United Nations
Educational, Scientific and
Cultural Organization

Intergovernmental
Oceanographic
Commission

Brief summary & Report

SEA LEVEL STATION MONITORING FACILITY

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Content

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

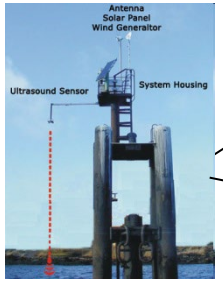
Summary

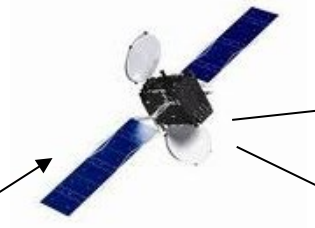
- SLSMF collects and processes data in real time from world wide stations:
  - 1257 sea level measuring stations
  - 179 institutes (station operators)

- 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 raw 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





GTS

Belgian MetOffice

KMI IRM

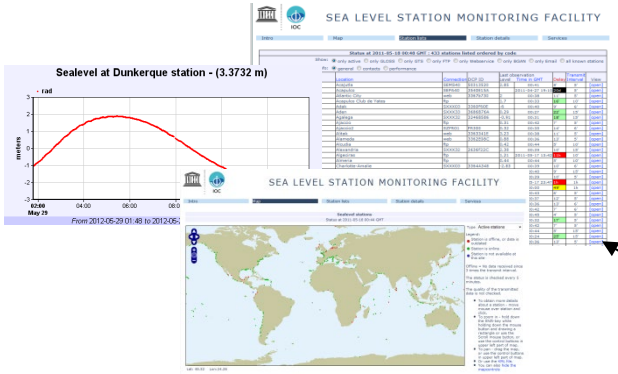
BGAN

FTP / HTTP

Internet

FTP upload
VLIZ server (1x/min)

Push/pull to VLIZ server (5min-1h)



Website

± 1257 stations: parse & insert into database

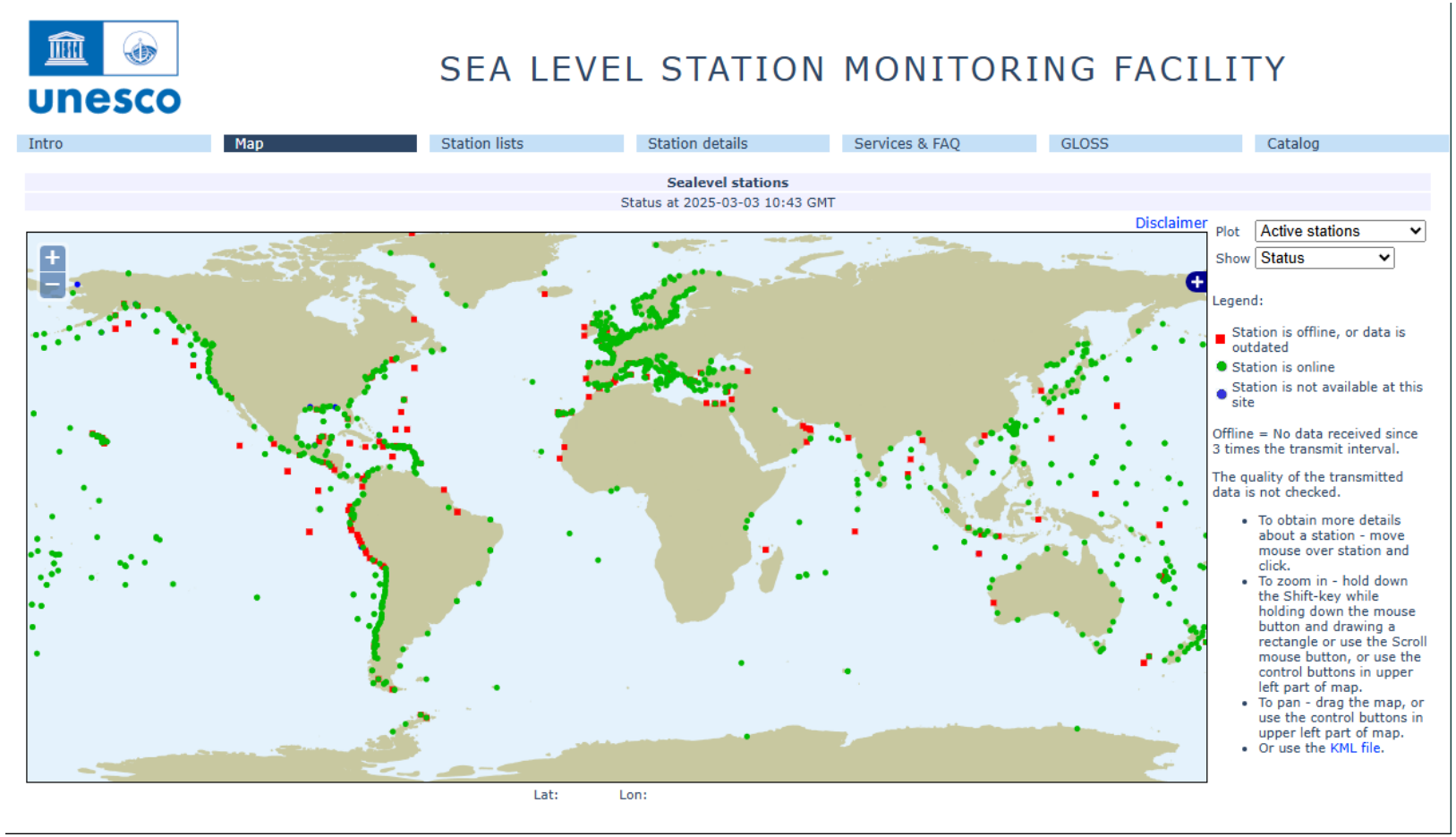
Webservice / REST API

Database

Script(s)

Tsunami centers
Station operators

SLSMF Platform - map



SLSMF Platform - list of stations

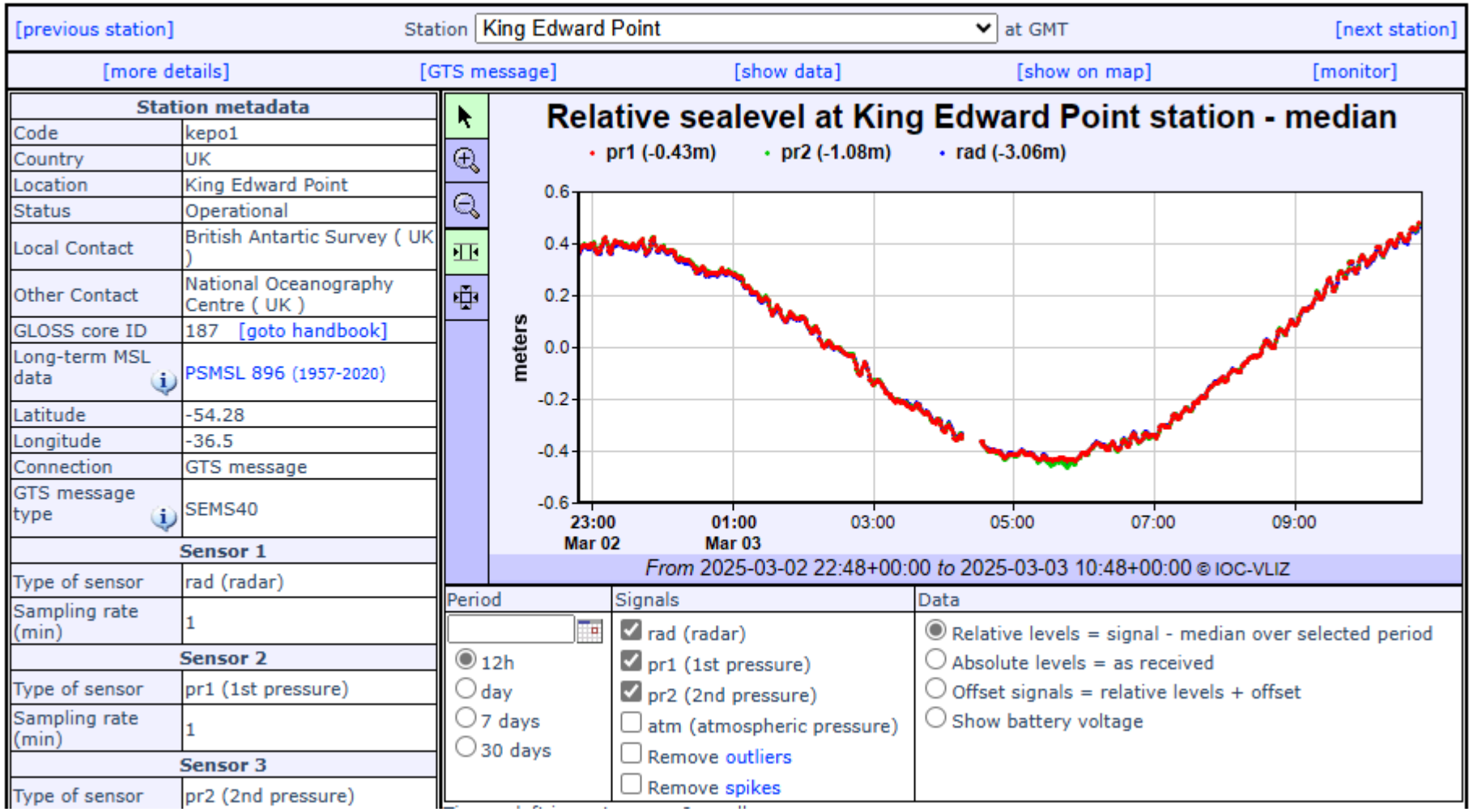
Intro | Map | **Station lists** | Station details | Services & FAQ | GLOSS | Catalog

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

Show: GLOSS core network Info: General information

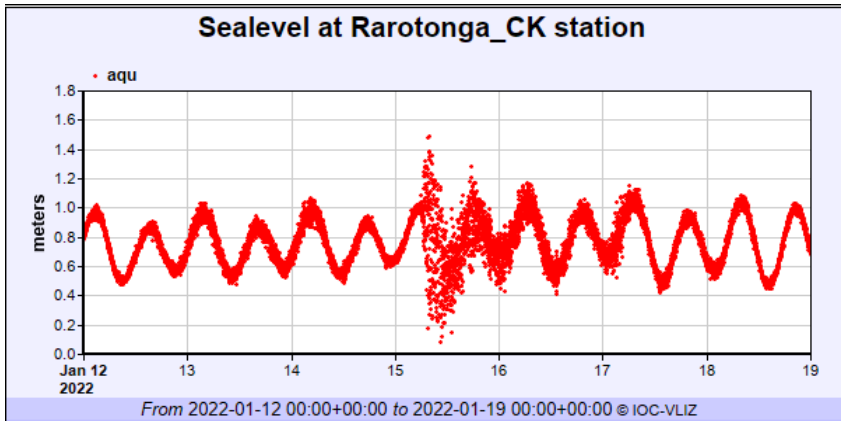
Code	GLOSS ID	Country	Location	Connection	DCP ID	Last observation Level	Last observation Time in GMT	Delay	Transmit Interval	View
tfbc	156	Canada	Tofino BC	SXAK50	15C3A33C	-999	10:48		5'	[open]
scor	315	Greenland	Ittoqqortoormiit, Scoresbysund	ftp		-0.1	10:47	1'	1'	[open]
thul	343	Greenland	Thule - Pituffik	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]

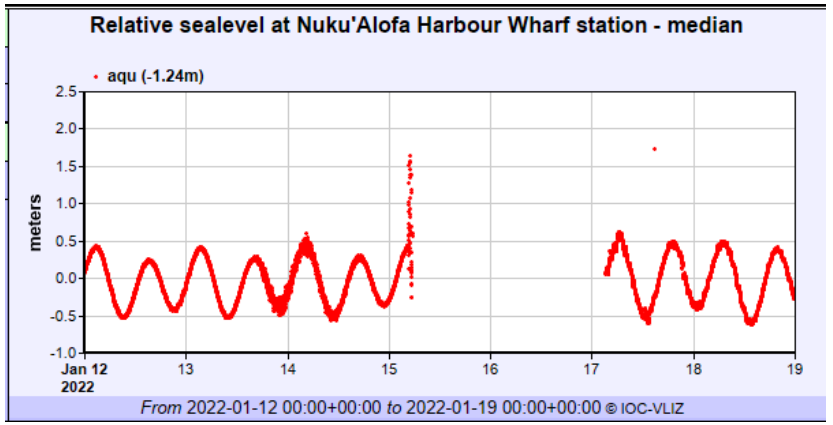
SLSMF Platform - station details

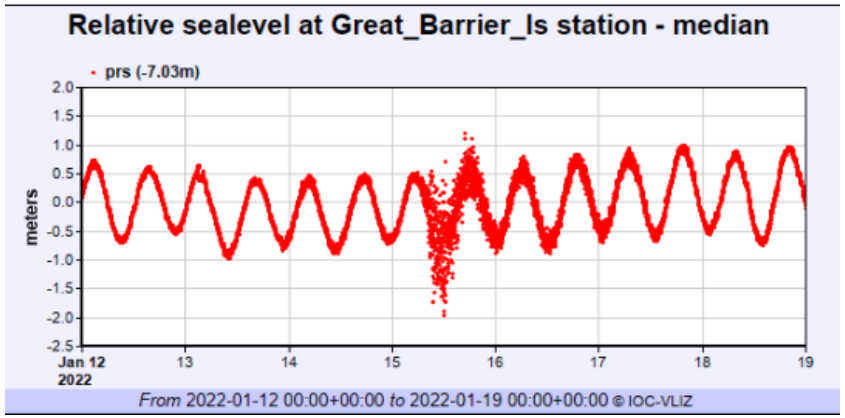


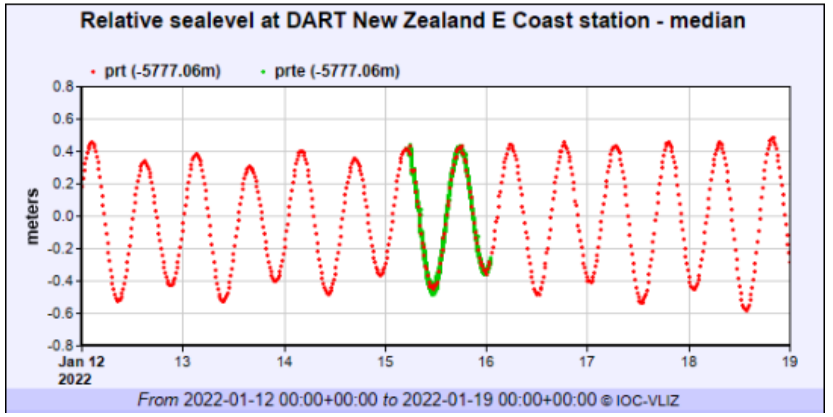
SLSMF Platform – tsunami signal

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

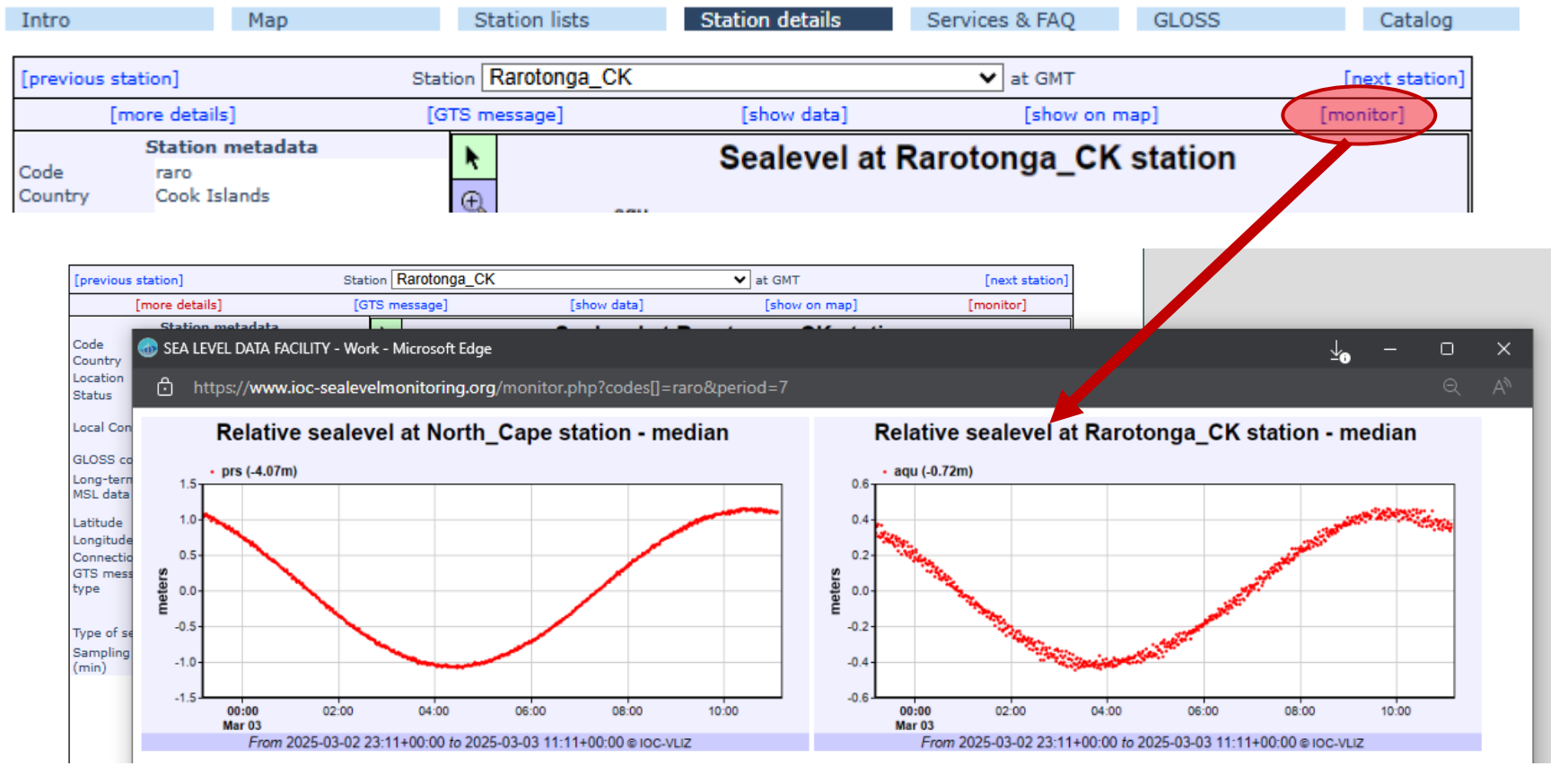




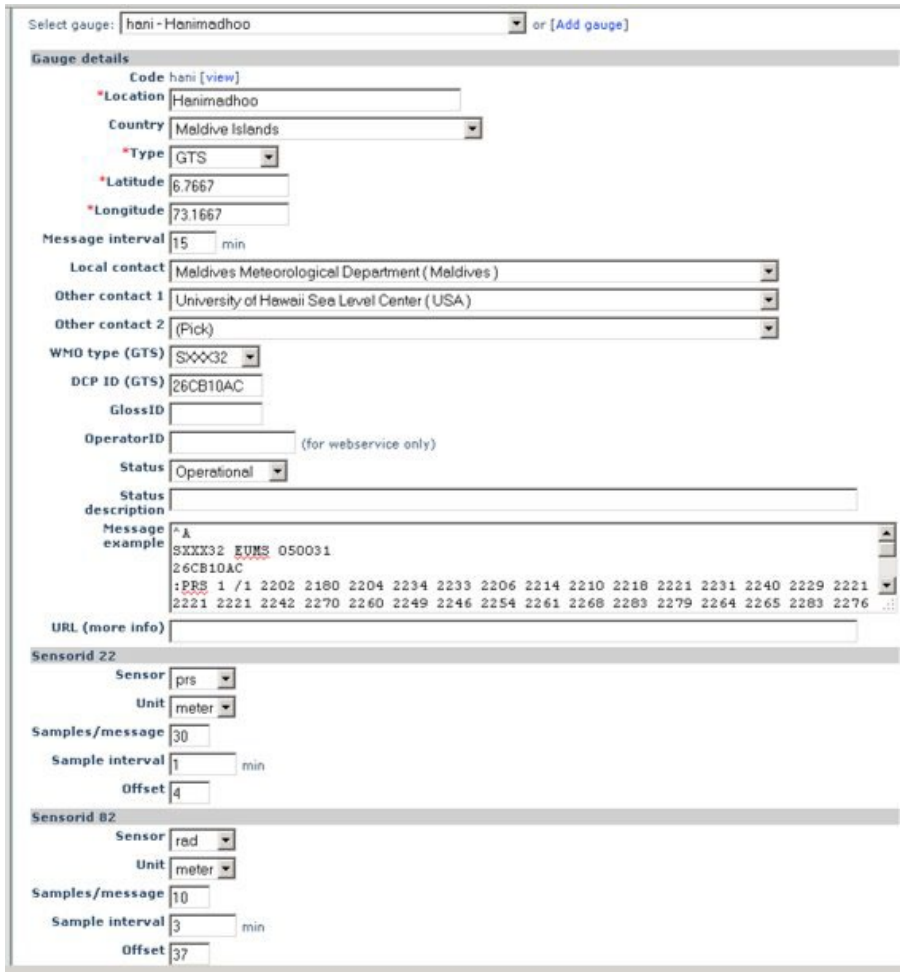




SLSMF Platform - monitoring of multiple stations



SLSMF Platform – metadata editing



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

SLSMF Platform – webservice API

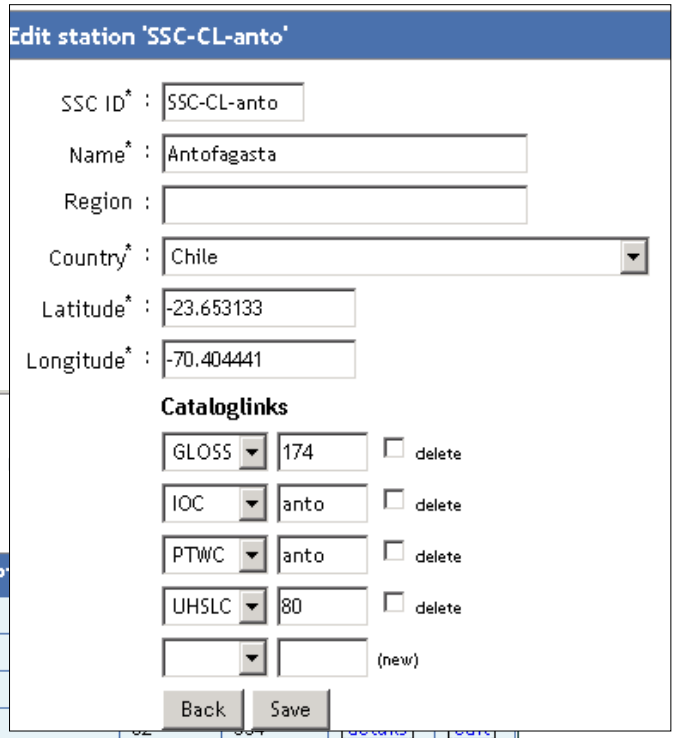
- OpenAPI standard applied to API
- Currently limited to 30 days
- No research quality data

SLSMF Platform - Sealevel Station Catalog (SSC)

- Metadata
  One Central point to store basic station metada 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



IOC

Sealevel Station

SSC ID	Station Name	Country	Latitude	Longitude	IOC code					
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	acaj	182	82	[details]	[edit]
SSC-MX-acap	Acapulco	Mexico	16.83	-99.92	acap	acap	267	316	[details]	[edit]
SSC-MX-acya	Acapulco Club de Yates	Mexico	16.84	-99.9	acya		267		[details]	[edit]
SSC-US-adak	Adak	United States	51.86	-176.63	adak	adak	302	40	[details]	[edit]
SSC-YE-aden	Aden	Yemen	12.79	44.97	aden	aden	3		[details]	[edit]

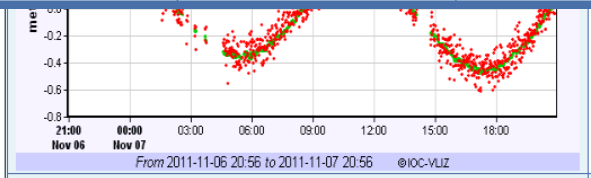
SLSMF Platform - Sealevel Station Catalog (SSC)

Stored in SSC

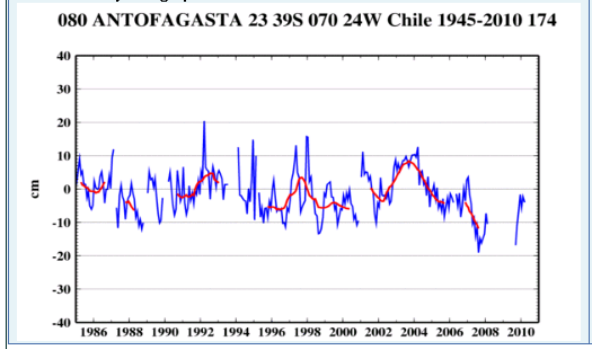
Linked via Web-service

Compare metadata

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

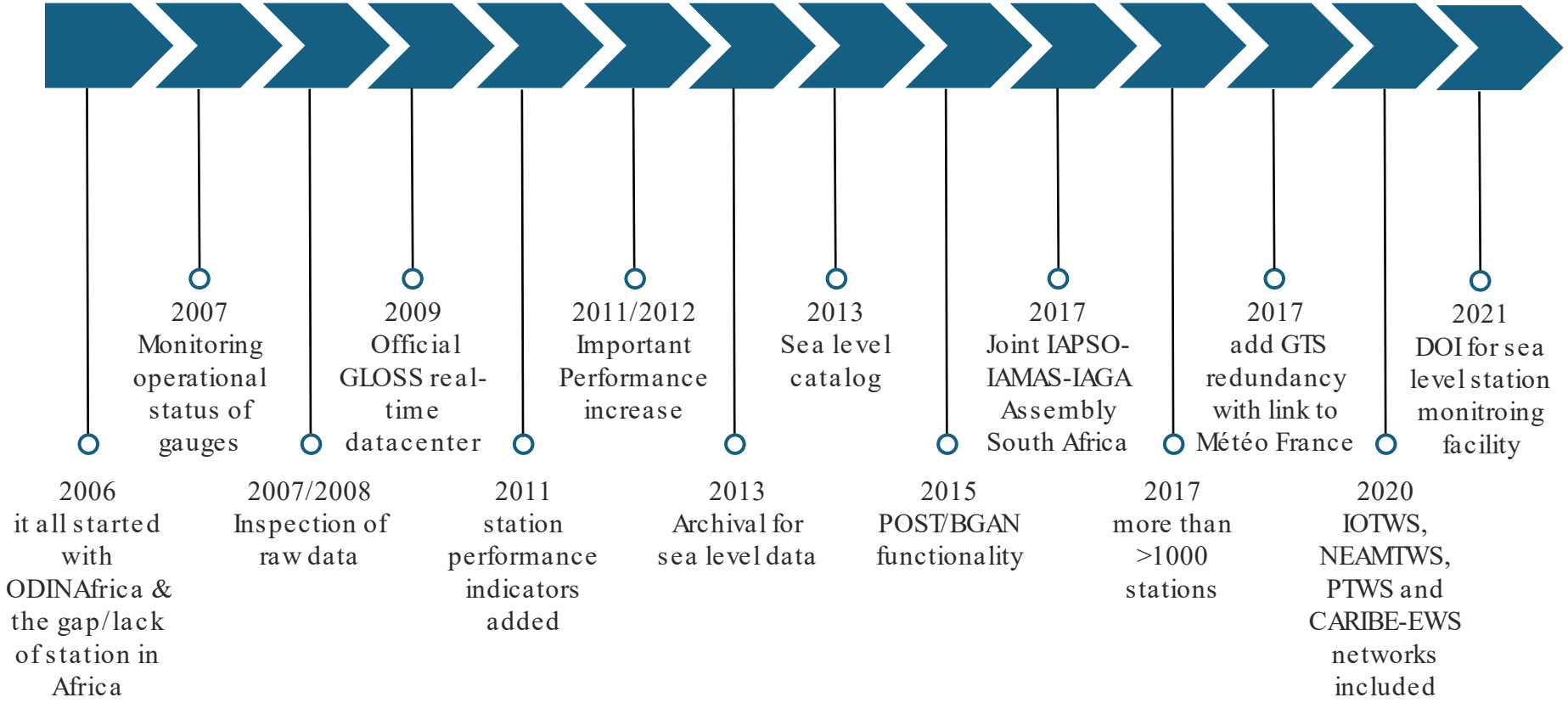


UHSLC monthly AVG graph

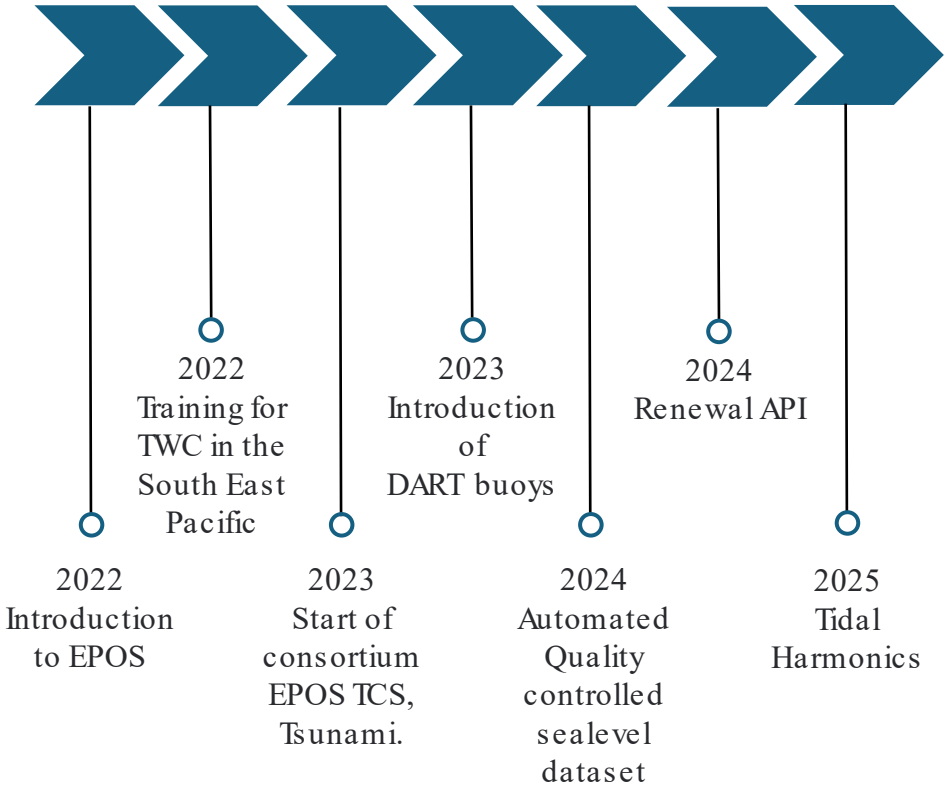


Distributed metadata source: GLOSS Station Handbook	
Ocean	Southern
Operational	Yes
Responsible country	Argentina
Additional parameters	water/air temperature, wind direction/speed,
Tide gauge benchmarks	Benchmark bolt inside tide gauge hut adjacent
Benchmark relationships	Tide gauge zero (TGZ): Local Chart Datum TG
Auxiliary benchmarks	AUX: Pilar de referencia ubicado en cercauias
Other relevant codes	UHSLC 601
Distributed metadata source: PTWC COMP META file	
DCP ID	334D4708
WMO	XXXXXX
Samp Rate	30
Num# Samp	2
Unit	F
Scale	1.0000
Xmt Int.	060
Fst Min.	0028
HAR	0
Owner	UHSLC
Data availability	
IOC Sea Level Station Monitoring Facility - realtime graph for 'espr'	

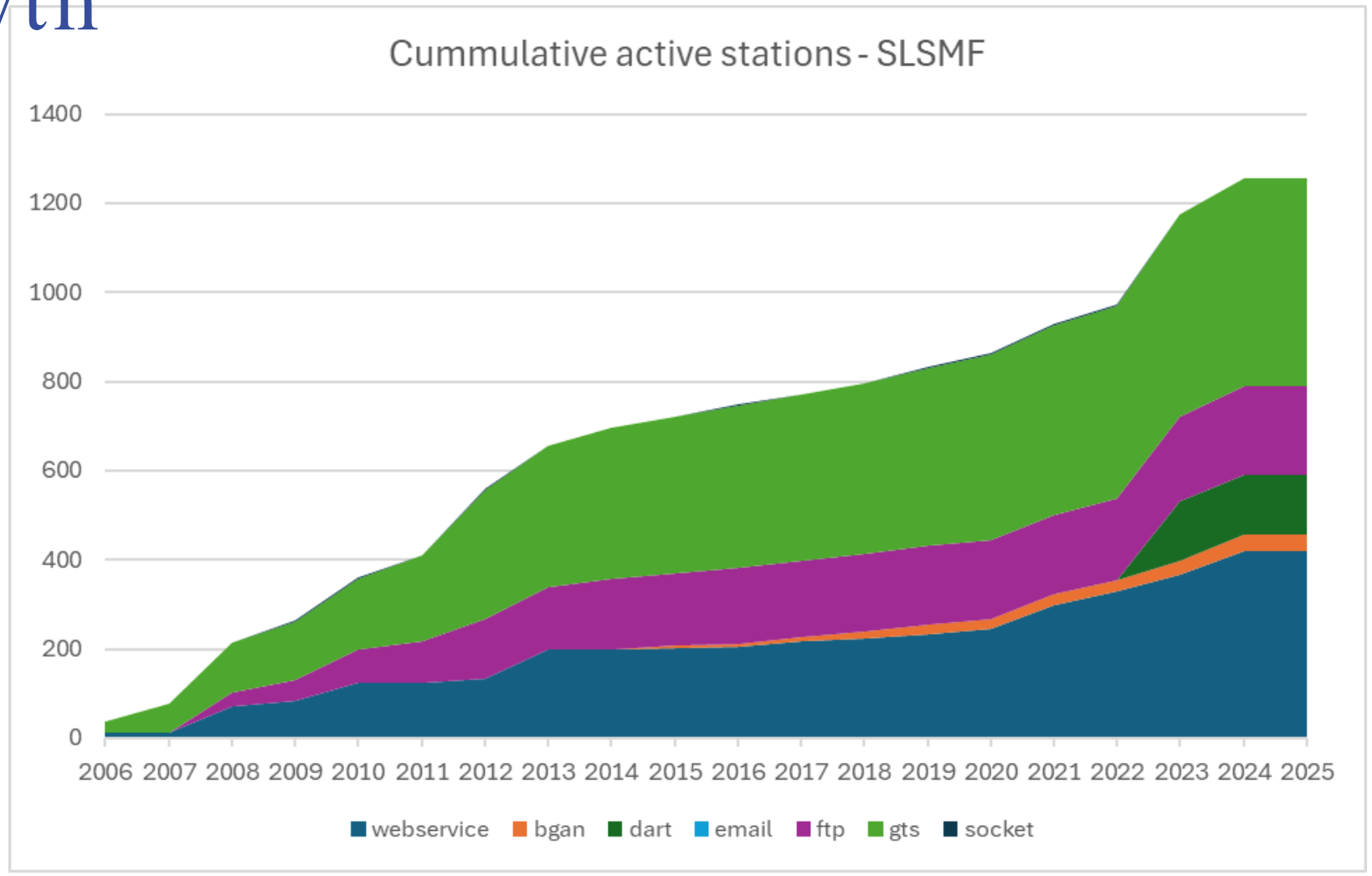
Progress 2022-2025 - timeline



Progress 2022-2025 - timeline

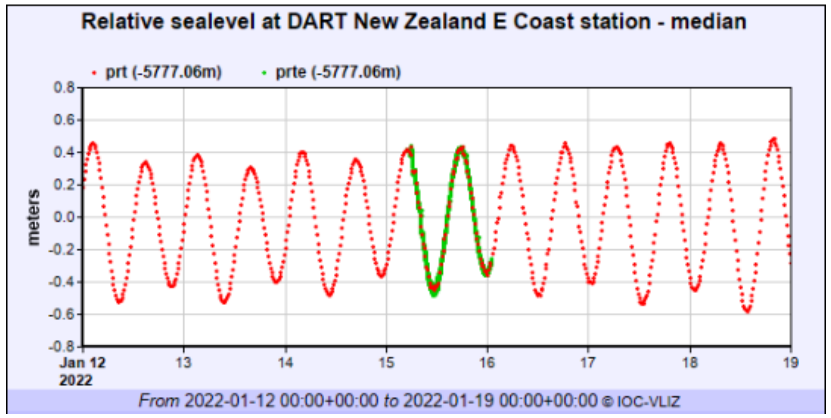


Progress 2022-2025 – station growth



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)



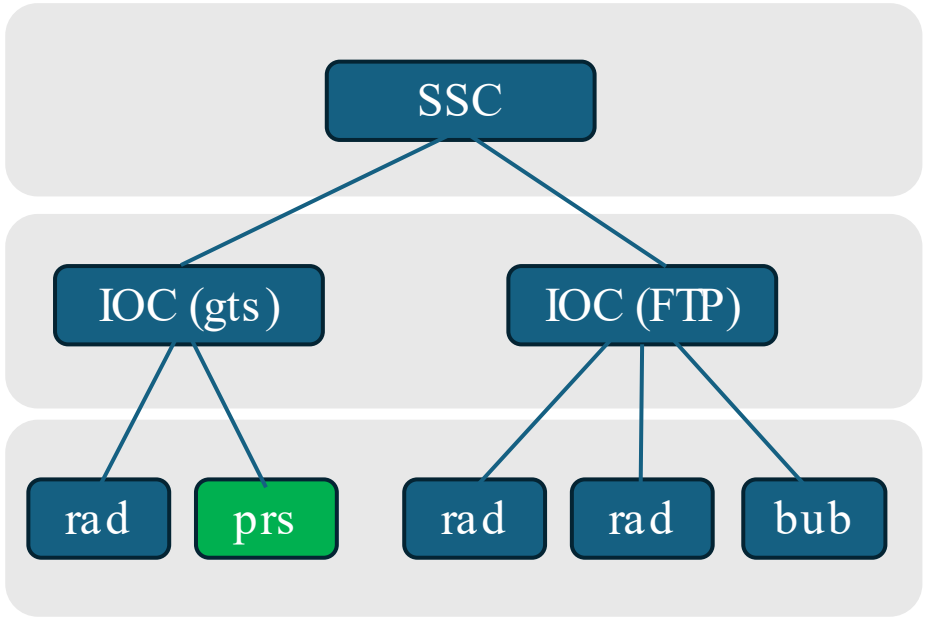
Progress 2022-2025 – EPOS TCS member

- 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 onedatastream 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)

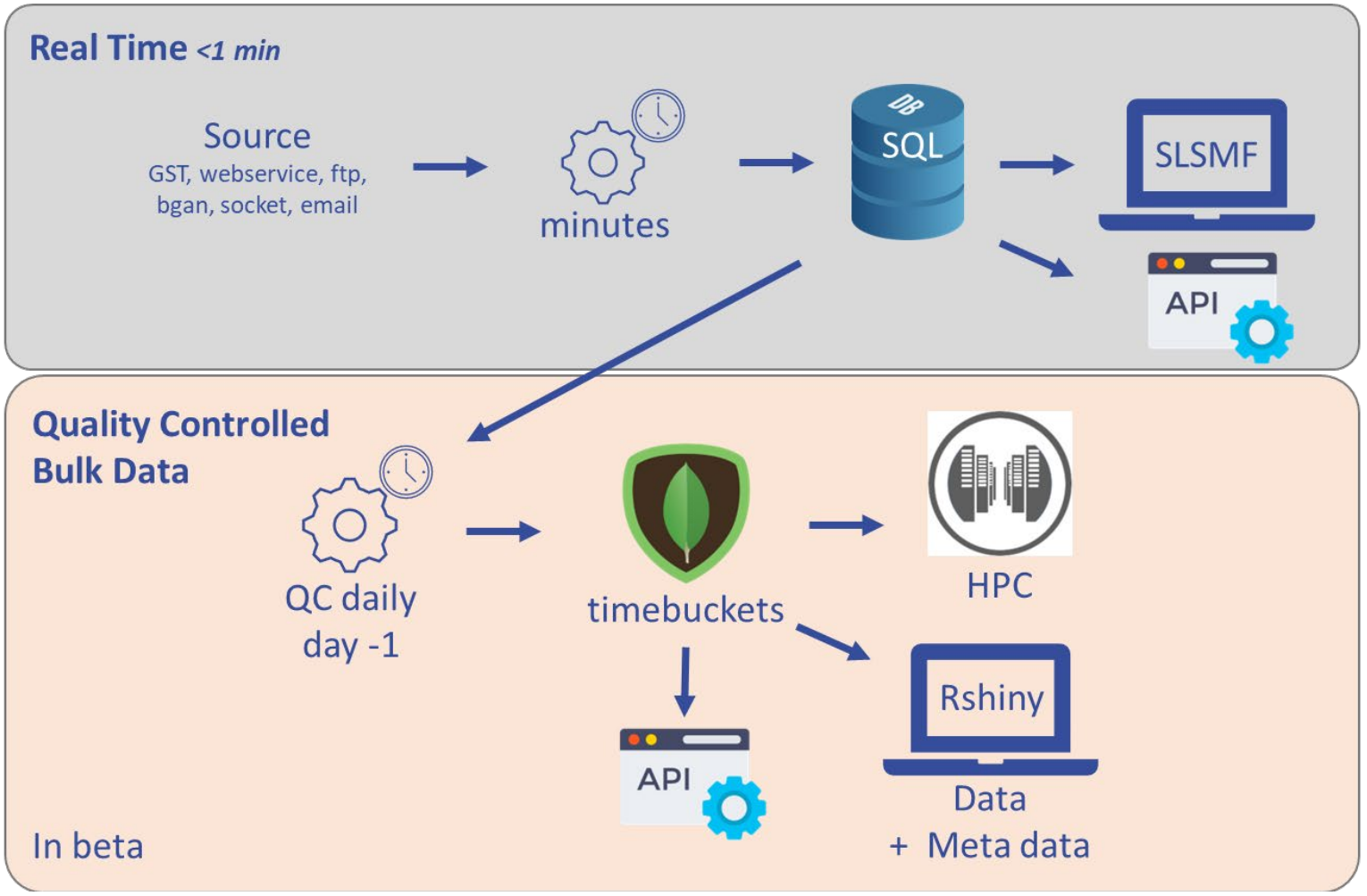


Report 2022 - 2025

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 offical 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-ui)
- 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 forma
station	"code=" + stationcode "format"= "json", "xml" , default = json	will give all details for this station ,in the specified format

query query

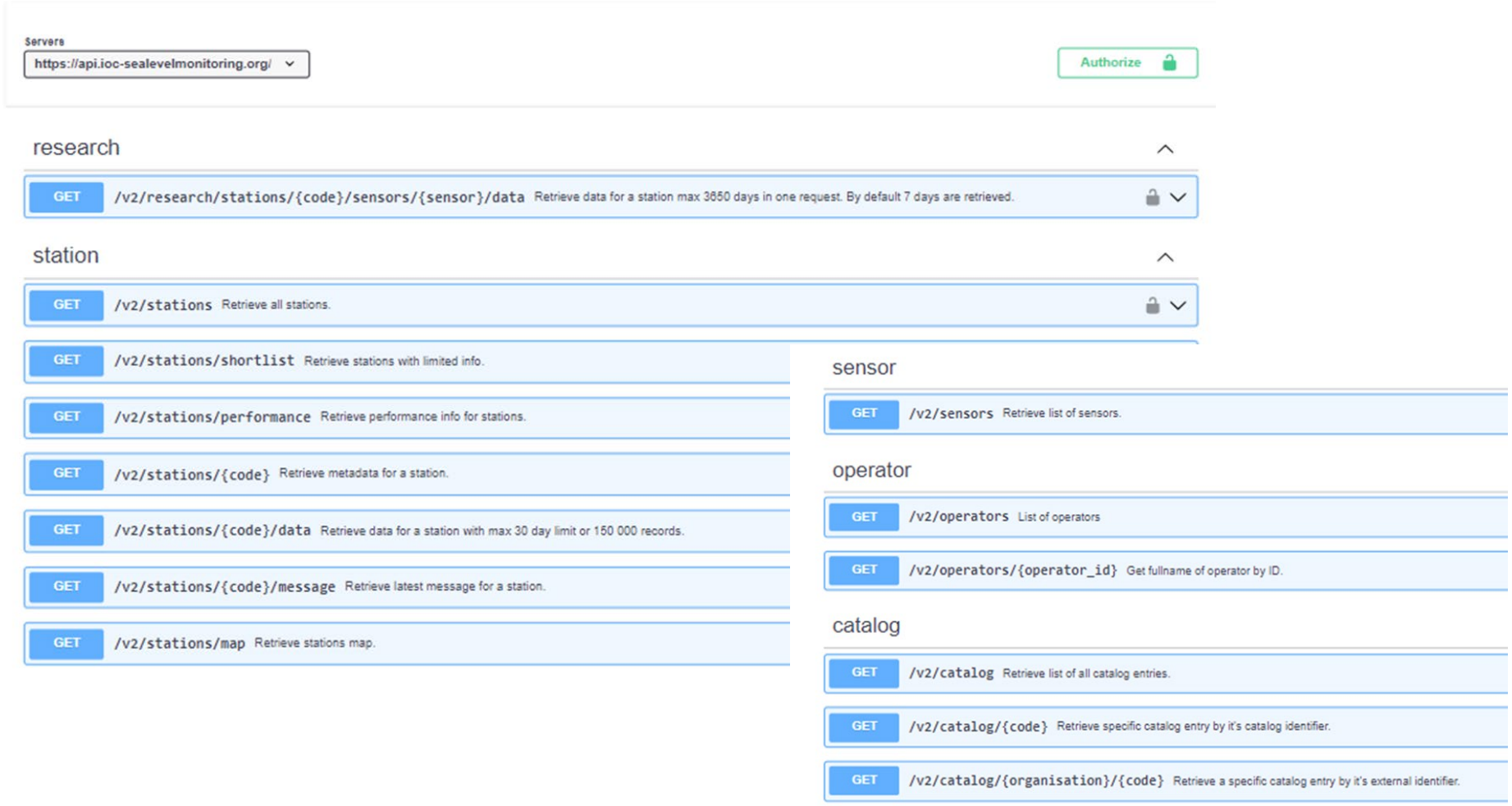
GET **/service.php?query=data** Retrieve data for a station with max 30 day limit or 150 000 records within the timestart and timestop interval.

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



Progress 2022-2025 – tidal harmonics

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

Planning

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