



United Nations
Educational, Scientific and
Cultural Organization



Intergovernmental
Oceanographic
Commission

Brief summary & Report

SEA LEVEL STATION MONITORING FACILITY

Bart Vanhoorne
Stijn Vermaere



info@ioc-seaivelmonitoring.org
Flanders Marine Institute (VLIZ)
Belgium

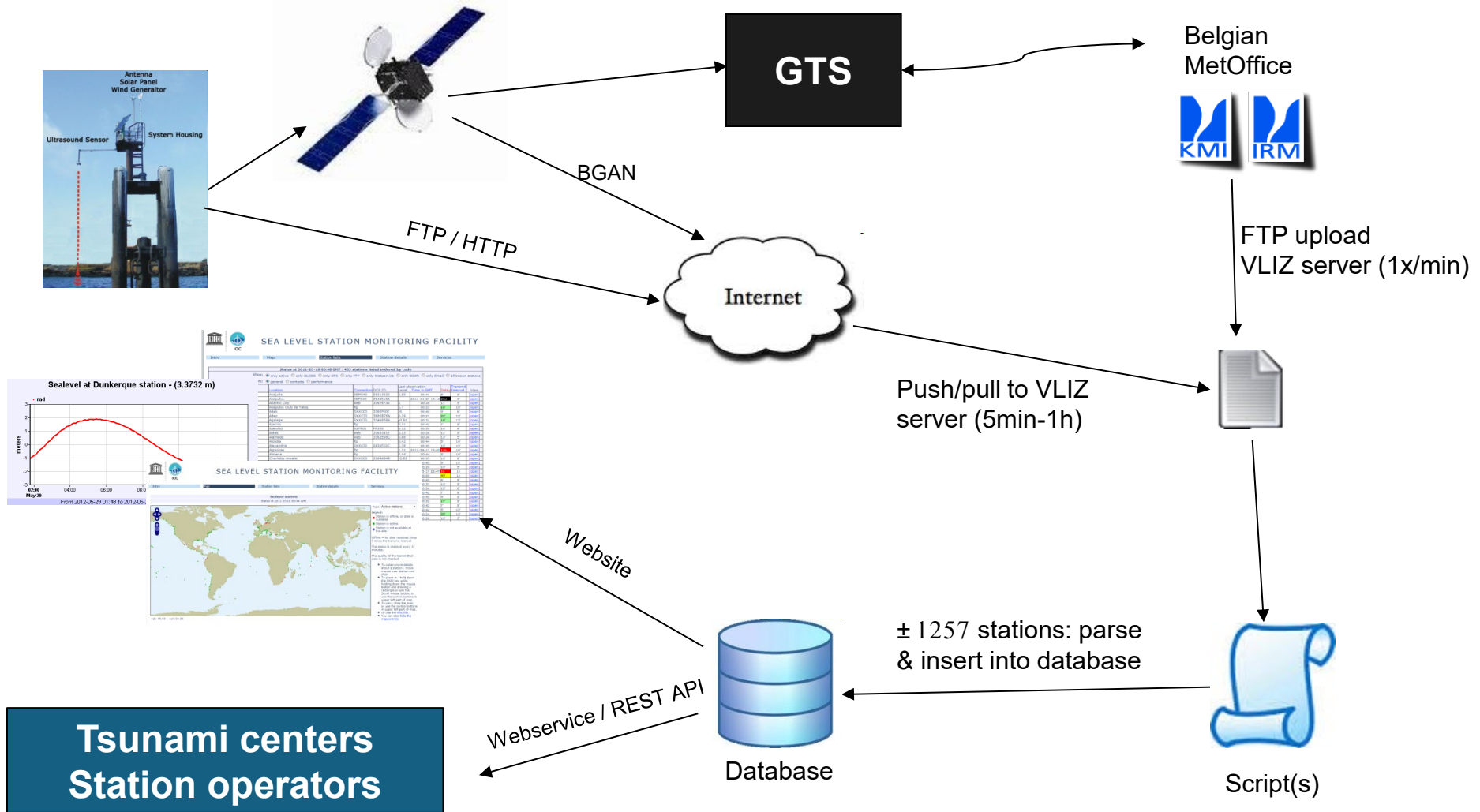
Content

- Summary
- Data flow
- Operational Interface
- Station metadata management
- Webservices & API
- Sea Level Station Catalogue (SSC)
- Progress report 2022 - 2025

Summary

- SLSMF collects and processes data in real time from world wide stations:
 - 1257 sea level measuring stations
 - 179 institutes (station operators)
- The objective of this service is
 - to provide information about the operational status of global and regional networks of real time sea level stations
 - to provide a display service for quick inspection of the data stream from individual stations.
- The system was build and is operated by Flanders Marine Institute (VLIZ) for UNESCO as part of the GLOSS program of IOC.

Data flow



SLSMF Platform - map



SEA LEVEL STATION MONITORING FACILITY

Intro **Map** Station lists Station details Services & FAQ GLOSS Catalog

Sealevel stations
Status at 2025-03-03 10:43 GMT

Disclaimer

Plot: Active stations
Show: Status

Legend:

- Station is offline, or data is outdated
- Station is online
- Station is not available at this site

Offline = No data received since 3 times the transmit interval.
The quality of the transmitted data is not checked.

- To obtain more details about a station - move mouse over station and click.
- To zoom in - hold down the Shift-key while holding down the mouse button and drawing a rectangle or use the Scroll mouse button, or use the control buttons in upper left part of map.
- To pan - drag the map, or use the control buttons in upper left part of map.
- Or use the [KML file](#).

Lat: Lon:

SLSMF Platform - list of stations

Intro

Map

Station lists

Station details

Services & FAQ

GLOSS

Catalog

Status at 2025-03-03 10:47 GMT : 284 stations listed ordered by delay

Show: Info:

Code	GLOSS ID	Country	Location	Connection	DCP ID	Last observation Level	Time in GMT	Delay	Transmit Interval	View
tfbc	156	Canada	Tofino BC	SXAK50	15C3A33C	-999	10:48		5'	[open]
scor	315	Greenland	Ittoqqortoormiit, Scoresbysund	ftp		-0.1	10:47	1'	1'	[open]
thul	343	Greenland	Thule - Pituffik	ftp		-0.98	10:47	1'	1'	[open]
nuk1	225	Greenland	Nuuk harbour, new	ftp		1.23	10:47	1'	1'	[open]
casc	246	Portugal	Cascais	socket		-1.28	10:46	1'	0.0833'	[open]
qaqo	344	Greenland	Qaqortoq, Julianehab	ftp		1.24	10:46	2'	1'	[open]
reun	17	France	Pointe des Galets (Reunion Island)	ftp		1.01	10:45	3'	5'	[open]
fort	336	Brasil	Fortaleza	SEPO40	3542D134	3.27	10:45	3'	5'	[open]
pdas	245	Portugal	Ponta Delgada Azor	SEPO40	354271CC	4.37	10:45	3'	5'	[open]
kant	145	Kiribati	Kanton KI	SEPA40	354305A6	-999	10:45	3'	15'	[open]
sitk	154	USA	Sitka AK	web	33625302	3.09	10:45	3'	6'	[open]
sbea	157	USA	South Beach OR	web	3368974E	2.84	10:45	3'	6'	[open]
fren	107	USA	Tern,Fr. Frigate US	SXHW11	15D58280	7.01	10:45	3'	5'	[open]
sala	4	Oman	Salalah	SXXX33	1605C096	3.4	10:45	3'	6'	[open]
prin2	155	Canada	Prince Rupert	web		6.78	10:45	3'	10'	[open]
malh	239	Ireland	Malin Head	web		3.9	10:45	3'	15'	[open]
stjo	223	Canada	St. Johns	web		1.15	10:45	3'	10'	[open]
sanf	177	Chile	San Felix CL	SXCH40	ADC09D8E	4.87	10:45	3'	5'	[open]
call	173	Perú	Callao,La-Punta PE	SEPO40	354165B4	6.16	10:45	3'	5'	[open]

SLSMF Platform - station details

[previous station]
Station at GMT
[next station]

[more details]
[GTS message]
[show data]
[show on map]
[monitor]

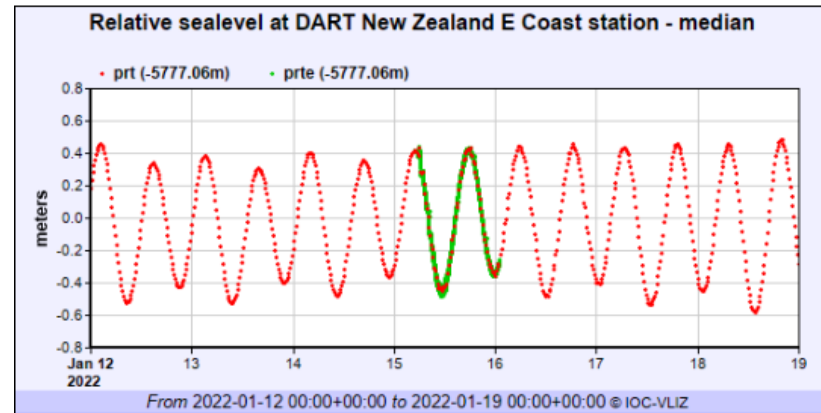
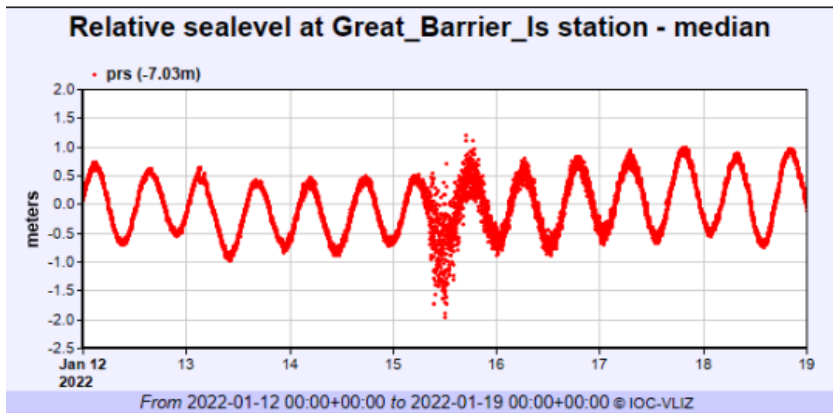
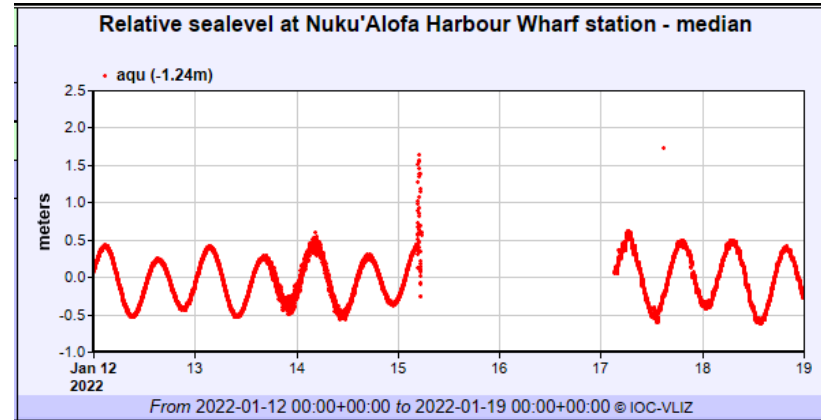
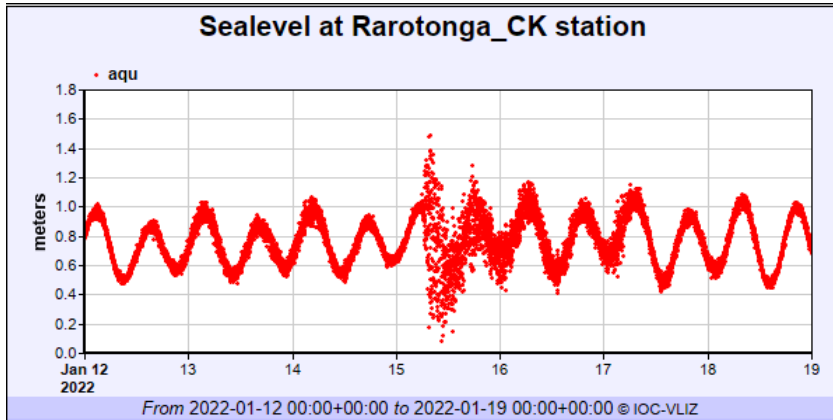
Station metadata	
Code	kepo1
Country	UK
Location	King Edward Point
Status	Operational
Local Contact	British Antarctic Survey (UK)
Other Contact	National Oceanography Centre (UK)
GLOSS core ID	187 [goto handbook]
Long-term MSL data	PSMSL 896 (1957-2020)
Latitude	-54.28
Longitude	-36.5
Connection	GTS message
GTS message type	SEMS40
Sensor 1	
Type of sensor	rad (radar)
Sampling rate (min)	1
Sensor 2	
Type of sensor	pr1 (1st pressure)
Sampling rate (min)	1
Sensor 3	
Type of sensor	pr2 (2nd pressure)

From 2025-03-02 22:48+00:00 to 2025-03-03 10:48+00:00 © IOC-VLIZ

Period	Signals	Data
<input type="text" value="12h"/> <input checked="" type="radio"/> 12h <input type="radio"/> day <input type="radio"/> 7 days <input type="radio"/> 30 days	<input checked="" type="checkbox"/> rad (radar) <input checked="" type="checkbox"/> pr1 (1st pressure) <input checked="" type="checkbox"/> pr2 (2nd pressure) <input type="checkbox"/> atm (atmospheric pressure) <input type="checkbox"/> Remove outliers <input type="checkbox"/> Remove spikes	<input checked="" type="radio"/> Relative levels = signal - median over selected period <input type="radio"/> Absolute levels = as received <input type="radio"/> Offset signals = relative levels + offset <input type="radio"/> Show battery voltage

SLSMF Platform – tsunami signal

Hunga Tonga - Hunga Ha'apai volcano eruption - January 15, 2022



SLSMF Platform - monitoring of multiple stations

Intro Map Station lists **Station details** Services & FAQ GLOSS Catalog

[previous station] Station: **Rarotonga_CK** at GMT [next station]

[more details] [GTS message] [show data] [show on map] **[monitor]**

Station metadata	
Code	raro
Country	Cook Islands

Sealevel at Rarotonga_CK station

[previous station] Station: **Rarotonga_CK** at GMT [next station]

[more details] [GTS message] [show data] [show on map] [monitor]

SEA LEVEL DATA FACILITY - Work - Microsoft Edge
https://www.ioc-sealevelmonitoring.org/monitor.php?codes[]=raro&period=7

Relative sealevel at North_Cape station - median

• prs (-4.07m)

From 2025-03-02 23:11+00:00 to 2025-03-03 11:11+00:00 @ ioc-vliz

Relative sealevel at Rarotonga_CK station - median

• aqu (-0.72m)

From 2025-03-02 23:11+00:00 to 2025-03-03 11:11+00:00 @ ioc-vliz

SLSMF Platform – metadata editing

Select gauge: hani - Hanimadhoo or [Add gauge]

Gauge details

Code hani [view]

*Location Hanimadhoo

Country Maldives Islands

*Type GTS

*Latitude 6.7667

*Longitude 73.1667

Message interval 15 min

Local contact Maldives Meteorological Department (Maldives)

Other contact 1 University of Hawaii Sea Level Center (USA)

Other contact 2 (Pick)

WMO type (GTS) SXXX32

DEP ID (GTS) 26CB10AC

GlossID

OperatorID (for webservice only)

Status Operational

Status description

Message example

```
A
SXXX32 EUMS 050031
26CB10AC
:PRS 1 /1 2202 2180 2204 2234 2233 2206 2214 2210 2218 2221 2231 2240 2229 2221
2221 2221 2242 2270 2260 2249 2246 2254 2261 2268 2283 2279 2264 2265 2283 2276
```

URL (more info)

Sensorid 22

Sensor prs

Unit meter

Samples/message 30

Sample interval 1 min

Offset 4

Sensorid 82

Sensor rad

Unit meter

Samples/message 10

Sample interval 3 min

Offset 37

- Gauge general metadata
- Gauge specific parsing metadata
- Sensors
- Sensor metadata

SLSMF Platform – webservice API

- OpenAPI standard applied to API
- Currently limited to 30 days
- No research quality data

SLSMF Platform - Sealevel Station Catalog (SSC)

- Metadata

One Central point to store basic station metadata updated by datacenters and/or gauge operators.

- Global identifier

Linking station identifiers of datacenters (UHSLC, PSMSL, SONEL, ...) and any other identifier (GLOSS, PTWC, ...)

SLSMF Platform - Sealevel Station Catalog (SSC)

Very limited fields (4-5) stored in SSC

SSC ID	Station Name	Country	Latitude	Longitude	IOC code	P
SSC-JP-abas	Abashiri	Japan	44.02	144.28		
SSC-SL-aber	Aberdeen Point	Sierra Leone	8.5	-13.23		
SSC-CI-abid	Abidjan	Cote d'Ivoire	5.25	-4		
SSC-JP-abur	Aburatsu	Japan	31.35	131.25		
SSC-SV-acaj	Acajutla	El Salvador	13.57	-89.84	acaj	aca
SSC-MX-acap	Acapulco	Mexico	16.83	-99.92	acap	aca
SSC-MX-acya	Acapulco Club de Yates	Mexico	16.84	-99.9	acya	aca
SSC-US-adak	Adak	United States	51.86	-176.63	adak	ada
SSC-YE-aden	Aden	Yemen	12.79	44.97	aden	ada

Edit station 'SSC-CL-anto'

SSC ID* :

Name* :

Region :

Country* :

Latitude* :

Longitude* :

Cataloglinks

GLOSS delete

IOC delete

PTWC delete

UHSLC delete

(new)

SLSMF Platform - Sealevel Station Catalog (SSC)

Stored in SSC

Linked via Web-service

Station catalog metadata [edit] [station overview]				
SSC ID	SSC-AR-espr			
Station Name	Bahia_Esperanza			
Country	Argentina			
Latitude	-63.33			
Longitude	-56.9166			
DateLastModified	2011-07-17 20:52:53			
Linked codes				
Codes	IOC:espr	GLOSS:185	UHSLC:601	PTWC:espr
Location	Bahia Esperanza AR	Bahia Esperanza	Esperanza	Bahia Esperanza AR
Latitude	-63.33	-63.3	-63.395 (= 63 23.7)	-63.3977
Longitude	-56.9166	-56.91666	-56.995 (= 056 59, W)	-56.9958
Sensors	pwl, bwl	Acoustic	N/A	pwl, bwl

From 2011-11-06 20:56 to 2011-11-07 20:56 @IOC-VLIZ

Distributed metadata source: GLOSS Station Handbook	
Ocean	Southern
Operational	Yes
Responsible country	Argentina
Additional parameters	water/air temperature, wind direction/speed,
Tide gauge benchmarks	Benchmark bolt inside tide gauge hut adjacent
Benchmark relationships	Tide gauge zero (TGZ): Local Chart Datum TG
Auxiliary benchmarks	AUX: Pilar de referencia ubicado en cercaulas
Other relevant codes	UHSLC 601

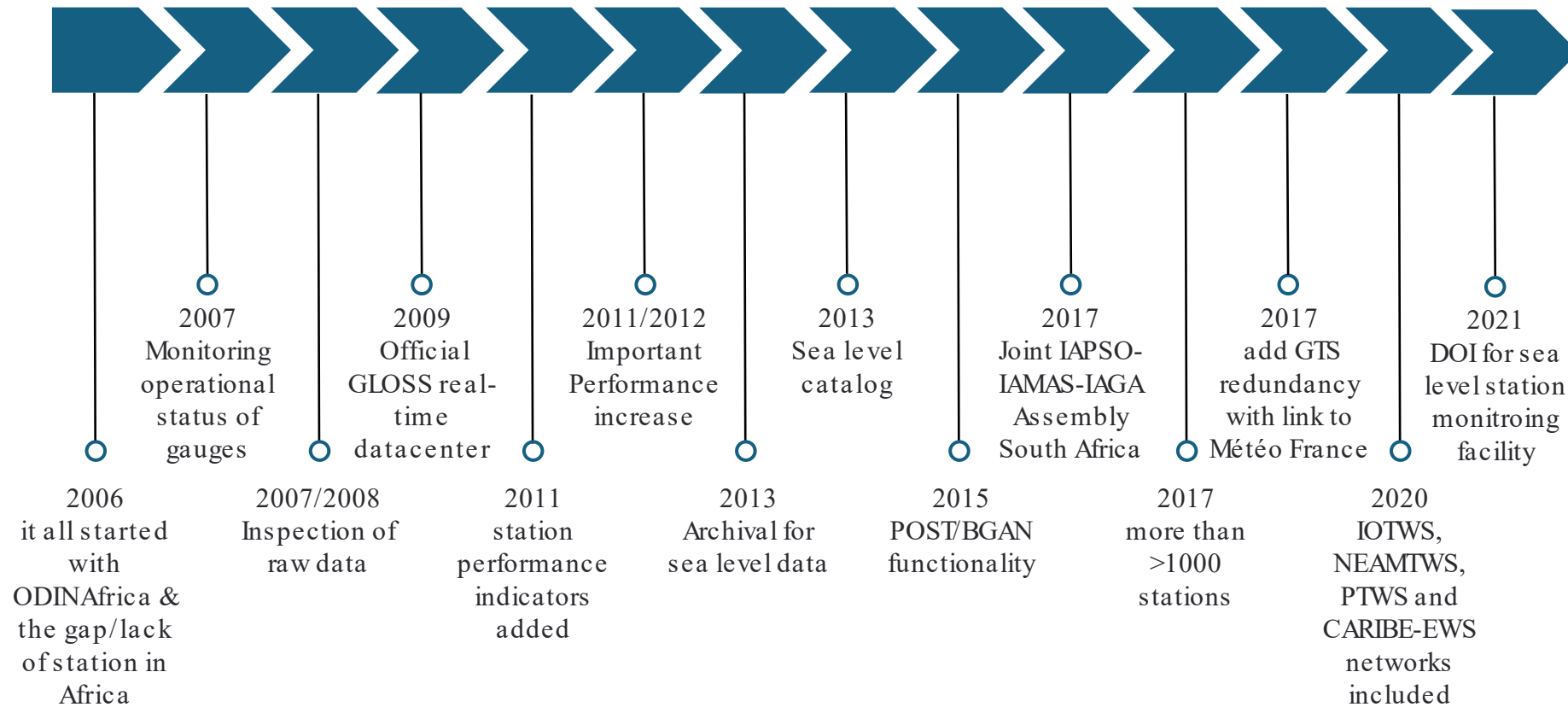
Distributed metadata source: PTWC COMP META file	
DCP ID	334D4708
WHO	XXXXXX
Samp Rate	30
Num# Samp	2
Unit	F
Scale	1.0000
Xmt Int.	060
Fst Min.	0028
HAR	0
Owner	UHSLC

UHSLC monthly AVG graph

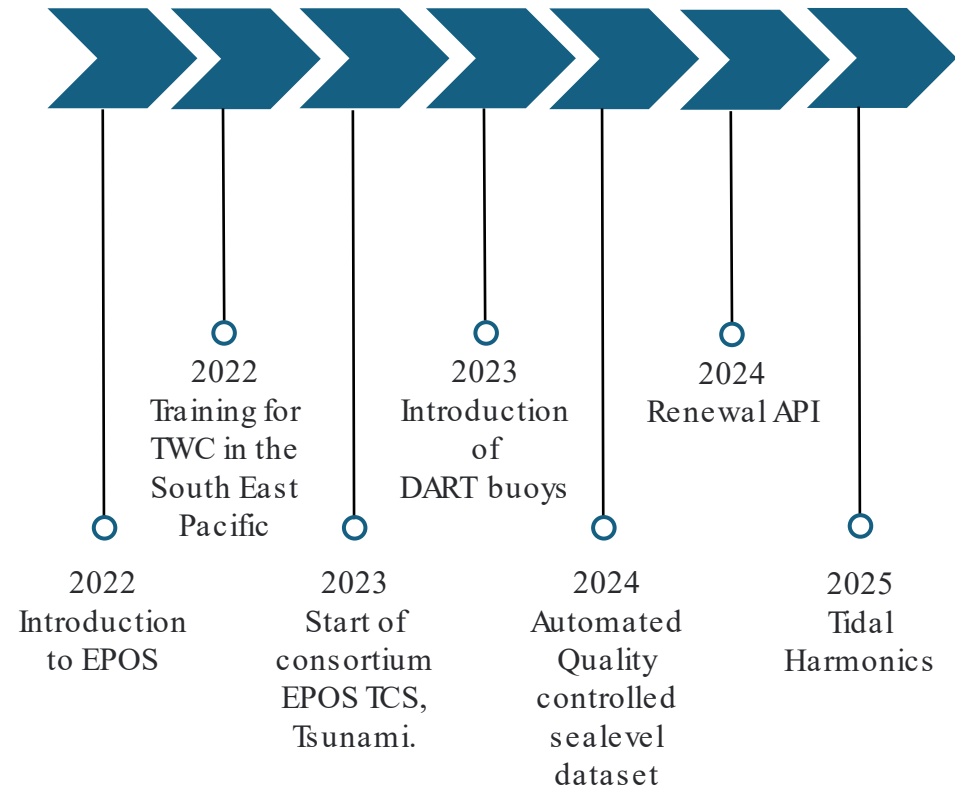
080 ANTOFAGASTA 23 39S 070 24W Chile 1945-2010 174

Data availability	
IOC Sea Level Station Monitoring Facility - realtime graph for 'espr'	
ANTOFAGASTA 2	

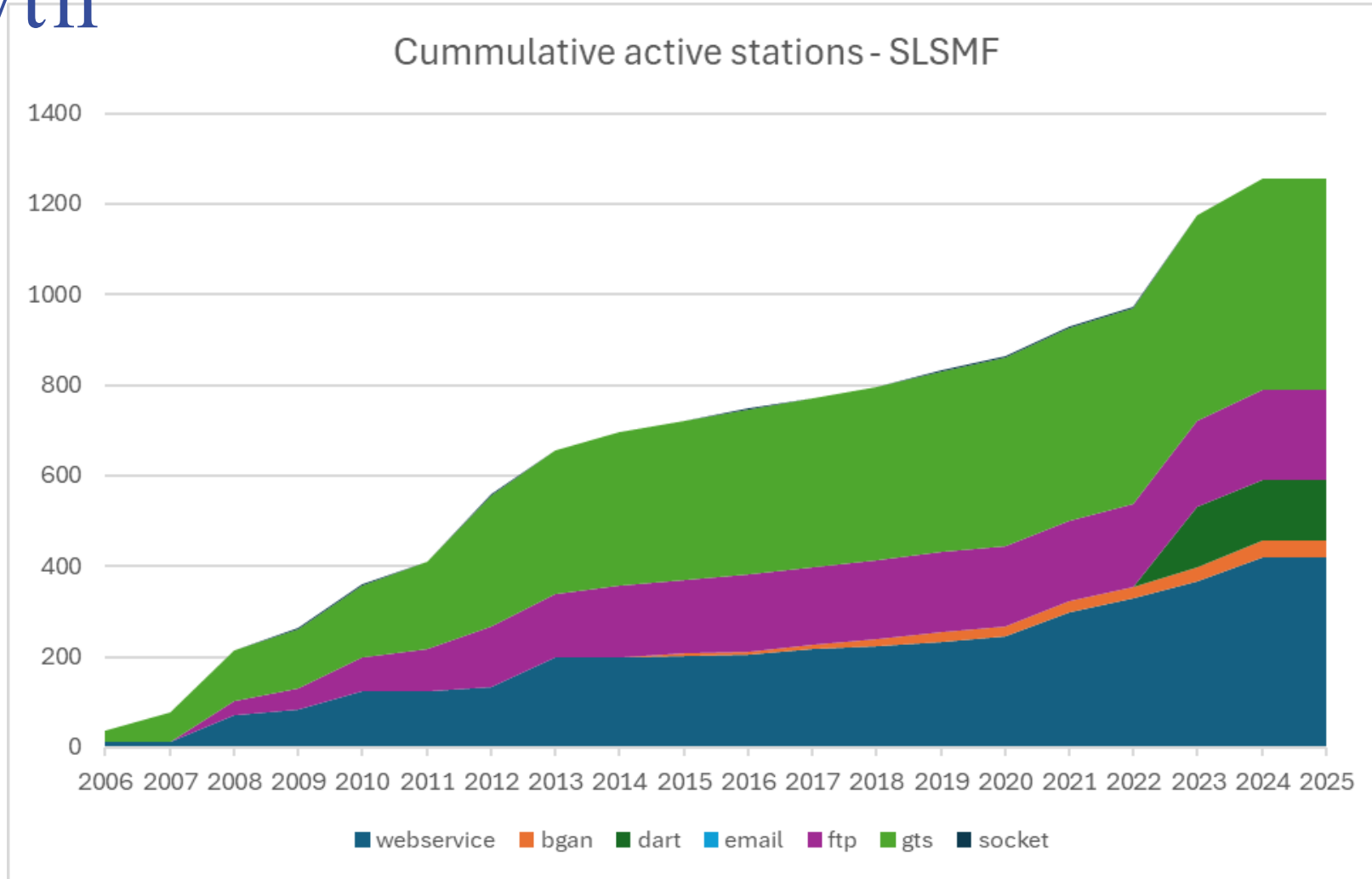
Progress 2022-2025 - timeline



Progress 2022-2025 - timeline

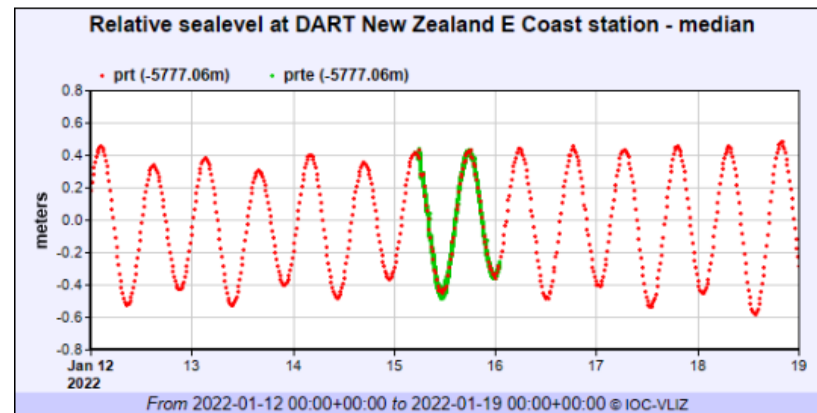


Progress 2022-2025 – station growth



Progress 2022-2025 – dart buoys

- Deep-ocean Assessment and Reporting of Tsunamis (DART)
 - Network from NOAA Center for Tsunami Research
 - Network from New Zealand GeoNet
 - Historical data has been imported for web service stations.
 - Event mode of dart buoys has a separate sensor (prte)
(in the new dataset these are combined)



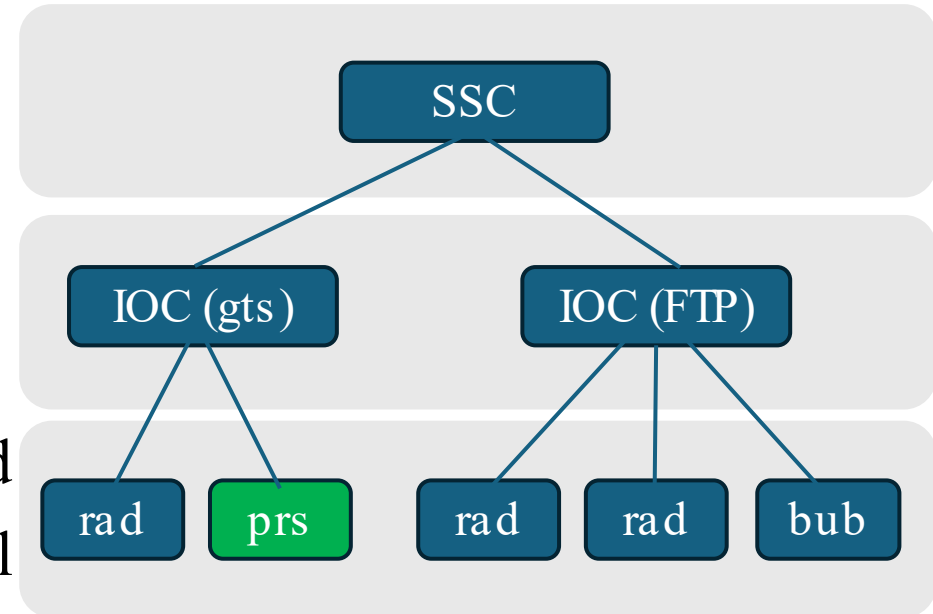
Progress 2022-2025 – EPOS TCS member

- European plate observing system (EPOS-ERIC)
- Thematic core service Tsunami (TCS-TSU)
 - Support to Tsunami Service Providers
 - Tsunami Data
 - Numerical Models
 - Hazard and Risk Products

Since yesterday this TCS-TSU is an endorsed UN Ocean Decade action.

Progress 2022-2025 – daily QC'ed research data

- Add qc value flag
 - Per day
 - Per value
- Datastreams grouped on ssc-id
- A preferred sensor per day is selected
- Resulting in one datastream per physical station
(ie. Prs of the IOC(gts) station is selected as preferred in favor of the 4 other sensors originating from two datastreams)

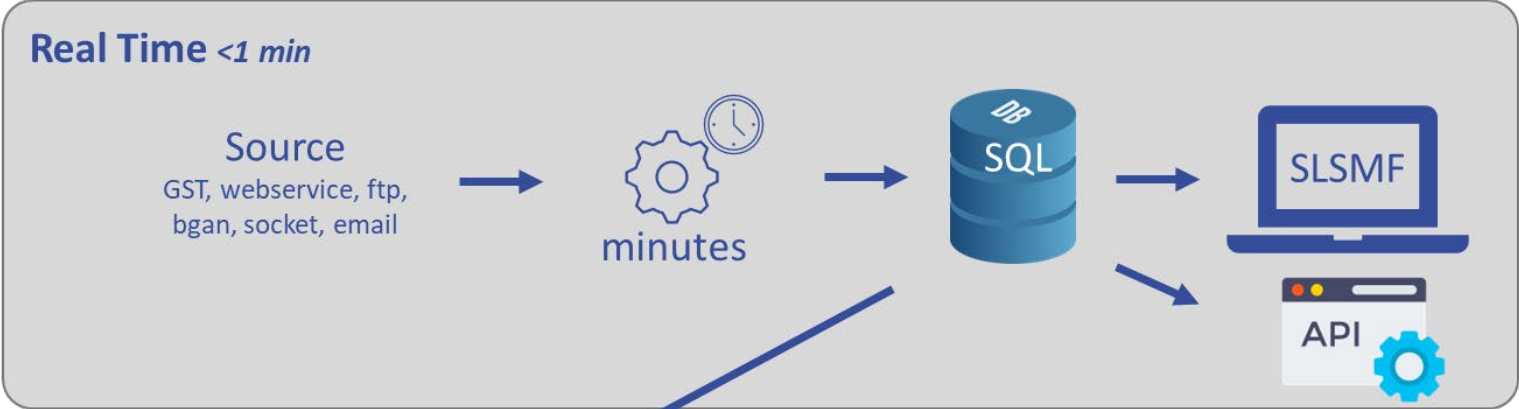


Report 2022 - 2025

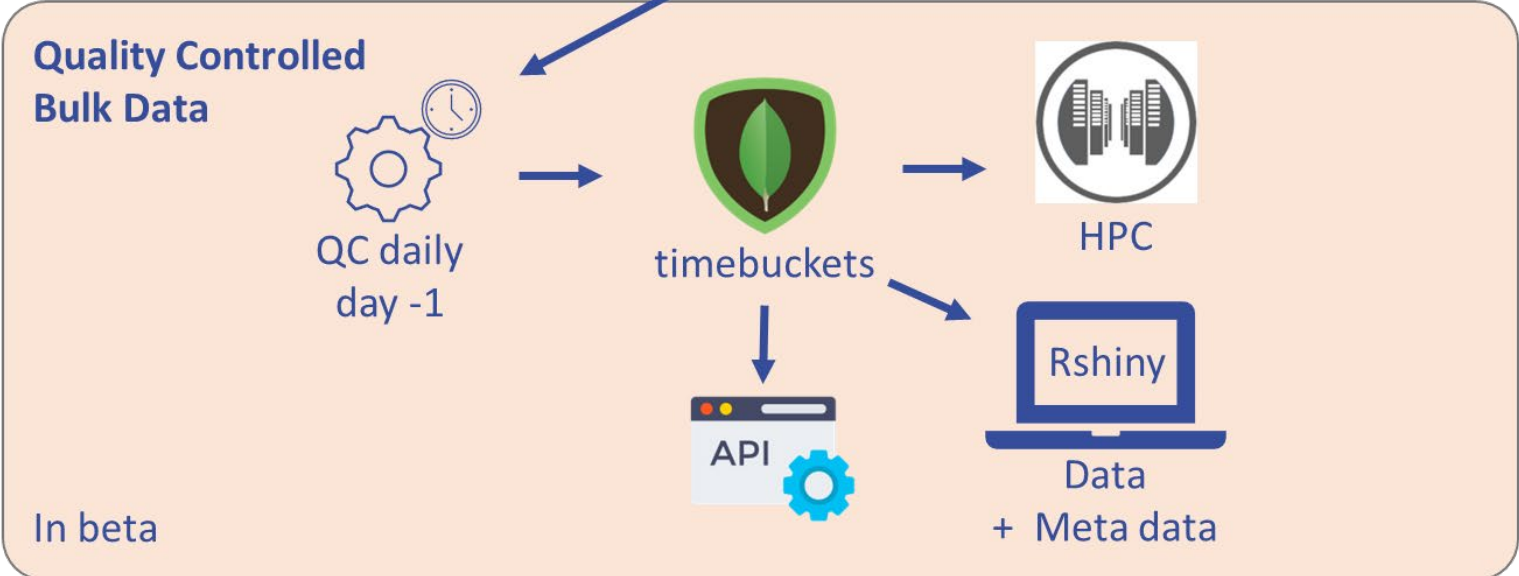
Daily Quality Controlled Research Sea Level Data

- Quality Control
 - Completeness (flag/day)
 - Distinctness (flag/day)
 - Sensor Shift detection (flag/day)
 - Out of range
 - Exceeding neighbour
 - Flatline
 - Spikes via median

Progress 2022-2025 – daily QC’ed research data



Tsunami
Warning
Centers



Researchers
Digital twins

Progress 2022-2025 – daily QC'ed research data

- Webinar and official release

- 2025-03-26

- <https://www.geo-inquire.eu/dissemination/training-activities/slsmf-api>



Progress 2022-2025 – new API

- OpenAPI standard introduced
- Interactive documentation page (swagger)
- api.ioc -sealevelmonitoring.org
- V1
 - Existing API
 - No API Key necessary
- V2
 - Works with API key
 - Already 14 functionalities
 - Including daily quality controlled research sea level data and tidal harmonics
 - More functionalities for retrieving metadata.

Progress 2022-2025 – new API v1

service.php?query=xxx&format=xxx[&additional partameters]

with possible values :

query= "data", "station", "stationlist", default= null
format= "json", "xml" or sometimes "ascii", default = json
optional additional parameters depend on the query :

query	additional paramaters	use
data	"code=" + stationcode "timestart=" + ISOdate (YYYY-MM-DDTHH:MM), default = now()-12 hours "timestop=" + ISOdate (YYYY-MM-DDTHH:MM), default = now "format=" "json", "xml", "ascii", "xtab", "html", default = json	will give data for station with code stationcode from timesta timestop ,in the specified format
stationlist	"showall=" "gts", "web", "bgan" or "g" for GLOSS, default is all "format=" "json", "xml", default = json "output=" "contacts", "performance", default= general	will give stationlist restricted according to the 'showall' para the specified format, 'output' specifies different field lists
sensorlist	"showall=" "gts", "web", "bgan" or "g" for GLOSS, default is all "format=" "json", "xml", default = json	will give list of all sensors, with last data and time stamp re: according to the 'showall' parameter ,in the specified format
station	"code=" + stationcode "format=" "json", "xml", default = json	will give all details for this station ,in the specified format

query query



GET

/service.php?query=data Retrieve data for a station with max 30 day limit or 150 000 records within the timestart and timestop interval.



GET

/service.php?query=stationlist will give stationlist restricted according to the 'showall' parameter, in the specified format, 'output' specifies different field lists.



GET

/service.php?query=sensorlist will give list of all sensors, with last data and time stamp restricted according to the 'showall' parameter, in the specified format



GET

/service.php?query=station Retrieve metadata for a station.



Progress 2022-2025 – new API v2

Servers
https://api.ioc-sealevelmonitoring.org/ Authorize

research ^

GET /v2/research/stations/{code}/sensors/{sensor}/data Retrieve data for a station max 3650 days in one request. By default 7 days are retrieved. lock ^

station ^

GET /v2/stations Retrieve all stations. lock ^

GET /v2/stations/shortlist Retrieve stations with limited info.

GET /v2/stations/performance Retrieve performance info for stations.

GET /v2/stations/{code} Retrieve metadata for a station.

GET /v2/stations/{code}/data Retrieve data for a station with max 30 day limit or 150 000 records.

GET /v2/stations/{code}/message Retrieve latest message for a station.

GET /v2/stations/map Retrieve stations map.

sensor

GET /v2/sensors Retrieve list of sensors.

operator

GET /v2/operators List of operators

GET /v2/operators/{operator_id} Get fullname of operator by ID.

catalog

GET /v2/catalog Retrieve list of all catalog entries.

GET /v2/catalog/{code} Retrieve specific catalog entry by it's catalog identifier.

GET /v2/catalog/{organisation}/{code} Retrieve a specific catalog entry by it's external identifier.

Progress 2022-2025 – tidal harmonics

- Experimental for now
- We used the Rpackage from OCE
- Calculated constituents in relationship with the qc research data
 - Calculate residuals
 - Predict tides

Planning

- Metadata Versioning
- Renewal infrastructure
 - Updates server and databases
 - Erddap server implementation
- Introduction of more functionalities to the API
- New unified station pages
 - Oriented from Catalog identifiers