datetime64[ns]	...		
blue_phase	(time)	float32	...		
serial_number	(time)	object	...		
temp_compensa...	(time)	float32	...		
dissolved_oxygen	(time)	float64	...		
calibrated_phase	(time)	float32	...		
ingestion_timest...	(time)	datetime64[ns]	...		
port_timestamp	(time)	datetime64[ns]	...		
estimated_oxyge...	(time)	float32	...		
deployment	(time)	int32	...		
sea_water_practi...	(time)	float64	...		
estimated_oxyge...	(time)	float32	...		
optode_tempera...	(time)	float32	...		
preferred_timest...	(time)	object	...		
int_ctd_pressure	(time)	float64	...		
dosta_abcdjm_cs...	(time)	float64	...		
red_amplitude	(time)	float32	...		
depth	(time)	float64	...		

dissolved_oxygen	(time)	float64	...		
comment :	Dissolved Oxygen (DO) concentration from the Stable Response DO Instrument is a measure of the concentration of gaseous oxygen mixed in seawater. This data product is corrected for salinity, temperature, and pressure.				
long_name :	DO from Onboard Calculation - Corrected				
precision :	4				
coordinates :	time lat lon depth				
data_product_id...	DOXYGEN_L2				
standard_name :	moles_of_oxygen_per_unit_mass_in_sea_water				
units :	umol kg-1				
ancillary_variable...	estimated_oxygen_concentration sea_water_practical_salinity sea_water_temperature				

sea_water_practi...	(time)	float64	...		
comment :	Salinity is generally defined as the concentration of dissolved salt in a parcel of seawater. Practical Salinity is a more specific unitless quantity calculated from the conductivity of seawater and adjusted for temperature and pressure. It is approximately equivalent to Absolute Salinity (the mass fraction of dissolved salt in seawater) but they are not interchangeable.				
data_product_id...	PRACSAL_L2				
precision :	4				
coordinates :	time lat lon depth				
long_name :	Practical Salinity				
standard_name :	sea_water_practical_salinity				
units :	1				
alternate_param...	ctdbp_cdef_dcl_instrument-practical_salinity				
instrument :	CP10CNSM-MFD37-03-CTDBPC000				
stream :	ctdbp_cdef_dcl_instrument				
[22919 values with dtype=float64]					

# The Data





# Annotations

---

## Human-in-the-loop Assessment

- Added to the datasets for specified time periods by the operators
- Provide info on data quality, performance, issues, and context
- Available from the OOI Data Portal

## Request

- Endpoint: <https://ooinet.oceanobservatories.org/api/m2m/12580/anno/find>
- Parameters
  - refdes (required): reference designator
  - beginDT & endDT (optional): must be unix epoch time as microseconds
  - method (optional): only returns annotations for the given method for a given reference designator
  - stream (optional): only returns annotations for the given data stream for a given reference designator - stream



# Annotations



- Example Request

- Annotations for Coastal Pioneer MAB Central Surface Mooring seafloor oxygen sensor from 2024-06-01 to 2024-09-01
- Request url:  
<https://ooinet.oceanobservatories.org/api/m2m/12580/anno/find?refdes=CP10CNSM-MFD37-04-DOSTAD000&beginDT=1420088401000&endDT=1451624401000>

	@class	id	subsite	node	sensor	method	stream	beginDT	endDT	annotation	exclusionFlag	source	qcFlag	parameters
0	.AnnotationRecord	5604	CP10CNSM	MFD37	None	None	None	2024-05-07 13:00:00	None	Deployment 1: DCL37 power was temporarily dis...	False	cdobson@whoi.edu	9	[]
1	.AnnotationRecord	5718	CP10CNSM	MFD37	None	None	None	2024-07-15 12:00:00	None	Deployment 1: DCL37 was re-enabled on 2024-07-...	False	cdobson@whoi.edu	0	[]

2024-05-07 13:00:00 to None: Deployment 1: DCL37 power was temporarily disabled throughout this deployment due to the buoy's low power state. No telemetered data is expected for these periods without power. Instruments that do not collect data on battery power will have gaps in their recovered data for these times. Known down-times include 2024-05-07 to 2024-05-23 2024-06-10 to 2024-07-25 and 2024-08-06 to present.

2024-07-15 12:00:00 to None: Deployment 1: DCL37 was re-enabled on 2024-07-15 and was put on a limited power schedule to conserve power. It will be powered four times a day rather than every hour.

- Answer missing data: **Power limitations!**

- Sometimes instruments which self power and self log will continue sampling even when they lose power or comms with the buoy controllers. However, the optode is not one of those instruments.

# Metadata: Calibrations



## Reference Designator based

- Since individual instruments are swapped during each mooring deployment & recovery, the calibration coefficients for a reference designator are different for each deployment. The way OOI operates is that it loads all the available calibration coefficients for a given reference designator.
- Recommend that limit an individual request to a single deployment - otherwise get a lot of calibrations
- Example request for Coastal Pioneer MAB Central Surface Mooring seafloor oxygen sensor
- Request url: <https://ooinet.oceanobservatories.org/api/m2m/12587/asset/cal?refdes=CP10CNSM-MFD37-04-DOSTAD000&beginDT=2024-06-01T00:00:00.000Z&endDT=2024-06-01T00:00:00.000Z>

	deploymentNumber	uid	calCoef	value	calFile
0	1	CGINS-DOSTAD-00394	CC_conc_coef	[0.0, 1.0]	CGINS-DOSTAD-00394__20231126_Cal_Info.xlsx
1	1	CGINS-DOSTAD-00394	CC_csv	[0.00259917, 0.000110874, 2.10957e-06, 160.512...	CGINS-DOSTAD-00394__20231126_Cal_Info.xlsx

# Metadata: Calibrations

Unique Identifier (UID) based

- Return a list for all of the calibrations available in the system for a particular instrument
- Request data for oxygen sensor with UID CGINS-DOSTAD-00228
- Request url: <https://ooinet.oceanobservatories.org/api/m2m/12587/asset/cal?UID=CGINS-DOSTAD000-00228>

	uid	calCoef	calDate	value	calFile
2	CGINS-DOSTAD-00228	CC_conc_coef	2013-08-04 00:00:00	[0.0, 1.0]	CGINS-DOSTAD-00228__20130804_Cal_Info.xlsx
4	CGINS-DOSTAD-00228	CC_csv	2013-08-04 00:00:00	[0.00313162, 0.000129918, 2.61329e-06, 233.397...	CGINS-DOSTAD-00228__20130804_Cal_Info.xlsx
0	CGINS-DOSTAD-00228	CC_conc_coef	2016-02-26 00:00:00	[0.0, 1.0]	CGINS-DOSTAD-00228__20160226_Cal_Info.xlsx
3	CGINS-DOSTAD-00228	CC_csv	2016-02-26 00:00:00	[0.00289589, 0.000120386, 2.34238e-06, 233.068...	CGINS-DOSTAD-00228__20160226_Cal_Info.xlsx
1	CGINS-DOSTAD-00228	CC_conc_coef	2017-09-18 00:00:00	[-0.5159482, 0.9981074]	CGINS-DOSTAD-00228__20170918_Cal_Info.xlsx
5	CGINS-DOSTAD-00228	CC_csv	2017-09-18 00:00:00	[0.00289589, 0.000120386, 2.34238e-06, 233.068...	CGINS-DOSTAD-00228__20170918_Cal_Info.xlsx





# Metadata: Deployments

- Provide information on deployment numbers, times, cruises, and what instrument was deployed
- A deployment is defined as span of time a mooring or instrument were deployed and then recovered
- Reference Designator based
  - Request deployments for Coastal Pioneer MAB Central Surface Mooring seafloor oxygen sensor
  - Request url:  
<https://ooinet.oceanobservatories.org/api/m2m/12587/events/deployment/inv/CP10CNSM/MFD37/04-DOSTAD000>
  - If no deployment number is given, returns a list of available deployments

API Endpoint: <https://ooinet.oceanobservatories.org/api/m2m/12587/events/deployment/inv/CP10CNSM/MFD37/04-DOSTAD000>

[1]

# Metadata: Deployments

- Recommended to add in the deployment number
  - Request deployment 1 Coastal Pioneer MAB Central Surface Mooring seafloor oxygen sensor
  - Request url:  
<https://ooinet.oceanobservatories.org/api/m2m/12587/events/deployment/inv/CP10CNSM/MFD37/04-DOSTAD000>
  - Can iterate through each deployment to build a table

	deploymentNumber	uid	assetId	latitude	longitude	depth	deployStart	deployEnd	deployCruise	recoverCruise
0	1	CGINS-DOSTAD-00129	2378	49.9795	-144.254	28.0	2013-07-21 22:44:00	2014-06-15 17:30:00	MV1309	MV1404
1	2	CGINS-DOSTAD-00127	2382	49.9775	-144.2463	28.0	2014-06-18 05:56:00	2015-06-05 14:53:00	MV1404	TN323
2	3	CGINS-DOSTAD-00394	3654	49.97667	-144.24617	28.0	2015-06-06 22:40:00	2016-06-28 15:02:00	TN323	RB1605
3	4	CGINS-DOSTAD-00130	2413	49.97434	-144.23972	30.0	2016-07-01 01:07:00	2017-07-18 15:13:00	RB1605	SR1710
4	5	CGINS-DOSTAD-00129	2378	50.02288	-144.36125	30.0	2017-07-13 23:00:00	2018-07-26 15:51:00	SR1710	SR1811
5	6	CGINS-DOSTAD-00228	2500	49.976145	-144.246335	30.0	2018-07-23 22:54:00	2019-09-29 15:54:00	SR1811	SKQ201920S
6	7	CGINS-DOSTAD-00379	3752	50.0227	-144.360783	30.0	2019-09-29 04:40:00	2021-07-26 18:24:00	SKQ201920S	SKQ202111S
7	8	CGINS-DOSTAD-00377	3756	49.977455	-144.244048	30.0	2021-07-23 19:43:00	None	SKQ202111S	None
8	9	CGINS-DOSTAD-00439	1208	49.9	-144.2	30.0	2022-05-11 00:00:00	None	SKQ202208S	None



# Metadata: Vocab



## OOI Vocabulary

- Provides more detailed information on the reference designator
- Includes the description names of the instrument at that reference designator, the array, the mooring, and node, as well as nomica
- Request vocab for Coastal Pioneer MAB Central Surface Mooring seafloor oxygen sensor
- Example url:  
<https://ooinet.oceanobservatories.org/api/m2m/12586/vocab/inv/CP10CNSM/MFD37/04-DOSTAD000>

	@class	vocabld	refdes	instrument	tocL1	tocL2	tocL3	manufacturer	model	mindepth	maxdepth
0	.VocabRecord	931	CP10CNSM-MFD37-04-DOSTAD000	Dissolved Oxygen	Coastal Pioneer MAB	Central Surface Mooring	Seafloor Multi-Function Node (MFN)	Aanderaa	Optode 4831	29.0	29.0

# Metadata: Metadata



- The metadata contains such valuable information such as the available methods and streams (which are required to download the data), the particleKeys (the data variable names), parameter IDs, number of particles (data points), and the associated units
- Example request for Coastal Pioneer MAB Central Surface Mooring seafloor oxygen sensor
  - <https://ooinet.oceanobservatories.org/api/m2m/12587/asset/cal?refdes=GP03FLMA-RIS01-DOSTAD000&beginDT=2018-08-29T22:25:00.000Z&endDT=2018-08-30T22:54:00.000Z>

```
In [30]: metadata = get_metadata(refdes)
         metadata
```

Out[30]:

	pdid	particleKey	type	shape	units	fillValue	stream	unsigned	method	count
0	PD7	time	DOUBLE	SCALAR	seconds since 1900-01-01	-9999999	dosta_abcdjm_sio_instrument	False	telemetered	3914
1	PD10	port_timestamp	DOUBLE	SCALAR	seconds since 1900-01-01	-9999999	dosta_abcdjm_sio_instrument	False	telemetered	3914
2	PD11	driver_timestamp	DOUBLE	SCALAR	seconds since 1900-01-01	-9999999	dosta_abcdjm_sio_instrument	False	telemetered	3914
3	PD12	internal_timestamp	DOUBLE	SCALAR	seconds since 1900-01-01	-9999999	dosta_abcdjm_sio_instrument	False	telemetered	3914
4	PD14	dissolved_oxygen	FLOAT	FUNCTION	μmol kg-1	-9999999	dosta_abcdjm_sio_instrument	False	telemetered	3914

- Results returns a table with 54 entries!



# Preload: Metadata & Data Levels

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- Data Levels refer to the level of processing that the given data parameter has undergone
  - Level 1, or L1 Data Products, are derived from L0 data, and provide data that has been calibrated using vendor-provided values or values derived from pre-deployment procedures, and that is in scientific units
  - Level 2, or L2 Data Products are derived quantities created via an algorithm that draws on multiple L1 Data Products. L2 data products may be based on data from the same or a combination of separate instruments.
- Preload
  - Contains detailed information on each parameter, queried based on the parameter ID
  - Get annotations for the CP10CNSM-MFD37-04-DOSTAD000 dissolved\_oxygen (parameter ID = “14”)
  - Example request: <https://ooinet.oceanobservatories.org/api/m2m/12575/parameter/14>



# Preload: Metadata & Data Levels

- Example request: <https://ooinet.oceanobservatories.org/api/m2m/12575/parameter/14>

```
{'name': 'dissolved_oxygen',
'display_name': 'DO from Onboard Calculation - Corrected',
'netcdf_name': 'dissolved_oxygen',
'standard_name': 'moles_of_oxygen_per_unit_mass_in_sea_water',
'description': 'Dissolved Oxygen Concentration from the Stable Response Dissolved Oxygen Instrument is a measure of the concentration of gaseous oxygen mixed in seawater. This data product is corrected for salinity, temperature, and depth.',
'id': 14,
'data_product_identifier': 'DOXYGEN_L2',
'precision': 4,
'fill_value': {'value': '-9999999'},
'unit': {'value': 'µmol kg-1'},
'data_level': 2,
'code_set': None,
'value_encoding': {'value': 'float32'},
'parameter_type': {'value': 'function'},
'parameter_function': {'id': 61,
'name': 'do2_salinity_correction',
'function_type': {'value': 'PythonFunction'},
'function': 'do2_salinity_correction',
'owner': 'ion_functions.data.do2_functions',
'description': 'Salinity and pressure correction to dissolved oxygen producing L2 DOCONCS',
'qc_flag': None},
'data_product_type': {'value': 'Science Data'},
'dimensions': [],
'parameter_function_map': '{"DO": "dpi_DOCONCS_L1", "SP": ["dpi_PRACSal_L2", "dpi_SALSURF_L2"], "lon": "CC_lon", "P": ["PD2606", "dpi_PRESWAT_L1", "PD17"], "T": ["dpi_TEMPWAT_L1", "dpi_TEMPSRF_L1"], "lat": "CC_lat"}',
'visible': True}
```



# Metadata & Preload



- With the Data Levels queried from **Preload** for each of the parameters returned with the **Metadata**, we can filter for the different Data Levels. Below we filtered the metadata for the CP10CNSM-MFD37-04-DOSTAD000 for L1 & L2 data products
  - This allows us to cut down on the size of the data request and resulting data files

	<b>pddid</b>	<b>particleKey</b>	<b>type</b>	<b>shape</b>	<b>units</b>	<b>fillValue</b>	<b>stream</b>	<b>unsigned</b>	<b>method</b>	<b>count</b>	
<b>4</b>	PD14	dissolved_oxygen	FLOAT	FUNCTION	μmol kg-1	-9999999	dosta_abcdjm_sio_instrument	False	telemetered	3914	2014-06-
<b>7</b>	PD940	estimated_oxygen_concentration	FLOAT	SCALAR	μmol L-1	-9999999	dosta_abcdjm_sio_instrument	False	telemetered	3914	2014-06-
<b>18</b>	PD2843	dosta_abcdjm_cspp_tc_oxygen	FLOAT	FUNCTION	μmol L-1	-9999999	dosta_abcdjm_sio_instrument	False	telemetered	3914	2014-06-
<b>23</b>	PD14	dissolved_oxygen	FLOAT	FUNCTION	μmol kg-1	-9999999	dosta_abcdjm_sio_instrument_recovered	False	recovered_host	152192	2013-07-
<b>26</b>	PD940	estimated_oxygen_concentration	FLOAT	SCALAR	μmol L-1	-9999999	dosta_abcdjm_sio_instrument_recovered	False	recovered_host	152192	2013-07-
<b>37</b>	PD2843	dosta_abcdjm_cspp_tc_oxygen	FLOAT	FUNCTION	μmol L-1	-9999999	dosta_abcdjm_sio_instrument_recovered	False	recovered_host	152192	2013-07-

- **Important:** Notice that **time** was filtered out. This is because they don't have a defined data product level. An additional wrinkle is that **time** is NOT the default dimension of delivered netCDF files - this means it needs to be specifically requested for data requests. This is something to be aware of when requesting only specific data variables.

# Further Information

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- Presentation will be available on gitHub at [github.com/reedan88/OOI-Pioneer-MAB-Community-Workshop](https://github.com/reedan88/OOI-Pioneer-MAB-Community-Workshop)
- OOI Data Explorations
  - Available on the OOI github at [github.com/oceanobservatories/ooi-data-explorations](https://github.com/oceanobservatories/ooi-data-explorations)
  - Includes code to both request and process data from OOI as well as some QC routines
  - Code in both python, MatLab, and R
- Supplemental & Complementary Datasets
  - Discrete water sampling data available on the OOI Alfresco Web Document Server
  - [alfresco.oceanobservatories.org](http://alfresco.oceanobservatories.org): OOI > Array > Cruise Data > Cruise > Ship Data > Water Sampling
- Other Sources for OOI Data
  - OOI Data Explorer website & ERDDAP server - see “**Data Explorer**” Breakout Session
  - Raw Data Server, Camera Data, & Hydrophone Data - see “**Raw Data Server**” Breakout Session







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# Questions?

Utilize the OOI Discourse site to discuss notebook issues, tips and tricks, updates, etc.

<https://discourse.oceanobservatories.org/>

