

Jupyter Notebooks for Accessing Ocean Data

Tricy Aquino, Wylee Fitz-Gerald, Edward Mason, Dwight Owens, Sean Tippett

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A UNIVERSITY OF VICTORIA INITIATIVE

About Us



Wylee Fitz-Gerald
Post-Secondary Education
Coordinator



Tricy Aquino
User Engagement
Officer



Dwight Owens
Impact & Capacity
Development Manager



Ed Mason
Scientific Data
Specialist



Sean Tippett
Research Data
Specialist

This workshop could not have been completed without the help of ONC's GIS team and Data Analytics & Quality team, specifically **Angela Schlesinger** and **Drew Snauffer**.




Special shout-out to **Sage Lichtenwalner** of Rutgers University for addition of data from the Ocean Observatories Initiative (OOI) into this case study.

Land Acknowledgement



We acknowledge and respect the lək̓ʷəŋən peoples on whose traditional territory the University of Victoria stands and the Songhees, Esquimalt and W̱SÁNEĆ peoples whose historical relationships with the land and the ocean continue to this day.



CODE OF CONDUCT

Expected behavior

- 1 — Treat everyone with respect.
- 2 — Respect your fellow participants by using good practices for intercultural collaborations.
- 3 — Be mindful of your surroundings and of your fellow participants.
- 4 — Provide your true professional identity, affiliation, and, where appropriate, contact information, at registration, and during attendance and participatory sessions, as required.
- 5 — Respect copying and use of presented materials and ideas as indicated by AGU's Guidelines on Photography and Social Media, including knowing when you may need to obtain permission regarding copying materials.
- 6 — Respect the rules and policies of the meeting venue, hotels, AGU contracted facility, online platform, or any other venue.
- 7 — Be Accountable: When we as organizers or participants fail to meet these guidelines, work together to identify problems and adjust policy and practice together.

AGU24 Learning Evaluation



<https://bit.ly/3D0N49s>

ONC survey:

<https://www.surveymonkey.com/r/QCRM7CF>



Where are you joining us from?



What brought you here?

Describe your experience using Python and Jupyter notebooks

Prerequisites

- Token available in your account profile at Oceans 3.0. To register for an account, go to this [link](#).
- <https://data.oceannetworks.ca/Registration>

Ocean Networks Canada [Edit Profile](#)
Oceans 3.0

Logged in as [Tricy Aquino](#) | [Profile](#) | [Help](#) | [Logout](#)

[Home](#) [Data Preview](#) [Data Search](#) [Plotting Utility](#) [SeaTube](#) [Digital Fishers](#) [Cameras](#) [More](#) [Admin](#) [System Status](#) [Request Support](#)

Modify your profile

[Account Information](#) [Additional Information](#) [Contact Information](#) [Web Services API](#)

Token [Generate New Token](#) [Copy Token](#)

[Complete my profile changes](#)

Short-form Privacy Statement and Collection

Ocean Networks Canada (ONC) is committed to providing our staff, advisors, partners, collaborators and general public with websites that respect their privacy. This page summarizes the organization's privacy policy and practices.

The Ocean Networks Canada website does not automatically gather any personal information from you, such as your name, phone number, or e-mail address. This information is only obtained if you provide it voluntarily, through contacting us via e-mail or as part of becoming a registered user.

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For further information on the privacy policy of Ocean Networks Canada, refer to our [Legal Notices](#).

Prerequisites

API Demo Cases

- Sign up for a free account at [Deepnote](#) and make sure to create a **workspace**.
- Once you have created an account and workspace, follow the steps below:
 1. [Click on this link](#)
 2. On the right side of the screen, click on the hamburger button and choose duplicate project.
 3. After clicking Duplicate project, you will be prompted with a screen asking for a workspace, choose your workspace and hit the Duplicate project button

OpenAPI Demo Cases

- Add **JSON extension** for different browser types (Firefox none required; [JSON Formatter](#) for Chrome, [prettyJSON](#) for Safari).

Agenda

- 8:35 Overview of Ocean Networks Canada (ONC) and Oceans 3.0 (*Dwight Owens*)
- 9:00 Oceans 3.0 Application Programming Interface (API) overview (*Tricy Aquino*)
- 9:20 Break
- 9:30 HANDS ON: Oceans 3.0 OpenAPI overview and demo (*Ed Mason*)
- 10:15 HANDS ON: Case Study: Honga Tonga volcanic eruption and tsunami
(step by step API workflows for scalar data)
- 11:15 Break
- 11:25 How to cite data from ONC? (*Sean Tippett*)
- 11:40 Q&A, Individual work

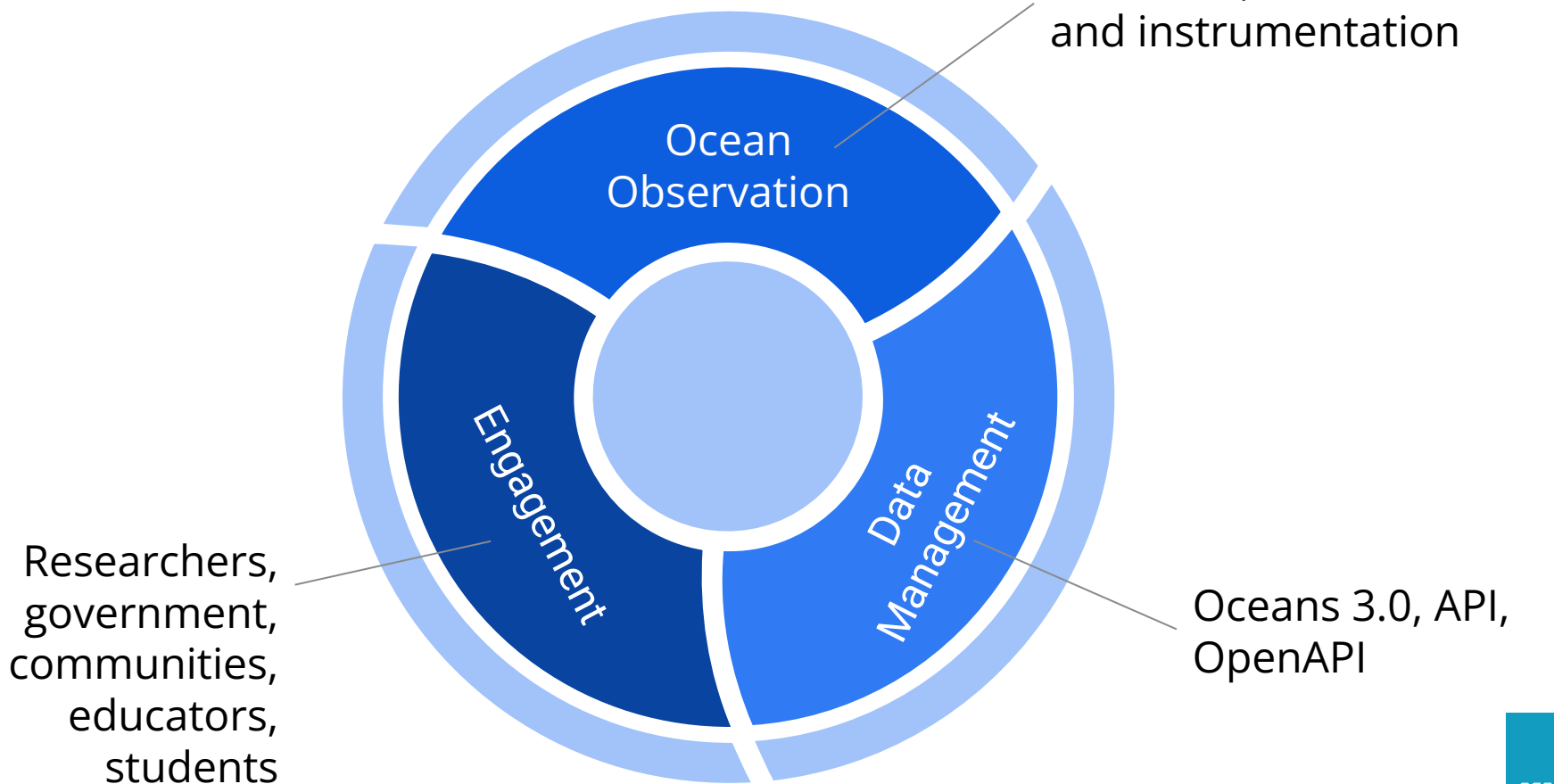


Official Trailer

BEYOND THE ABYSS

Ocean Intelligence for a Sustainable Planet

ONC's Main Activities



Oceans 3.0 in Numbers

12500+ Active sensors producing data;

640+ Instruments producing data daily;

10,000+ Pre-generated plots produced daily;

10,500+ Average daily data requests;

410 GB Average volume of uncompressed data archived per day;

1.74 PB Total uncompressed volume of archived data.

Oceans 3.0 Main Applications

OCEAN NETWORKS CANADA

Oceans 3.0 Data Portal

Search, preview, download and visualize data from cabled observatories, mobile platforms and autonomous instruments.

Log in

Data Preview

Data Search

Plotting Utility

Hydrophone Viewer

Community Fishers Map

Fixed Cameras
Access video and annotation data from any ONC fixed camera location via SeaTube Pro.

SeaTube V3

Digital Fishers

Dashboards

```
import sys
import urllib

def get_device_category_codes(completion):
    url = 'https://data.oceannetworks.ca/api/devicecategories'
    params = {'method': 'get'}, {'method': 'get'}, {'method': 'get'}
    response = urllib.urlopen(url, params)
    return response.read()

def get_device_status_codes(completion):
    url = 'https://data.oceannetworks.ca/api/devicestatuscodes'
    params = {'method': 'get'}, {'method': 'get'}, {'method': 'get'}
    response = urllib.urlopen(url, params)
    return response.read()

if __name__ == '__main__':
    with open('output.txt', 'w') as f:
        f.write('Device Categories\n')
        f.write('-----\n')
        f.write(get_device_category_codes(''))
        f.write('\n')
        f.write('Device Status Codes\n')
        f.write('-----\n')
        f.write(get_device_status_codes(''))
```

Web Services API

```
def get_device_status_codes(completion):
    url = 'https://data.oceannetworks.ca/api/devicestatuscodes'
    params = {'method': 'get'}, {'method': 'get'}, {'method': 'get'}
    response = urllib.urlopen(url, params)
    return response.read()

def get_device_category_codes(completion):
    url = 'https://data.oceannetworks.ca/api/devicecategories'
    params = {'method': 'get'}, {'method': 'get'}, {'method': 'get'}
    response = urllib.urlopen(url, params)
    return response.read()

if __name__ == '__main__':
    with open('output.txt', 'w') as f:
        f.write('Device Status Codes\n')
        f.write('-----\n')
        f.write(get_device_status_codes(''))
        f.write('\n')
        f.write('Device Categories\n')
        f.write('-----\n')
        f.write(get_device_category_codes(''))
```

OPeNDAP

Legacy Menu

<https://data.oceannetworks.ca/home>

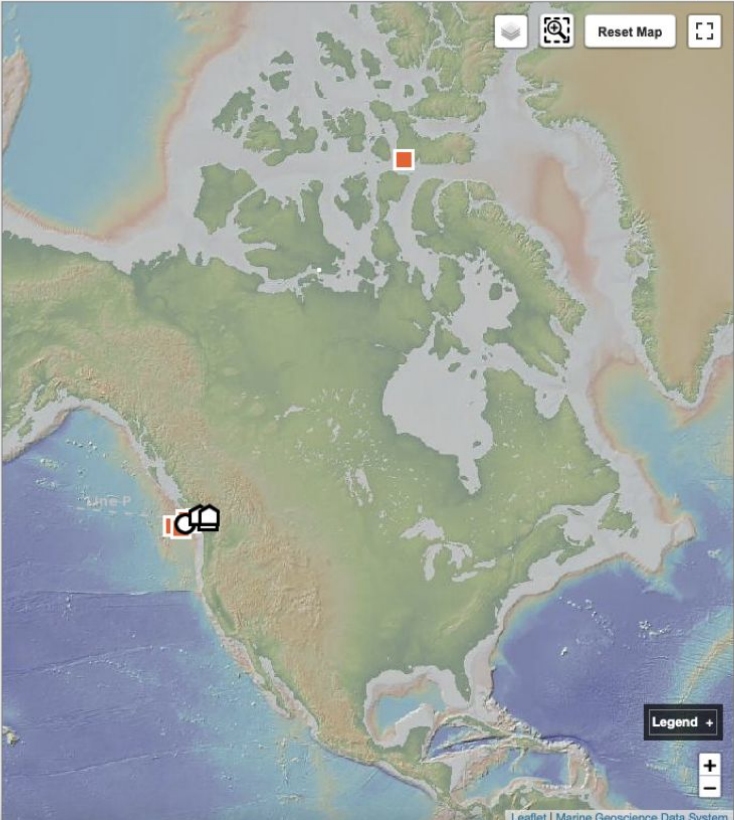
Data Search

Data Source Selection | Data Product Selection | View Cart (0 items) | Data Search Help

Data Source Selection

Sort by: Properties by Location

- Ocean Networks Canada
 - Arctic
 - Cambridge Bay
 - Darnley Bay
 - Davis Strait
 - Dease Strait
 - Franklin Strait
 - Gascoyne Inlet
 - Peel Sound
 - Queen Maud Gulf
 - Victoria Strait
 - Atlantic
 - Bay of Fundy
 - Conception Bay
 - Fortune Bay
 - Placentia Bay
 - Port aux Basques
 - St. John's Bay
 - Mobile Platforms
 - British Columbia Ferries
 - ROV Data
 - Pacific
 - British Columbia Lower Fraser
 - British Columbia North Coast
 - Northeast Pacific Ocean
 - Salish Sea
 - Vancouver Island



Map controls: Reset Map, Legend +

Data Source Filters

- Display Drifters
- Display Community Fisher Sampling Stations

Depth Range Filter

From (m): All

To (m): All

Time Period Filter

From (UTC): dd-MMM-yyyy hh:mm:ss

To (UTC): dd-MMM-yyyy hh:mm:ss

All Available

Reset Time Fields

Common Property Selection

Apply Filters | Clear Filters

Leaflet | Marine Geoscience Data System

Data Preview

Ocean Networks Canada Data Preview

Oceans 3.0

Logged in as Dwight Owens | [Profile](#) | [Help](#) | [Logout](#)



Data Preview

Data Search

Plotting Utility

SeaTube

Digital Fishers

Cameras

More

Admin

System Status

Request Support

Sort by: Instruments by Location

Filter on: No Filter

Ocean Networks Canada

Arctic

Atlantic

Mobile Platforms

Pacific

British Columbia Lower Fraser

British Columbia North Coast

Northeast Pacific Ocean

Salish Sea

Baynes Sound

Burrard Inlet

Discovery Passage

East Point

Juan de Fuca Strait

Monarch Head

Saanich Inlet

Strait of Georgia

Fraser River Delta

Strait of Georgia Central

Strait of Georgia CODAR System

Strait of Georgia East

Hydrophone Array - Box Type

Hydrophone A

Hydrophone

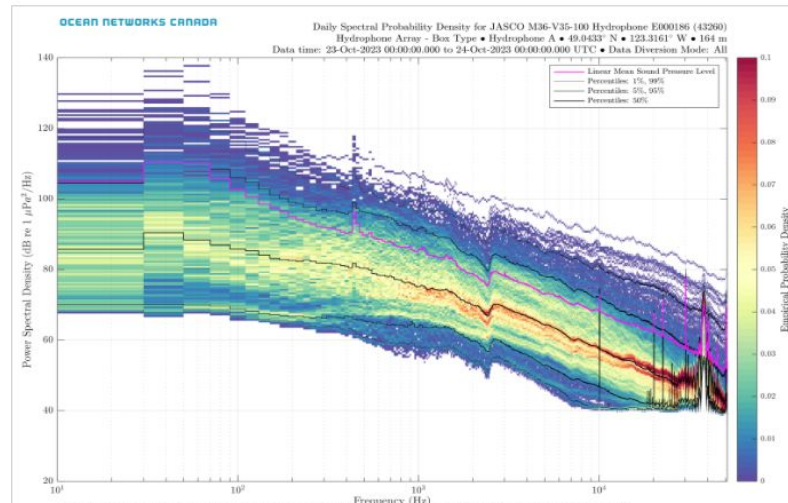
Summary

Day

Month

Latest

Instruments by Location: Ocean Networks Canada - Pacific - Salish Sea - Strait of Georgia - Strait of Georgia East - Hydrophone Array - Box Type - Hydrophone A - Hydrophone



SeaTube

Ocean Networks Canada SeaTube V3 Help | Login

Oceans 2.0 Request Support | Report a Problem

Data Preview | Data Search | Plotting Utility | SeaTube | More ▾

EX1905L2-Dive09 - North Atlantic Ocean

Map

Video

OKEANOS EXPLORER 2019

Annotation List 21 of 21

Filter

- fans, and sea feathers; horny corals; soft corals) | ID: 1365 [WORM]
- 17:39 specimen 3 in suction canister 3
- 17:47 Corallium | ID: 125325 [WORM]
- 17:48 Lithodidae (king crabs; stone crabs) | ID: 106737 [WORM]
- 17:54 Porifera (sponges) | ID: 558 [WORM]
two color...what's growing on the surface?
- 18:17 specimen 4 in suction canister 4
- 18:24 additional specimen 4 in port outside bio box
- 18:39 Paragorgiidae | ID: 125281 [WORM]
- 18:58 specimen 5 sponge in starboard inside bio box.
- 18:59 ROV leaving bottom.

Videos | Playlists

Resolution: Medium

Fixed Camera Video

Map | Profile | Detail

00:00 / 05:03

Dive Log Entries | My Annotations

| Start Date (UTC) | End Date (UTC) | Comr | Latitude | Longitude | Depth | Origin | Action |
|------------------|----------------|------|----------|-----------|-------|--------|--------|
| 00:00:39 | | | | | | | |
| 01:00:42 | | | | | | | |
| 02:00:44 | | | | | | | |
| 03:00:42 | | | | | | | |
| 04:00:45 | | | | | | | |
| 05:00:43 | | | | | | | |
| 06:00:41 | | | | | | | |
| 07:00:44 | | | | | | | |
| 08:00:41 | | | | | | | |
| no-aa-aa | | | | | | | |

Plotting Utility



Hydrophone Data Search

Hydrophone Data Search

- Arctic
- Atlantic
- Conception Bay
- Holyrood Bay Underwater Network
- Ocean Sonics icListen SC2-ETH Hydrophone**
- Pacific

Spectrogram: Date From (UTC): Date To (UTC):

Annotation Search:

Currently Viewing: Atlantic > Conception Bay > Holyrood Bay Underwater Network > Ocean Sonics icListen SC2-ETH Hydrophone 2098

Zoom

[« prev 01-Apr-2021](#) [next »](#)

2021-04-01 20:11:03 UTC

2021-04-01 20:16:03 UTC

2021-04-01 20:11:03 UTC

2021-04-01 20:16:03 UTC

Ocean Sonics icListen SC2-ETH Hydrophone 2098

Location: Atlantic > Conception Bay > Holyrood Bay Underwater Network

Deployment Dates:

- 14-Feb-2021 - 06-Apr-2021

Selected Data

Format: PNG PDF WAV FLAC MP3 FFT

No records found.

Annotations Search



Annotation Filters



Resource



Resource Type

Device Data



Resource

Ocean Sonics icListen AF Hydrophone 2545 (24206)



Include annotations up topology tree

Date (UTC)



Source

Hydrophone Viewer

Oceans 3.0



Fields



Owner

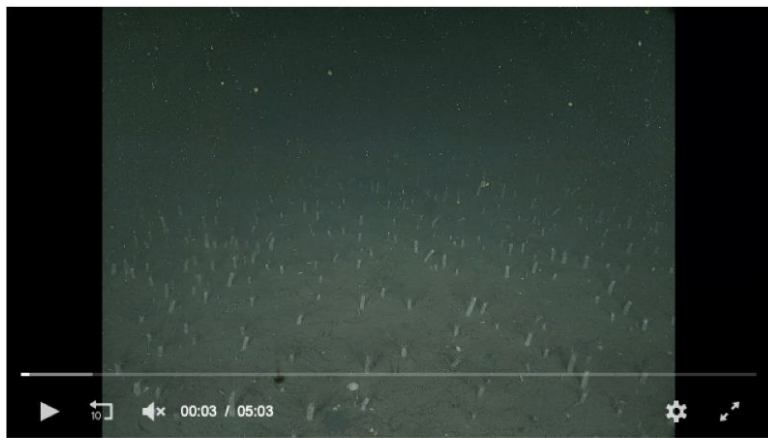
Shared



SEARCH

Data Dashboards

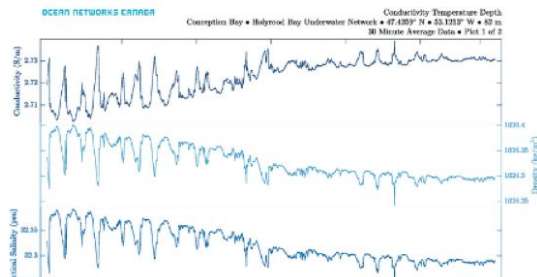
Latest Underwater Video Clip



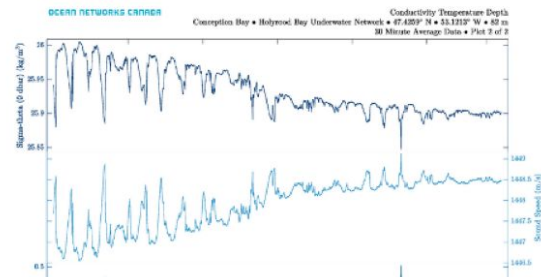
Minas Passage (Bay of Fundy) Shore Camera



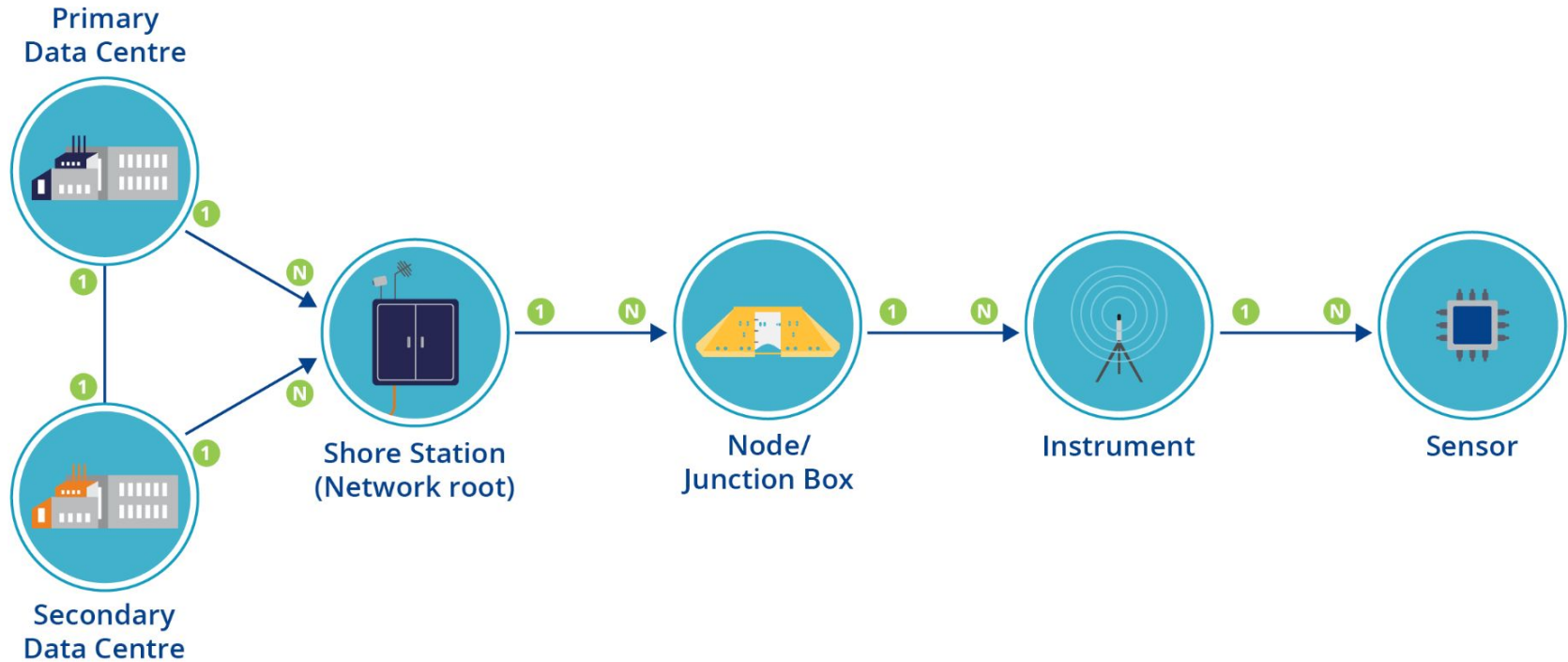
CTD Readings: Conductivity, Density Practical Salinity, Sigma T



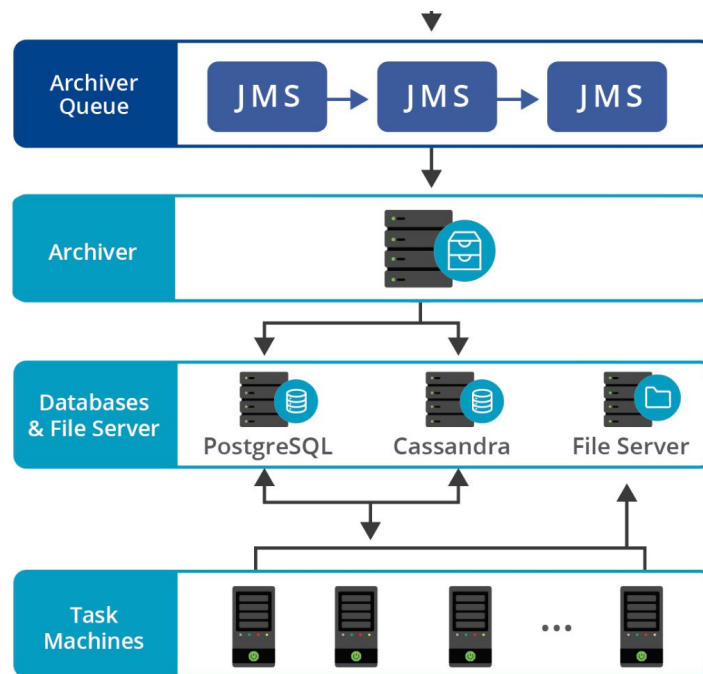
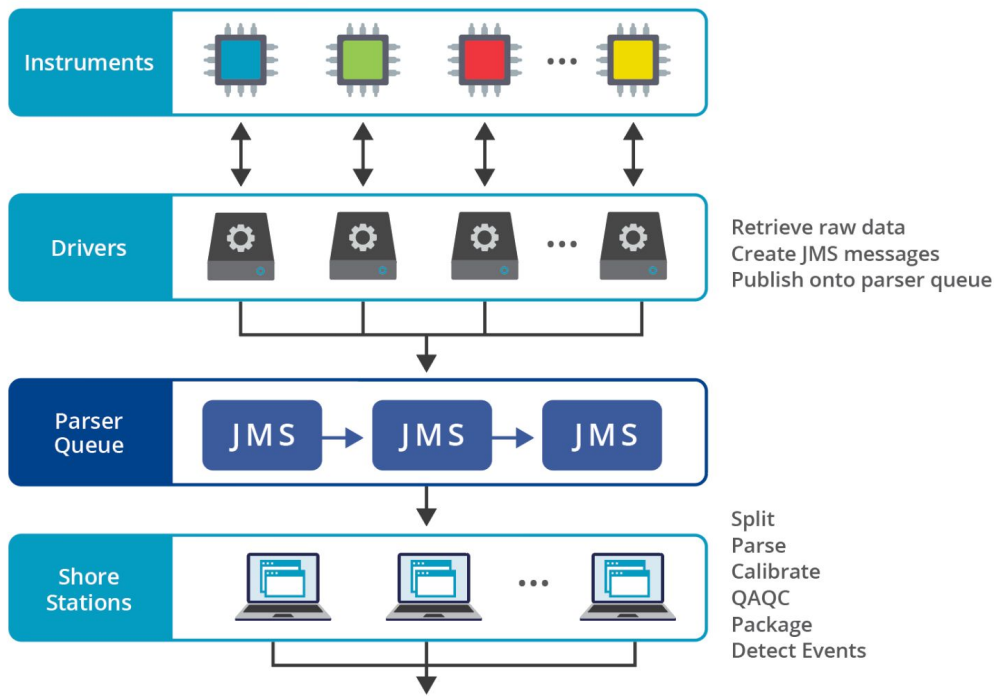
CTD Readings: Sigma-Theta, Sound Speed, Temperature



Oceans 3.0 Infrastructure Hierarchy



Data Acquisition and Archival



Data Products

- Hundreds of different varieties of data products currently available
- Generated within Oceans 3.0 by Java or MATLAB
- Usually generated on demand
- Some generated from scalar values in the databases
- Some are generated from complex array-based data files
- Some generated from both scalar and complex data
- <https://wiki.oceannetworks.ca/display/DP/Data+Products+Home>

Data Product Examples

Hydrophone

Ocean Sonics iListen SC2-ETH Hydrophone 2098 (22356) [Details](#)

Date From (UTC): 16-Feb-2021 00:00:00

All Available

Date To (UTC): 08-Apr-2021 23:59:59

Reset Time Fields



| | Time Series Scalar Data | | | | Time Series Scalar Plot | | | Log File | Audio Data | | | Time Series Staircase Plot | | Hydrophone Spectral Data | | | | Hydrophone Spectral Probability Density | | | Annotation File | Manual Scalar QAQC Results |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|-----|----------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|---|--------------------------|--------------------------|--------------------------|----------------------------|
| | CSV | MAT | TXT | JSON | PNG | PDF | TXT | WAV | MP3 | FLAC | PNG | PDF | PNG | MAT | PDF | DATA | PNG | MAT | PDF | .. | .. | |
| Hydrophone 45 Annotations (Disable Pop-up Blocker to See All) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |

Time Series Scalar Data



Time Series Scalar Plot



Audio Data



Processing Options

- Cleaning
- Averaging
- Min-Max
- Standard Deviation
- De-tiding
- Special Options

Conductivity Temperature Depth

Sea-Bird Microcat SBE37SIP 5682 (13107) [Details](#)

Date From (UTC): 14-Feb-2021 00:00:00 All Available
Date To (UTC): 07-Apr-2021 23:59:59 Reset Time Fields

04 Feb 2021 00:00:00
05 Feb 2021 00:00:00
06 Feb 2021 00:00:00
07 Feb 2021 00:00:00
08 Feb 2021 00:00:00
09 Feb 2021 00:00:00
10 Feb 2021 00:00:00
11 Feb 2021 00:00:00
12 Feb 2021 00:00:00
13 Feb 2021 00:00:00
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28 Feb 2021 00:00:00
29 Feb 2021 00:00:00
01 Mar 2021 00:00:00
02 Mar 2021 00:00:00
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27 Mar 2021 00:00:00
28 Mar 2021 00:00:00
29 Mar 2021 00:00:00
30 Mar 2021 00:00:00
31 Mar 2021 00:00:00
01 Apr 2021 00:00:00
02 Apr 2021 00:00:00
03 Apr 2021 00:00:00
04 Apr 2021 00:00:00
05 Apr 2021 00:00:00
06 Apr 2021 00:00:00
07 Apr 2021 00:00:00

| | CSV | HTML | JSON | PDF | PNG | XML | Log File |
|---|--------------------------|-------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Conductivity Temperature Depth 189 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Annotations (Disable Pop-up Blocker to See All) | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Conductivity (4224) | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Density (6995) | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Practical Salinity (1536) | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Sigma-t (7017) | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Sigma-theta (0 dbar) (15925) | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Sound Speed (6973) | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Temperature (4223) | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Data Product Options

Quality Control: Clean Data Raw Data

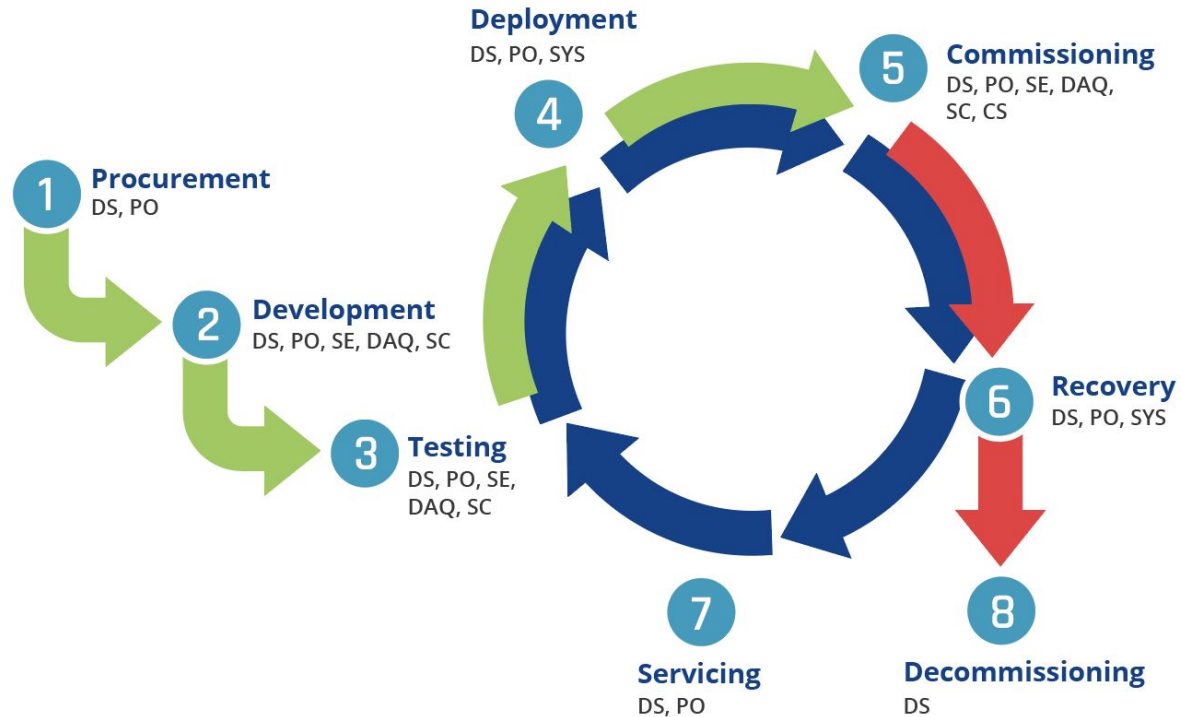
Data Gaps: Fill missing/bad data with NaNs (Not a Number) Do not fill gaps

Processing: Average 1 Minute 10 Minute 15 Minute 1 Hour 1 Day

NOTE: Most data products have [data](#) automatically generated and added to the Cart.

[+ Add to Cart](#)

Quality Assurance / Quality Control (QAQC)



DS: Data Stewardship
PO: Physical Operations
SYS: Systems
SE: Software Engineering

DAQ: Data Analytics & Quality
SC: Science Team
CS: Client Services

QARTOD: Quality Assurance of Real Time Ocean Data

1. Every real-time observation must be accompanied by a **quality descriptor**.
2. Some level of **automated real-time quality test** for all observations.
3. Quality flags and quality test descriptions must be sufficiently **described** in the accompanying metadata.
4. Observers should independently **verify or calibrate a sensor** before deployment.
5. Observers should **describe their method / calibration** in the metadata.
6. Observers should **quantify the level of calibration accuracy** and the associated expected error bounds.
7. **Manual checks** on the automated procedures, the real-time data collected and the status of the observing system must be provided by the observer on a timescale appropriate to ensure the integrity of the observing system.

Three QAQC methods

1. Real-time automated tests

- To catch failures, major spikes/dropouts

2. Delayed-mode automated tests

- Spikes, gradient (after 2 sample periods)
- Stuck values (after 3 hours)

3. Manual tests

- Performed by data specialists
- Periodic testing and flagging

Learn more about Oceans 3.0

The screenshot shows the article page on the Frontiers website. At the top, the journal logo 'frontiers in Marine Science' is displayed alongside the journal's impact factor (4.9) and the journal's focus area, 'Ocean Observation'. A navigation bar includes links for 'SECTION', 'ABOUT', 'ARTICLES', 'RESEARCH TOPICS', 'FOR AUTHORS', and 'EDITORIAL BOARD'. The article title, 'The Oceans 2.0/3.0 Data Management and Archival System', is prominently featured, along with the authors' names and their affiliations. The article is categorized as a 'TECHNOLOGY AND CODE article' and is dated 08 March 2022. A 'Check for updates' button is visible next to the article title. The abstract begins with the text: 'The advent of large-scale cabled ocean observatories brought about the need to handle large amounts of ocean-based data, continuously recorded at a high sampling rate over many years and made accessible in near-real time to the ocean science community and the public. Ocean Networks Canada (ONC) commenced installing and operating two regional cabled observatories on Canada's Pacific Coast, VENUS inshore and NEPTUNE offshore in the 2000s, and later expanded to include observatories in the Atlantic and'.

Impact Factor 4.9
More on impact >

frontiers
in Marine Science | Ocean Observation

SECTION ABOUT ARTICLES RESEARCH TOPICS FOR AUTHORS EDITORIAL BOARD ARTICLE

< Articles

THIS ARTICLE IS PART OF THE RESEARCH TOPIC
The Discovery of the Unknown Planet: The Ocean View

EDITED BY
Juan J. Dañoibeitia
European Multidisciplinary
Seafloor and water column
Observatory, ERIC foundation
(Italy), Italy

REVIEWED BY
Lucia Fanini
Institute of Marine Biological
Resources and Inland Waters,
Hellenic Center for Marine
Research, Greece

Michael F. Vardaro
University of Washington, United
States

The editor and reviewers' affiliations are the latest provided on their Loop research profiles and may not reflect their situation at the time of review.

TABLE OF CONTENTS
Abstract

TECHNOLOGY AND CODE article
Front. Mar. Sci., 08 March 2022 | <https://doi.org/10.3389/fmars.2022.806452>

The Oceans 2.0/3.0 Data Management and Archival System

Dwight Owens, **Dilumie Abeysirigunawardena**, **Ben Biffard**, **Yan Chen**, **Patrick Conley**, **Reyna Jenkyns**, **Shane Kerschtién**, **Tim Lavallee**, **Melissa MacArthur**, **Jina Mousseau**, **Kim Old**, **Meghan Paulson**, **Benoît Pirenne**, **Martin Scherwath** and **Michael Thorne**

Ocean Networks Canada, University of Victoria, Victoria, BC, Canada

The advent of large-scale cabled ocean observatories brought about the need to handle large amounts of ocean-based data, continuously recorded at a high sampling rate over many years and made accessible in near-real time to the ocean science community and the public. Ocean Networks Canada (ONC) commenced installing and operating two regional cabled observatories on Canada's Pacific Coast, VENUS inshore and NEPTUNE offshore in the 2000s, and later expanded to include observatories in the Atlantic and

<https://www.frontiersin.org/articles/10.3389/fmars.2022.806452/full>

The background of the slide is a blue-tinted image of an octopus, showing its tentacles and body. The octopus is positioned in the upper right and lower right areas of the frame.

API Overview

Introduction to API

- **Definition**

API (Application Programming Interface):

- enables machine-to-machine or cloud-to-cloud communication
- allows access to the functionality and data of other applications without needing to understand their internal workings.

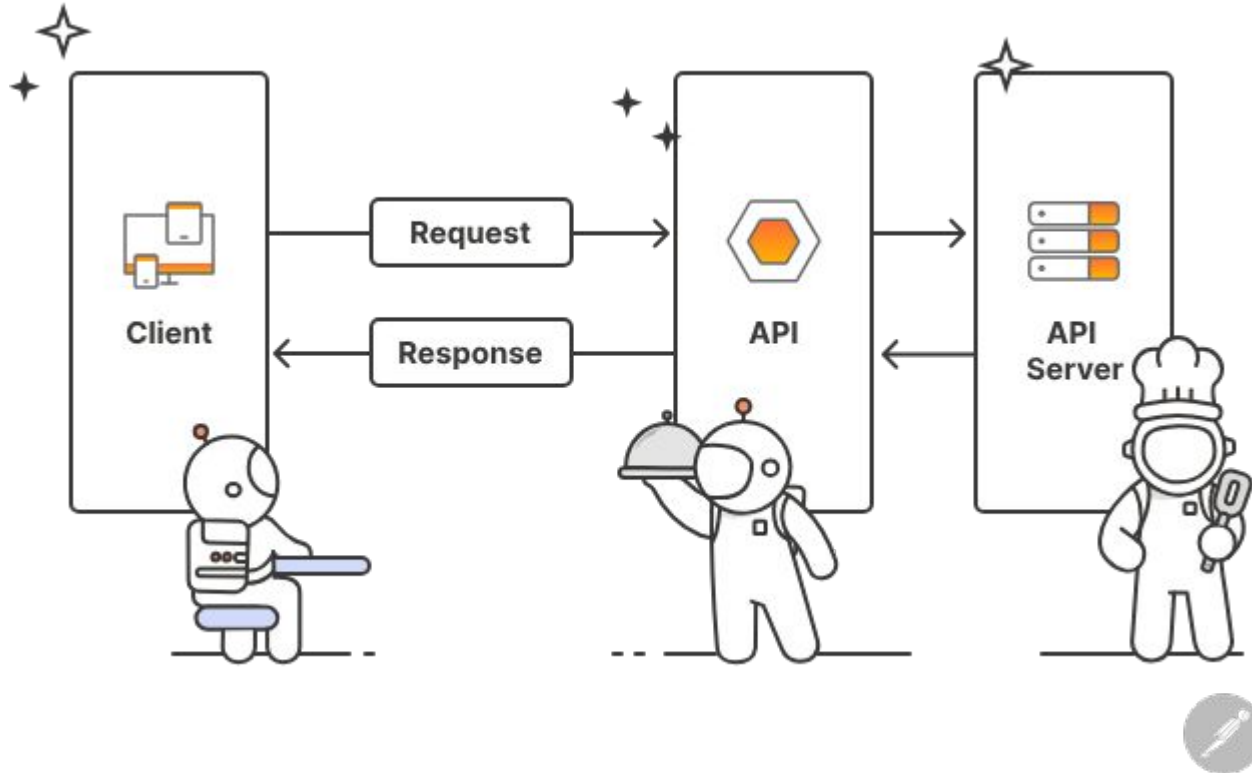
- **Who uses APIs?**

- Data Scientists
- Data Analysts
- Developers
- Cloud service providers

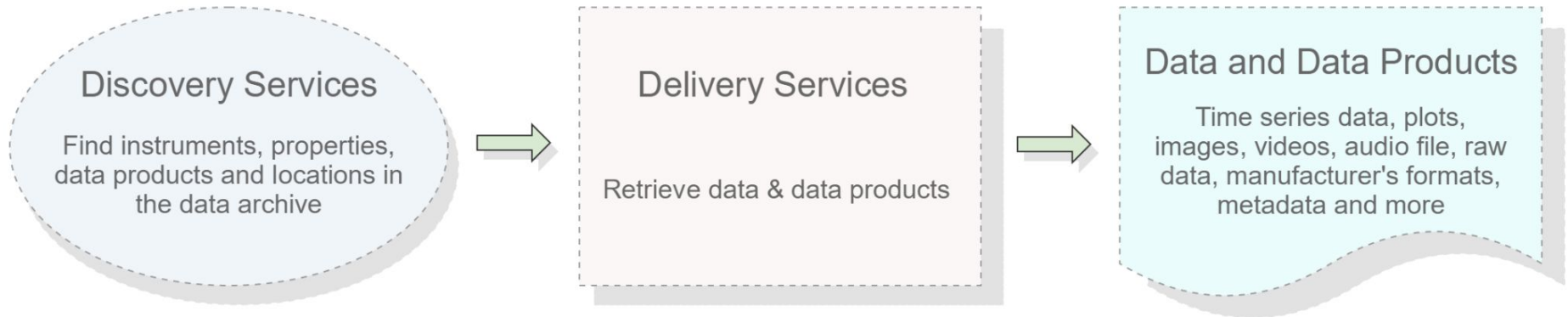
Benefits of API

1. Data Access
2. Automation
3. Real-Time Data
4. Integration
5. Collaboration

How does an API work?



Discovery, Delivery, Data



Discovery

locations

devices

dataProducts

properties

deployments

deviceCategories

Delivery Services

ONCs API

Real-Time

scalarData
rawData

Data Product Delivery

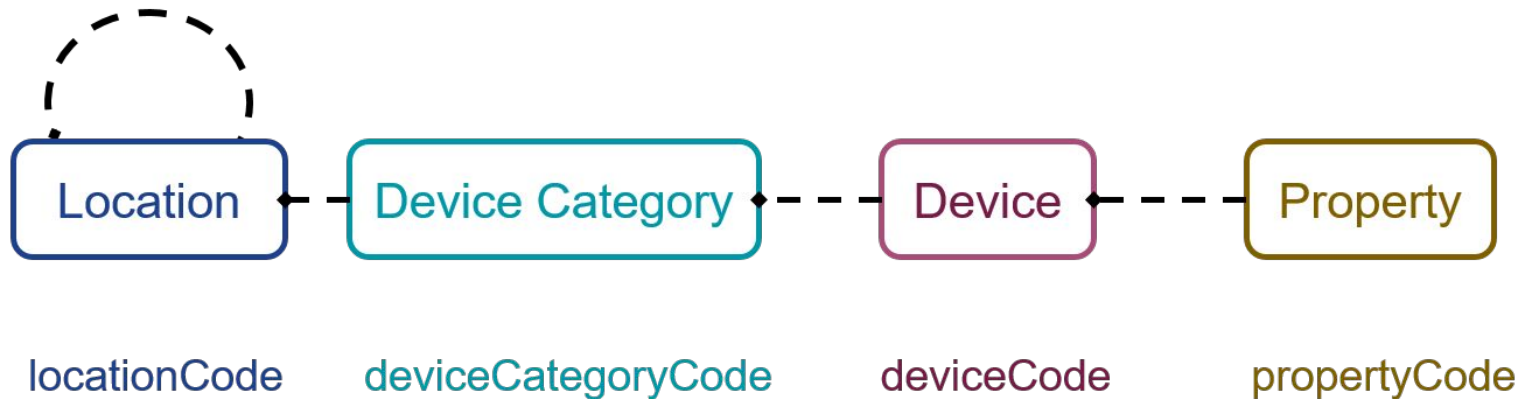
dataProductDelivery

Archive Files

archiveFiles

API Codes

API elements (locations, devices, etc.) are identified by a code, not an id number.



i.e.: “NC89”

“BPR”

“BPR_889”

“pressure”

Methods of Data Delivery

| API Web Services | API Endpoint | Required Parameters |
|---|--------------------------|---|
| Scalar data and raw data https://data.oceannetworks.ca/api/scalardata https://data.oceannetworks.ca/api/rawdata | Location | token, locationCode, deviceCategoryCode |
| | Device | token, deviceCode |
| Archive files https://data.oceannetworks.ca/api/archivefiles | Location | token, locationCode, deviceCategoryCode |
| | Device | token, deviceCode |
| | Download | token, filename |
| Data Product Delivery https://data.oceannetworks.ca/api/dataProductDelivery | Request | token, dataProductCode, extension, dateFrom, dateTo |
| | Run | token, dpRequestId |
| | Download | token, dpRunId, index, deleteFile |

Where to find information about ONCs API

The screenshot shows the Oceans 3.0 API website. The browser address bar displays `oceannetworkscanada.github.io/Oceans3.0-API/Home.html`. The left sidebar contains a search bar and a navigation menu with the following items: Oceans 3.0 API, Description, Get started, API Guide, and Code Examples. The main content area features the title "Oceans 3.0 API" and a "View page source" link. Below the title is a flow diagram illustrating the API process: "Discovery Services" (Find instruments, properties, data products and locations in the data archive) leads to "Delivery Services" (Retrieve data & data products), which leads to "Data and Data Products" (Time series data, plots, images, videos, audio file, raw data, manufacturer's formats, metadata and more). A "Description" section follows, stating that client libraries provide quick, easy, and consistent access to the Oceans 3.0 API in popular scientific programming languages. These libraries wrap web service calls, complex workflows, and business logic. The services are free, open source, and hosted on GitHub. A table lists the available client libraries for MATLAB and Python. Finally, a "Get started" section notes that all requests require an Oceans 3.0 API token and provides instructions on how to obtain one.

Oceans 3.0 API

Discovery Services → Delivery Services → Data and Data Products

Description

Client libraries provide quick, easy and consistent access to Oceans 3.0 API, in popular scientific programming languages.

These libraries provide a class with methods that wrap web service calls, complex workflows, and business logic so that users can discover and download data (raw, text, image, audio, video or any other available) in a single line of code.

They are all free projects, published under Open Source licenses and hosted on GitHub.

| Language | Latest version | License | GitHub Repo | Documentation |
|----------|-------------------------------------|--------------------------------------|-----------------------------------|-----------------------------------|
| MATLAB | File Exchange 2.2.0 | license BSD-2-Clause | api-matlab-client | WIP |
| Python | pyp1 v2.4.1 | license Apache-2.0 | api-python-client | api-python-client |

Get started

All requests require a unique Oceans 3.0 API token that authorizes you to access our data.

How to obtain an ONC token?

- Register for an Oceans 3.0 account at <https://data.oceannetworks.ca/Registration>.
- Log into your account at <https://data.oceannetworks.ca> by clicking the Log In link.
- Click the Profile link (top right corner) to access your account profile.
- Access the Web Services API tab and click Copy Token.

<https://oceannetworkscanada.github.io/Oceans3.0-API/Home.html>



Break

10 minutes

An aerial photograph of a coastline. The water is a deep teal color, with white foam from waves crashing against a dark, rocky shore on the left. The text '10:00' is overlaid in the center of the image in a white, sans-serif font.

10:00

The background of the slide is a blue-tinted image of an octopus, showing its tentacles and body. The octopus is positioned in the upper right and lower right areas of the frame.

Hands-on: OpenAPI Overview and Demo

Troubleshooting

- If you need assistance, please raise your hand or speak up and one of us will attend to your question.
- Please follow along with everything throughout the workshop unless otherwise stated.

Introduction to OpenAPI Specification

OpenAPI Specification (formerly Swagger Specification):

- A format used to describe, produce, and consume RESTful web services
 - Independent requests.
 - Resource based design (HTTP compatible)
 - Scalable and flexible.
- Defines the structure and syntax of REST API's
- Describes an API in its entirety:
 - Endpoints
 - Methods
 - Authentication and Security
 - Request and Response Formats
 - Data schema

Oceans 3.0 OpenAPI

Ocean Networks Canada OpenAPI

Oceans 3.0

Logged in as Tricy Aquino | Profile | Help | Logout

Home | Data Preview | Data Search | Plotting Utility | SeaTube | Digital Fishers | Cameras | More | Admin | System Status | Request Support

Oceans 3.0 Public API 1.0.0

For support and help email: info@oceannetworks.ca

The Oceans 3.0 API allows users to programmatically access Ocean Networks Canada vast data archive via user-defined code. The API is backward compatible and provides a number of RESTful webservice services following the OpenAPI specification. The services in the API are split into two groups:

- Discovery Services to find the data
- Delivery Services to retrieve data

Before you get started

Ocean Network Canada's RESTful web services return JSON formatted data. We recommend installing a JSON formatter/interpreter extension or using an online JSON formatter for example <https://jsonformatter.org/> to make the api responses more human readable.

Additional Resources

- https://en.wikipedia.org/wiki/OpenAPI_Specification
- https://en.wikipedia.org/wiki/Representational_state_transfer
- <https://wiki.oceannetworks.ca/display/O2A>

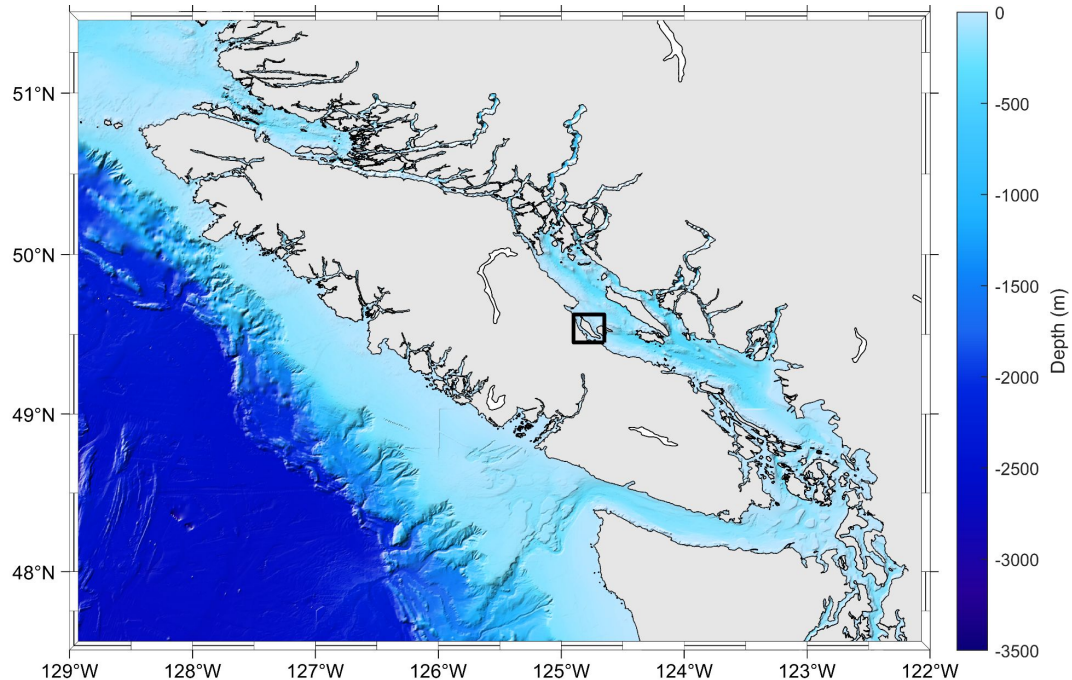
Link to - <https://data.oceannetworks.ca/OpenAPI>

Your turn!

- You will be asked 8 questions, for which you will have to use the OpenAPI to discover the answers.
- Make a note of your answers however you like:
 - On paper.
 - In a word document.
 - Remember them (?)
- We'll switch back to Menti to see how we got on!

Baynes Sound:

- Baynes Sound is a narrow channel situated between Denman Island and Vancouver Island .



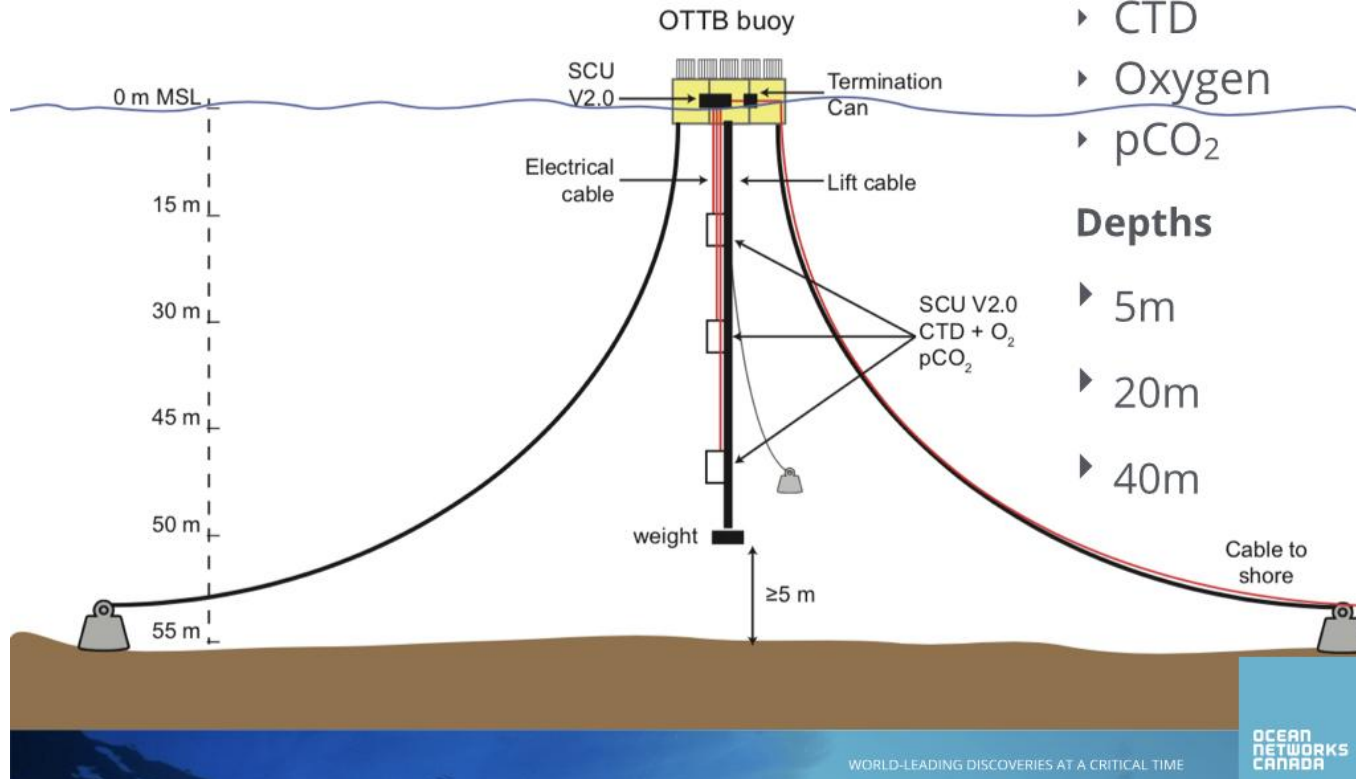
OCEAN ACIDIFICATION MOORING INSTALLED IN BAYNES SOUND

Science instruments

- ▶ Met station
- ▶ CTD
- ▶ Oxygen
- ▶ $p\text{CO}_2$

Depths

- ▶ 5m
- ▶ 20m
- ▶ 40m



Questions:

1. What is the location code for the Baynes Sound Mooring?
2. What is the location code for the platform at 40 mbss on the mooring?
3. On January 1st 2024, how many "children" did the mooring site have?
4. What is the device category code for the CO2 sensor at 40 mbss?
5. What is the deployment start date of the current CO2 Sensor at 40 mbss?
6. What is the property code for temperature from the CTD at 5 mbss?
7. What is the device ID of the CTD currently deployed at 5 mbss?
8. What does TSSP stand for as a data product code?
 - a. Bonus 1: What does TSSD stand for?
 - b. Bonus 2: What is the total file size (in kb) of the Log File collected on July 7th 2024 by the CTD at 5 mbss?

The background of the slide is a blue-tinted image of an octopus, showing its head and tentacles. The octopus is positioned in the upper right and lower right areas of the frame. The overall color scheme is various shades of blue.

ONC's API Client Library Prerequisites

Troubleshooting

- Common error: Error 401 - this means you need to input your personal token into the code for it to run
- If you need assistance, please raise your hand or speak up and one of us will attend to your question.
- Python Glossary Items - <https://docs.python.org/3/glossary.html>.
- Please follow along with everything throughout the workshop unless otherwise stated.

API Call Prerequisites

Install ONC Library

```
1 #access to system-specific parameters and functions
2 import sys
3
4 !{sys.executable} -m pip install --upgrade onc -q #ensures the command uses the pip associated with that environment
```

Library Imports

```
1 #import all libraries needed to run your codes
2 from onc import ONC
3 import json
4 import pandas as pd
5 import os
```



API Call Prerequisites, cont.

Request Parameters

```
1 # Request air pressure data from Campbell River Shore Station
2 # The codes for the parameters are found on the links provided or using OpenAPI
3
4 onc = ONC(token= os.environ['TRICY_TOKEN'])      # Enter your token here
5
6 requestParameters = {'locationCode':'CRSS',      # Define the location to use; Campbell River Shore Station
7                      'deviceCategoryCode':'METSTN', # Define the device category to use; Meteorological Station -
8                      'sensorCategoryCodes':'pressure1', # Define the sensor category to use; The absolute air press
9                      'qualityControl':'clean', # Define the quality control to use; See https://wiki.ocean
10                     'dateFrom':'2022-01-15T00:00:00.000Z', # Starting date and time for requested data (From Date)
11                     'dateTo':'2022-01-17T00:00:00.000Z'} # Ending date and time for requested data (To Date)
12
13
14
15 response = onc.getDirectByLocation(requestParameters) # Make the request using the parameters
```





Case Study

API and python with Oceans 3.0 data

Objectives:

- Learn how to download data using the **scalar data** service
- Learn how the Oceans 3.0 API is Interoperable with data from the Ocean Observatories Initiative
- Be able to perform some basic manipulations of the API downloaded data using python code

Overview: practice using API in a case studies

- Honga Tonga volcanic eruption and tsunami (step by step API workflows for scalar data)

Optional case studies for advanced students

- **Arctic** (complete API workflows with audio and scalar data)
- **Acoustic Doppler Current Profiler** (ADCP) (complete API workflows focusing on manipulation of scalar data)

Data: will be using clean data (data that has passed different quality control checks)

Raw and Clean data

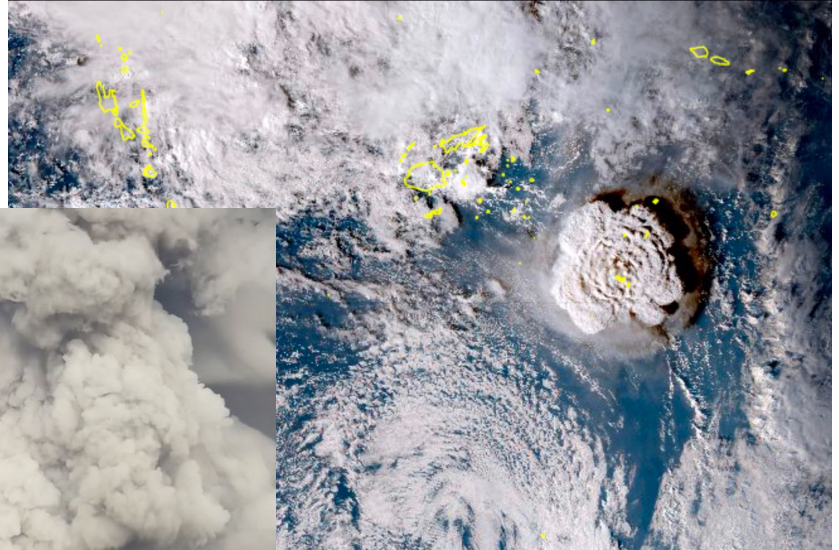
Raw Data

A quality control option that supplies raw data in the data products: no action is taken to modify the data. In general, all scalar data is associated with a quality control flag. These flags are stored adjacent to the data values.

Clean Data

A quality control option that will cause any data values with quality control failures to be replaced with NaNs. If the do not fill data gaps option is selected, data values with quality control failures will be removed. For all data products, when resampling with the clean option, any data with quality control failures are removed prior to the resampling (this rule applies to all resampling types: average, min/max, etc).

Hunga Tonga volcanic eruption & tsunami

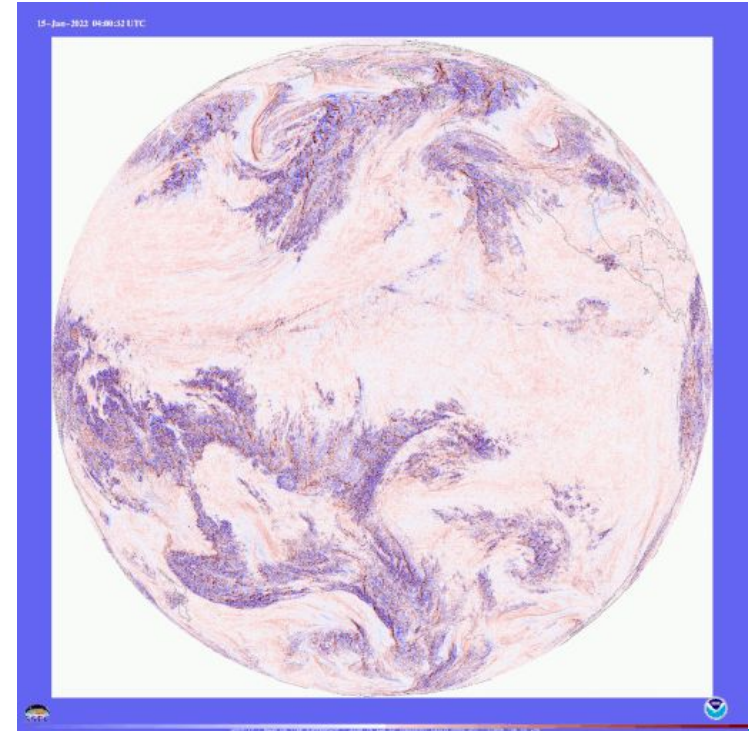


Hunga Tonga volcanic eruption & tsunami



January 15th 2022 (04:14 UTC)

Undersea volcano erupted causing a pressure wave in the atmosphere and also generating a tsunami



Atmospheric waves from eruption

Hunga Tonga volcanic eruption and tsunami

Hunga Tonga volcanic eruption & tsunami

This case study combines data from Ocean Networks Canada and the US Ocean Observatories Initiative

Jupyter Notebooks we will be using:

1. Absolute air pressure
2. Seafloor Pressure
3. De-tided seafloor pressure (DART (Deep ocean Assessment and Reporting of Tsunamis) sensor)

How to access the Notebooks:

Link to notebooks: [AGU 2024 Jupyter Notebooks](#)

If you need assistance, please ask!



Break

10 minutes

An aerial photograph of a tropical coastline. The water is a vibrant turquoise color, transitioning to a white sandy beach. The land is covered in lush green vegetation. The text '10:00' is overlaid in the center of the image.

10:00

The background of the slide is a blue-tinted image of an octopus, showing its tentacles and body. The octopus is positioned in the upper right and lower right areas, with its tentacles extending across the frame. The overall color scheme is various shades of blue.

ONC Data Citation

What is Data Citation?

Data citation is the practice of referencing data products used in research. A data citation includes key descriptive information about the data, such as the title, source, and responsible parties.

Joint Declaration of Data Citation Principles



Importance



Credit and Attribution



Evidence



Unique Identification



Access



Persistence



Specificity and Verifiability



**Interoperability and
Flexibility**

Data Citation Synthesis Group: Joint Declaration of Data Citation Principles. Martone M. (ed.) San Diego CA: FORCE11; 2014 <https://doi.org/10.25490/a97f-egyk>

Data Citations 101: Persistent Identifier (PID)

A persistent identifier (PID) is a long-lasting reference to a document, person, file, web page, or other object (real or digital)

Components of a PID:

- A unique **identifier**
- A **service** that resolves the identifier to the object - even if its location changes
- **Metadata** about the object



A type of PID commonly used in scholarly communication contexts is a DOI (Digital Object Identifier) and DataCite is an example of a non-profit organisation that provides persistent identifiers (DOIs) for research data and other research outputs.



DataCite
FIND, ACCESS, AND REUSE DATA

How to cite data at ONC?

Citing **data** is just like citing a **journal article**:

Typical journal citation

Chatzievangelou D, Thomsen L, Doya C, Purser A and Aguzzi J (2022) Transects in the deep: Opportunities with tele-operated resident seafloor robots. *Front. Mar. Sci.* 9:833617. doi: 10.3389/fmars.2022.833617

ONC dataset citation

Ocean Networks Canada Society. 2022. *Fraser River Delta Upper Slope Acoustic Doppler Current Profiler 300 kHz Deployed 2022-03-11*. Ocean Networks Canada Society.
<https://doi.org/10.34943/8a8882c3-3755-4b3a-bdef-caf9d503872d>.

Data Citation Components

Creator (PublicationYear). Title. Publisher. Identifier

- Ocean Networks Canada Society. 2022. Fraser River Delta Upper Slope Acoustic Doppler Current Profiler 300 kHz Deployed 2022-03-11. Ocean Networks Canada Society. <https://doi.org/10.34943/8a8882c3-3755-4b3a-bdef-caf9d503872d>.

Author or Creator: The people or organizations responsible for the intellectual work to develop a data set.

Public Release Date: When the particular version of the data set was first made available for use (and potential citation) by others.

Title: The formal title of the data set, not the project or a related publication.

Publisher/Repository: The name of the entity that holds or produces the data.

Resolvable Persistent Identifier: The unique identifier that provides the ability to access the data.

Access Date: Because data can be dynamic and changeable in ways that are not always reflected in release dates and versions, it is important to indicate when online data were accessed.

DataCite Metadata

Title

Douglas Channel Video Camera Deployed 2020-10-17

DOI

10.34943/c6b8cc3b-197c-4df2-86a4-e8cdc297c850

Abstract

The Axis Q6044 PTZ Dome Network Camera (S/N ACCC8E336A0C) was deployed on 2020-10-17 at Douglas Channel. Douglas Channel is one of the principal inlets of the British Columbia coast. This device is a Video Camera. Video cameras record video of characteristics of the surrounding environments and can be deployed on fixed and mobile platforms. It was deployed on a fixed platform. Data from this deployment were archived and made available through Ocean Networks Canada's Oceans 3.0 digital infrastructure, with quality assurance and derived data products following established practices.

Creators

Organizational

Gitga'at First Nation

Organizational

[Ocean Networks Canada Society](#)

Date Created

2020-10-20

Citation

DOI Citation

[Gitga'at First Nation](#), Ocean Networks Canada Society. 2020. Douglas Channel Video Camera Deployed 2020-10-17. Ocean Networks Canada Society. <https://doi.org/10.34943/c6b8cc3b-197c-4df2-86a4-e8cdc297c850>.

Data Links

[Download data using Data Search](#)

[View device details for Axis Q6044 PTZ Dome Network Camera \(S/N ACCC8E336A0C\)](#)

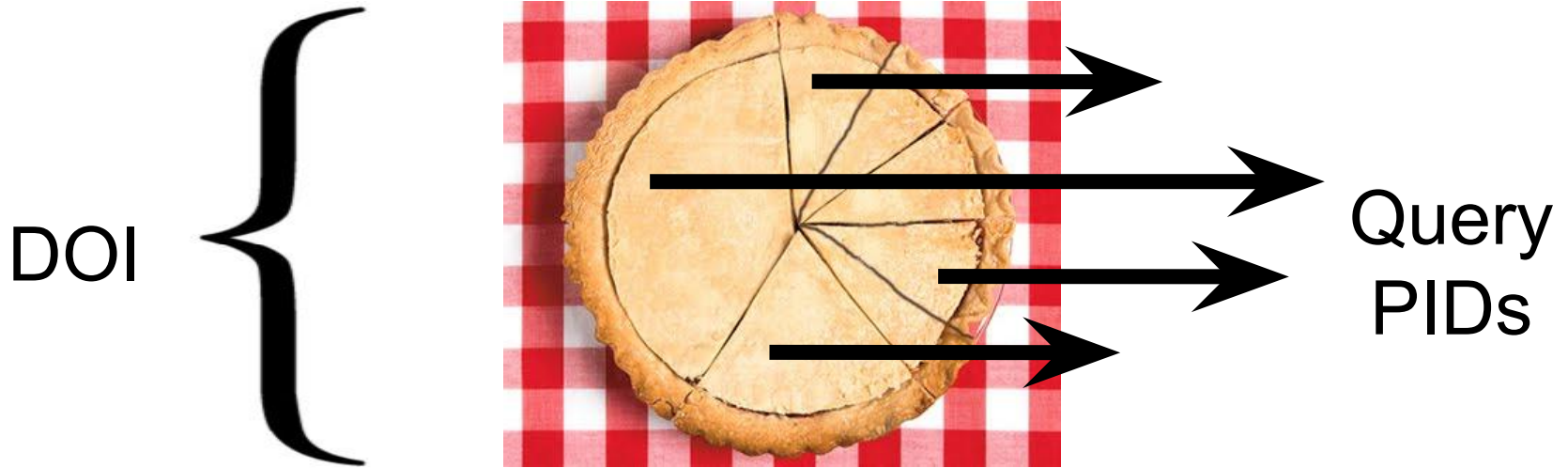
[Download latest ISO 19115 XML metadata](#)

Version History

| DOI | Reason | ↓ DOI Generation Date |
|--------------------------------------|--------|-------------------------|
| 10.34943/c6b8cc3b... | | 2020-11-02 19:00:16.916 |

1 of 1 < 1 >

Query PIDs



- Every data search (query) in Oceans 3.0 is **saved** in the database and labeled with its own **local identifier**, the '**Query PID**'
- Query PIDs can be used like a DOI in the Oceans 3.0 Landing Page Resolver, to retrieve a landing page with **additional details** specific to that exact search

23653374

DataCite Metadata

Title

Fraser River Delta Upper Slope Acoustic Doppler Current Profiler 300 kHz Deployed 2022-03-11

Query Details

Data Product

[Log File](#)

Query Citation

Ocean Networks Canada Society. 2022. Fraser River Delta Upper Slope Acoustic Doppler Current Profiler 300 kHz Deployed 2022-03-11. Ocean Networks Canada Society. <https://doi.org/10.34943/8a8882c3-3755-4b3a-bdef-caf9d503872d>. Subset Query: 23653374. Accessed 2024-01-10.

Creators

Organizational

[Ocean Networks Canada Society](#)

Format

txt




Data Product Options

Date Created

2022-03-12

Search History Tool

Link to Oceans 3.0 <https://data.oceannetworks.ca/SearchHistory>
 Documentation <https://wiki.oceannetworks.ca/display/O2KB/Search+History>

| Path | Search ID | Data Product | Date From | Date To | Options | Query Date | Search S... |
|--|--|-------------------------|---------------------|-------------------------|--|---|-------------|
| Ocean Networks Canada > Pacific > Salish Sea > Strait of Georgia > Fraser River Delta > Fraser River Delta Upper Slope > Delta Dynamics Laboratory | 37518243 | Log File | 2022-03-11 0... | 2022-04-04 0... | No options found | 2024-01-10 1... | Data Search |
| Query PID | Device | Date From | Date To | Site ID | Dataset DOI | Copy Citation | |
| 23653374 | RDI Workhorse Monitor ADCP... | 2022-03-11 20:42:58 | 2022-04-04 00:00:00 | 1026960 | 10.34943/8a8882c3-3755-4b3... |  | |
| Ocean Networks Canada > Arctic > Cambridge Bay > Underwater Network | 37517738 | Time Series Scalar Data | 2018-07-26 0... | 2018-08-04 0... | Fill missing/bad data with NaNs (Not a Number), Clean Data, None | 2024-01-10 1... | Data Search |
| Query PID | Device | Date From | Date To | Site ID | Dataset DOI | Copy Citation | |
| 23653371 | ASL Shallow Water Ice Profile... | 2018-07-26 20:58:00 | 2018-08-04 00:00:00 | 1004299 | 10.34943/5f5cb349-d2fd-4841... |  | |
| Ocean Networks Canada > Pacific > Salish Sea > Discovery Passage > Campbell River Shore Station | 37506413 | Time Series Scalar Data | 2017-09-12 0... | 2018-01-05 2... | Fill missing/bad data with NaNs (Not a Number), Clean Data, None | 2024-01-09 2... | Data Search |
| Query PID | Device | Date From | Date To | Site ID | Dataset DOI | Copy Citation | |
| 23642047 | Lufft WS501 (S/N 192.1216.1... | 2017-09-12 06:51:47 | 2018-01-05 22:02:50 | 1000522 | 10.34943/5491fb80-ef03-4cb8... |  | |

Web Services: Citation Text

DOIs and Query PIDs can also be used with the **Oceans 3.0 API** to retrieve the data citation formatted according to the [ESIP Data Citation Guidelines for Earth Science Data, v.2](#):

DOI

<https://data.oceannetworks.ca/api/citationText?method=get&doi=10.34943/8a8882c3-3755-4b3a-bdef-caf9d503872d>

Query PID

<https://data.oceannetworks.ca/api/citationText?method=get&queryPid=23653374>

DOIs can also be accessed via the following in a Jupyter Notebook

```
response = requests.get(url,params=requestParameters)
requestInfo = json.loads(str(response.content,'utf-8'))
requestInfo['citations']
```

```
> ['Ocean Networks Canada Society. 2022. Fraser River Delta Upper Slope Acoustic  
Doppler Current Profiler 300 kHz Deployed 2022-03-11. Ocean Networks Canada Society.  
https://doi.org/10.34943/8a8882c3-3755-4b3a-bdef-caf9d503872d.']
```

Another Method of Finding Citations in Data Search

The screenshot illustrates a four-step process for finding citations in the data search interface:

- Step 1:** In the 'Data Source Selection' panel, the 'Conductivity Temperature Depth' data source is selected.
- Step 2:** In the 'Site Device List' table, the device with ID '1208144' (VIP-31 - Saanich Inlet Central Node) is highlighted.
- Step 3:** The 'Site Device Entry' details for ID '1208144' are displayed, showing the device name 'VIP-31 - Saanich Inlet Central Node' and the start date '2020-09-25'.
- Step 4:** The 'DataCite Metadata' for the device is shown, including the DOI '10.34943/27b34f3a-92a6-4d47-86af-dba458f970d' and the abstract describing the deployment of the Sea-Bird SeaCAT SBE19plus V2 6937 at Patricia Bay.

Additional details from the 'DataCite Metadata' section:

- Title:** Patricia Bay Conductivity Temperature Depth Deployed 2020-09-25
- DOI:** 10.34943/27b34f3a-92a6-4d47-86af-dba458f970d
- Abstract:** The Sea-Bird SeaCAT SBE19plus V2 6937 was deployed on 2020-09-25 at Patricia Bay. Patricia Bay is located in the Saanich Inlet, on the southern tip of Vancouver Island. This device is a Conductivity Temperature Depth (CTD) is an instrument package that contains sensors for measuring the conductivity, temperature, and pressure of seawater. Salinity, sound velocity, depth and density are variables that can be derived from sensor measurements. CTDs can carry additional instruments and sensors such as oxygen sensors, turbidity sensors and fluorometers. It was deployed on a fixed platform. Data from this deployment were archived and made available through Ocean Network Canada's Oceans 2.0 digital infrastructure, with quality assurance and derived data products following established practices.
- Creators:** Organizational: Ocean Networks Canada Society
- DOI Datasets:** 10.34943/27b34f3a-92a6-4d47-86af-dba458f970d
- ERDDAP Datasets:** scalar_1208144, ERDDAP Management

<https://wiki.oceannetworks.ca/display/DP/Data+Citations#DataCitations-DatasetLandingPage>

Referencing ONC itself (not datasets)

Guidance for citing ONC Oceans 3.0 digital infrastructure

If you are referencing ONC's digital infrastructure, such as the tools and functions in Oceans 3.0:

Owens D, Abeysirigunawardena D, Biffard B, Chen Y, Conley P, Jenkyns R, Kerschtién S, Lavalée T, MacArthur M, Mousseau J, Old K, Paulson M, Pirenne B, Scherwath M and Thorne M (2022) The Oceans 2.0/3.0 Data Management and Archival System. *Front. Mar. Sci.* 9:806452. doi: 10.3389/fmars.2022.806452

<https://www.frontiersin.org/articles/10.3389/fmars.2022.806452/full>

Guidance for citing ONC data repository (entity)

Use the below citation if you are referring to Ocean Networks Canada data repository services:

Ocean Networks Canada's Oceans 3.0; editing status 2024-10-07; re3data.org - Registry of Research Data Repositories. <http://doi.org/10.17616/R3RW43> last accessed: YYYY-MM-DD

AGU24 Learning Evaluation



<https://bit.ly/3D0N49s>

ONC survey:

<https://www.surveymonkey.com/r/QCRM7CF>



The background of the slide is a blue-tinted image of an octopus, showing its tentacles and body. The octopus is positioned in the upper right and lower right areas, with its tentacles extending across the frame. The overall color scheme is various shades of blue.

Question & Answer Period

Please reach out to ue-officer@oceannetworks.ca for any further questions about a specific data and/or services.

THANK YOU!

Ocean Networks Canada is Funded by the Canada Foundation for Innovation, the Government of Canada, Natural Resources Canada, Fisheries & Oceans Canada, CANARIE, the Government of British Columbia, the University of Victoria, and many others.

 @ocean_networks  OceanNetworksCanada Visit: oceannetworks.ca

Special thanks to Sage Lichtenwalner and
the Ocean Observatories Initiative (OOI)