Project	AtlantOS – 633211
Deliverable number	4.2
Deliverable title	South Atlantic tide gauge data management plan
Description	Develop a harmonised data management plan [D4.2] [NERC-NOC] for all South Atlantic tide gauge data building on current international data centre activities.
Work Package number	WP4
Work Package title	Interfaces with coastal ocean observing systems
Lead beneficiary	NERC-NOC
Lead authors	Elizabeth Bradshaw
Contributors	Lesley Rickards
Submission data	
Due date	31 March 2018
Comments	

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Stakeholder engagement relating to this task*

WHO are your most important stakeholders?	☐ Private company If yes, is it an SME ☐ or a large company ☐? ☐ National governmental body ☒ International organization ☐ NGO ☒ others Please give the name(s) of the stakeholder(s): Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO) Permanent Service for Mean Sea Level (PSMSL) World Meteorological Organization (WMO)-IOC Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) Tide gauge operators in: Antigua and Barbuda, Aruba, Belize, Brazil, British Virgin Islands, Cape Verde Islands, Colombia, Curacao, Dominican Republic, Gambia, Haiti, Honduras, Mauritania, Mexico, Nicaragua, Panama, Puerto Rico, Senegal, South Africa, Trinidad and Tobago
WHERE is/are the company(ies) or organization(s) from?	☐ Your own country ☐ Another country in the EU ☒ Another country outside the EU Please name the country(ies): Antigua and Barbuda, Aruba, Belize, Brazil, British Virgin Islands, Cape Verde Islands, Colombia, Curacao, Dominican Republic, Gambia, Haiti, Honduras, Mauritania, Mexico, Nicaragua, Panama, Puerto Rico, Senegal, South Africa, Trinidad and Tobago
Is this deliverable a success story? If yes, why? **If not, why?**	☒ Yes, because ….. It builds on deliverable 4.1 and integrates deliverables from Work Package 7 to produce a Data Management Plan that will identifies data in need of quality control that can help contribute to the Atlantic Observing System. ☐ No, because …..
Will this deliverable be used? **If yes, who will use it?**	☒ Yes, by …… The data made available through the activities outlined in this Data Management Plan will be freely available from international data centres as well as

If not, why will it not be used?	AtlantOS integrators and will be used by scientists/academics, consultants, government departments and members of the public. ☐ No, because …..

NOTE: This information is being collected for the following purposes:

1. To make a list of all companies/organizations with which AtlantOS partners have had contact. This is important to demonstrate the extent of industry and public-sector collaboration in the obs community. Please note that we will only publish one aggregated list of companies and not mention specific partnerships.
2. To better report success stories from the AtlantOS community on how observing delivers concrete value to society.

*For ideas about relations with stakeholders you are invited to consult D10.5 Best Practices in Stakeholder Engagement, Data Dissemination and Exploitation.

CONTENTS

Introduction

The aim of this deliverable is to provide a data management plan for South Atlantic tide gauge data. As with D4.1 tide gauge stations from the Caribbean, Gulf of Mexico and small section of Antarctica were included as these regions impact on the South Atlantic Ocean and are also data sparse regions, requiring attention. The deliverable builds on several other AtlantOS deliverables including D4.1 Sea level observing site catalogue: Systematic documentation of South Atlantic tide gauge site data and benchmarks, and D11.2. AtlantOS Data Management Plan Framework, together with a number of WP7 deliverables (D7.1, D7.2, D7.3 and D7.4).

It is worth noting that tide gauge networks are often developed by national authorities with a particular purpose for the data collected; this may be, for example, to examine extreme events associated with tsunamis, storm surges, and other factors leading to short-term coastal inundation, port activities, or production of tide tables. However, the data are also valuable for many other purposes including monitoring and understanding global sea-level change, as well as interannual to decadal sea level variations, which in turn provide insight into ocean circulation changes on climate time scales, and oceanographic processes like surface and internal tides to surface currents and ocean eddies. Given the multi-dimensional, multi-purpose nature of tide gauge observations, there is considerable benefit to be gained from well-designed sea level observing networks that support a broad research and operational user base.

However, as became clear at the Task 4.4 Atlantic Coastal Observing Systems workshop held at the AtlantOS GA3 (November 2017, Gran Canaria), there are major differences in capability between the NE and NW Atlantic regions, which are well developed, compared with other Atlantic regions. The SWOT analysis for the five key coastal and shelf sea regions in the AtlantOS Atlantic Ocean basin domain, showed common issues of a lack of funding and coordination, and spatial and temporal gaps in observations due to a lack of operational platforms in many countries along

the Atlantic coastlines of South America, the Caribbean and west Africa. The Data Management Plan which forms this deliverable will assist and improve the data flow from these regions.

1. Data summary

The intention of AtlantOS Work Package (WP) 4 Task 4.3 was in part, to develop a harmonised Data Management Plan (DMP) for all Atlantic tide gauge data building on current international data centre activities. This DMP will set out uniform data management processes for contributing sea level organisations. This will establish the necessary agreements to provide all quality controlled sea level data via a single portal.

The AtlantOS Data Harmonization Report (Koop-Jakobsen et al 2016 D7.1) states that the main present barriers to sharing data are "Lack of organisational resources, insufficient institutional policies and support, disparate formats…" and this DMP should help address some of those issues. AtlantOS deliverable D7.3 Full life cycle Report: Report on AtlantOS Networks full life cycle data flow including Data Policy and Intellectual property rights (Koop-Jakobsen et al 2016 D7.3) mentions that there is a "growing need for identifying the most efficient strategy of processing the data all the way from the initial planning of data collection to the availability of the data products and their dissemination."

While completing AtlantOS deliverable 4.1 (Bradshaw 2017) it was made apparent that several sea level stations were operating in the South Atlantic and Caribbean that were not progressing through to the Permanent Service for Mean Sea Level (PSMSL) delayed mode mean sea level global data bank, or to the GLOSS Delayed-mode Data Centre (for higher frequency data) at BODC. The catalogue also identified a lack of tide gauge data available in Africa.

AtlantOS, as a Horizon 2020 project, is working on a principle of free an open access to data and also maximising the reuse of data (European Commission Directorate-General for Research & Innovation 2016). This DMP should help with a number of AtlantOS aims, such as making data available in a readily useable format (Koop-Jakobsen et al 2016, D7.1), standardising steps for the handling of data from discovery to publication (Koop-Jakobsen et al 2016, D7.3) and making data useable to a wider community (Harscoat and Pouliquen 2016).

The Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO) Strategic Plan for Data and Information Management (IOC-UNESCO 2017) states that one of the IOC's objectives is to facilitate and promote the exchange of oceanographic data and this DMP should encourage the delivery of data to the Global Sea Level Observing System (GLOSS) data centres. IOC encourages member states to provide timely, free and unrestricted access to relevant data and associated metadata (IOC UNESCO 2017). GLOSS is a programme under the auspices of IOC and the World Meteorological Organization (WMO)-IOC Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) and JCOMM states in its DMP that one of its long term objectives is to "coordinate the enhancement and long term maintenance of an…observing and data management system." The increase in sea level data flow through this task will help to achieve that objective.

Long term series of sea level data are rare and unrepeatable measurements. They can make an important contribution to climate science (sea level rise), oceanography (changes in ocean

currents, tides and storms surges) geodesy (national datum) and geophysics and geology (coastal land movements). Data from PSMSL are used in the Intergovernmental Panel on Climate Change (IPCC) assessment reports. It is envisaged that these data will be of use to scientists, commercial organisations and members of the general public. The data identified in this DMP also fit in with several of the IOC vision and High-Level Objectives for 2014-2021 such as creating effective early warning systems and preparedness for tsunamis and increased resiliency to climate change and variability. IOC also aims to provide an interface between data providers and user communities for ocean data and information products related to climate (IOC UNESCO 2017).

One of the roles of WP7 was to prioritise the Essential Ocean Variables (EOVs) collected by the networks involved in AtlantOS and sea level had been identified as an essential variable. For AtlantOS, the British Oceanographic Data Centre (BODC) has been identified as being the data provider for the tide gauge observing system, with long term experience in sea level data. The main EOV that will be collected is sea level, but it is possible that datasets may contain other parameters where they have been recorded at tide gauge stations, such as water temperature, air temperature and barometric pressure (Bradshaw 2015).

Over the last 10 years there has been an increase in the number of tide gauges providing near real time data, but resource constraints by some operators have meant that these data are not undergoing quality control and thus are not being delivered to some of the GLOSS data centres. The intention initially is to process near real time data from stations that are available via the IOC Sea Level Monitoring Facility (operated by Vlaams Instituut voor de Zee (VLIZ), Belgium) that have been identified as not being in the PSMSL data bank, and are not quality controlled by the data collecting agency. These data can be viewed as html files on the website or accessed through a web service. Where established national networks exist (e.g. South Africa, Argentina, Brazil), the higher frequency data will be sought directly from the data collector.

The AtlantOS Data Management Plan Framework (D11.2 2015) suggests that data be output in Network Common Data Form (NetCDF) and that published data formats shall meet accepted international standards. We intend to publish the data in NetCDF format and also ASCII files as agreed by the GLOSS community.

Existing data will be reused, in the sense that data already collected will be quality controlled and processed and placed in international data archive centres. We will initially be obtaining the data from the IOC Sea Level Monitoring Facility, but the original owners and operators of the gauges are listed in the appendix below.

The GLOSS Group of Experts has submitted a community white paper abstract to the OceanObs'19 conference which will outline a forward looking plan for the GLOSS programme. The conference has the main goal of developing "effective strategies for a sustained, multidisciplinary and integrated ocean observing system, and to better connect user communities and observers" (http://www.oceanobs19.net/general-information/). We will incorporate relevant advice from the white paper into the processing of South Atlantic data.

2. FAIR Data

2.1. Making data findable, including provisions for metadata

The Guidelines on FAIR Data Management in Horizon 2020 (2016) on which this DMP is based, detail how to make research data "Findable, accessible, interoperable and resuseable (FAIR)". Though Horizon 2020 regulations do not apply to most of the sea level data collected globally and sent to the GLOSS data centres, it is advisable to follow the FAIR principles laid out in the guidelines.

In order to make the South Atlantic tide gauge data discoverable we will send discovery metadata records to existing AtlantOS integrators such as SeaDataNet. The AtlantOS DMP (D11.2 2015) states that discovery metadata need to be INSPIRE compliant or ISO 191115. There are already existing GLOSS and PSMSL European Directory of Marine Environmental Data (EDMED) records, maintained by SeaDataNet, but we will create a new AtlantOS sea level data EDMED record. We will also create a European Directory of the Ocean Observing Systems (EDIOS) record, a further SeaDataNet catalogue. Discovery metadata entries can also be provided to other international metadata directories (e.g. NASA's Global Change Master Directory (GCMD)).

There is currently a GLOSS entry in the AtlantOS product catalogue, as described in the Data Management Handbook (Harscoat and Pouliquen 2016); if required, this could be supplemented by a South Atlantic sea level entry.

These data will be stored at the GLOSS Delayed Mode Data Centre and all incoming data accessions are assigned a unique identifier. As the data are processed, each individual station year will be assigned a unique identifier based on a Modulus 11 check algorithm.

BODC in collaboration with the British Library has the facility to mint Digital Object Identifiers (DOIs) and has already done so for the Global Extreme Sea Level Analysis (GESLA) dataset (www.bodc.ac.uk/data/published_data_library/catalogue/10.5285/3b602f74-8374-1e90-e053-6c86abc08d39/). It is the intention of the PSMSL to publish a Digital Object Identifier (DOI) annually for their data set. If appropriate, we will issue a DOI for the South Atlantic sea level data produced in AtlantOS WP4.

The Guidelines for a Research Data Management Plan (IOC UNESCO 2016) asks "Are original values (those as received) preserved, and if so, how?" BODC archive a copy of the data as they are when they arrive at the data centre and this is assigned a version number to indicate that it is the data as supplied. Each time a data file is changed through format updates and quality control procedures, a software routine is run which updates the version number in a database table. The final processed version of the data are assigned a version number which indicates they are ready to be made available to users. BODC can also apply version control to DOIs and issue new DOIs which supersede previous releases.

The Data Harmonization Report (Koop-Jakobsen 2016) outlines a minimum set of metadata common vocabularies to be used be all networks. SeaDataNet vocabularies are to be used for both usage and discovery metadata. SeaDataNet maintains the European Directory of Marine Organisations (EDMO) and for any new organisations operating tide gauges that are not included

in the EDMO directory, new records will be created. AtlantOS data uses the SeaDataNet parameter codes (https://www.bodc.ac.uk/resources/vocabularies/vocabulary_search/P02/) and the GLOSS delayed mode data centre uses BODC parameter codes (https://www.bodc.ac.uk/resources/vocabularies/vocabulary_search/P01/) but there are mappings between these two controlled vocabularies. We are able to create new parameter codes if necessary. AtlantOS also recommends the use of the SeaDataNet quality control (QC) flag scale. We will use the BODC flag scale, but a mapping between these scales is available (http://odv.awi.de/fileadmin/user_upload/odv/misc/ODV4_QualityFlagSets.pdf). Each individual station will be entered into the International Council for the Exploration of the Sea (ICES) Station Dictionary, which is a controlled vocabulary of monitoring stations (specific geographic locations that are visited continuously for monitoring purposes with repeated intervals).

We will investigate using SensorML to describe the sensors and processing at the stations as recommended in the Data Management Handbook (Harscoat and Pouliquen 2016).

Descriptive usage metadata required for sea level data is described in European sea level monitoring: Implementation of ESEAS quality control (García 2007). Information is required about the site such as "details of the datum and its method of determination, benchmark and levelling information and peculiar characteristics of the tide gauge site (for example, complex local geography, seiching, silting up of the harbour, river mouths)". We need to know about the data processing procedures and the data sampling and various aspects of the instrumentation used.

2.2. Making data openly accessible

The Full life cycle Report (Koop-Jakobsen et al 2016) states that all data produced under the framework of AtlantOS shall be available to third parties free of charge for scientific purposes. IOC also encourages member states to provide timely, free and unrestricted access to data. It is the intention that all sea level data collected in task 4.3 be made openly available.

High frequency data will be made available through the GLOSS delayed mode data centre (www.bodc.ac.uk) and monthly and annual mean sea level data will be available to download from PSMSL (www.psmsl.org). We will also investigate the production of a DOI for the high frequency data.

The AtlantOS Full life cycle Report (Koop-Jakobsen et al 2016) states that data will be made available "through integrators like Copernicus, SeaDataNet and EMODnet". BODC already have a work flow to deliver Common Data Index (CDI) records to SeaDataNet and this could be extended to include the data generated in task 4.3 if the data providers agree. Data may also be made available through the EMODnet Physics data portal.

BODC also maintain a dedicated requests team that will answer queries via telephone and email and help users obtain the data they require.

The data will be available via the BODC website online search tools (www.bodc.ac.uk) and a web browser is required to access the website. BODC distributes data in various standard formats and www.bodc.ac.uk/resources/delivery_formats/ list descriptions of the data formats available. Data are usually distributed in ASCII, NetCDF and Ocean Data View (ODV) format. ODV data can

visualised using freely available software (for non-commercial, non-military research and for teaching purposes).

The metadata are stored in BODC's National Oceanographic Database (NODB) (relational database) and include information about the data originator, position and collection start/end dates and times. The actual data measurements are stored outside the database in binary data files. The documentation are xhtml (EXtensible HyperText Markup Language) files stored in the NODB. Processing code is stored in Subversion (open source version control system).

Should there need to be any restriction to data (such as academic use only) BODC can utilise its access control system which assigns users a role and allows them to only download data that that role grants them privileges to see.

2.3. Making data interoperable

As mentioned earlier, AtlantOS WP7 aimed to define a minimum set of standards for use of identifiers for platforms and institutions, quality control and dissemination. The standards listed above were mainly for discovery metadata.

The JCOMM Data Management Plan (Data Management Coordination Group 2015) recommends Network Common Data Form (netCDF) for the exchange of oceanographic data and we will distribute the data in netCDF. JCOMM also recommend using Climate and Forecast (CF) conventions and GLOSS is looking at adopting these conventions.

JCOMM also recommend ensuring that all information required for the correct interpretation of data be included when data are delivered to clients. This can be done through maintaining lineage metadata describing the processing history. JCOMM also requires information be maintained about the observing practices so that older data may be compared to more recent data.

We will be using standard vocabulary for all data types present in your data set (BODC parameter codes https://www.bodc.ac.uk/resources/vocabularies/vocabulary_search/P01/).

2.4. Increase data re-use (through clarifying licences)

The GLOSS Implementation Plan – 2012 mentions the "need for an open data policy was also emphasized with timely, unrestricted access for all" (IOC UNESCO 2012). IOC Member States that participate in GLOSS have agreed that they will provide final quality assessed high frequency data and metadata to the GLOSS Delayed Mode Data Centre and monthly data and metadata to PSMSL.

It is intended that the quality controlled data will be made available by the end of March 2019. The data produced will be openly available and useable by third parties but the tide gauge data originators, GLOSS and AtlantOS should receive acknowledgement. This may be achieved by the inclusion of lineage metadata.

The sea level data will be quality controlled to international standards (e.g. Reverdin et al, 2017) by experienced data managers at the GLOSS delayed mode data centre. The screening process will include:

- Producing a tidal analysis and comparing M2, S2, N2, K1, O1, and Z0 constituents with previous data series, adjacent sites and the Admiralty Tide Tables for the closest site
- Looking for spikes, gaps, timing errors and datum shifts
- Comparing with previous series from the same site
- Comparing with neighbouring stations covering the same period
- Other parameters, such as sea temperature and atmospheric pressure, can be displayed at the same time to aid quality control
- Checking the statistics produced, i.e. mean sea level, with those produced in previous years

Data will be flagged where necessary and the flags will map onto the SeaDataNet QC flags. The Data Management Handbook (Harscoat and Pouliquen 2016) states that AtlantOS suggests common quality control for heterogeneous and near real time data.

It is important to maintain detailed data processing documentation and AtlantOS (AtlantOS Data Management Plan Framework 2015), JCOMM (Data Management Coordination Group 2015) and the IOC (Guidelines for a Research Data Management Plan 2016) all recommend that processing steps be well documented, preserving a processing history, storing this documentation with the dataset and making it available to users. The GLOSS delayed mode data centre will maintain a station history and processing notes for each station.

The JCOMM Data Management Plan (Data Management Coordination Group 2015) recommends using a standard suite of data quality testing procedures and along with the EuroGOOS Tide Gauge Task Team we will look to implement the automatic quality control procedures recommended in Reverdin et al 2017.

It is envisaged that these data will be available for the long term with no end date to the data retention period. The Guidelines for a Research Data Management Plan (IOC 2016) states that “conversion of data into standard interchangeable formats may be necessary for preservation purposes” and BODC provide secure long-term storage and long-term usability of data (by ensuring that data formats are always kept up to date).

3. Allocation of resources

The cost of making the data FAIR has already been included in the allocation for AtlantOS WP4 Task 4.3.

The GLOSS delayed mode data centre will be responsible for assembling the data and metadata but it is important that the data originators check the metadata supplied. Some information can only come directly from the operators e.g. instrument and sensor information, benchmark descriptions and calibration data.

The Data Management Plan Framework (D11.2. 2015) states that AtlantOS will make use of existing JCOMM networks facilities for the long term preservation of the data.

4. Data security

The JCOMM Data Management Plan (Data Management Coordination Group 2015) states that members should take care to guard "the integrity of data holdings from malicious individuals who break in to computer systems and do harm".

The IOC Strategic Plan for Data and Information Management (2017-2021) (IOC UNESCO 2017) promotes the accreditation of International Oceanographic Data and Information Exchange (IODE) data centres and the network of IODE NODCs as long term repositories for data and metadata. BODC are an IODE accredited data centre and PSMSL are World Data System (WDS) accredited and have in place systems that have been assessed as being robust for long term secure storage.

Backups of the BODC database are held in more than one location and there is a failover system for data delivery.

5. Ethical aspects

There are no new ethical considerations for this DMP.

6. Other

Although this DMP has been assembled following the "Guidelines on FAIR Data Management in Horizon 2020" (European Commission, Directorate-General for Research & Innovation 2016), international sea level data, particularly those collected under the GLOSS programme should adhere to a number of community standards. These include the IOC (IOC UNESCO, 2016), JCOMM (Data Management Coordination Group 2015) and also the EuroGOOS Tide Gauge Task Team.

References

(2015) D11.2. AtlantOS Data Management Plan Framework

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Koop-Jakobsen, Waldmann and Huber (2016) D7.3. Full life cycle Report: Report on AtlantOS Networks full life cycle data flow including Data Policy and Intellectual property rights

Koop-Jakobsen, Waldmann, Huber, Harscoat and Pouliquen (2016) D7.1. Data Harmonization Report: Report containing recommendation on data harmonization

Reverdin, G., Thierry, V., Utiz, J., d'Ortenzio, F., Bradshaw, E., Pfeil, B., Harscoat, V. and Pouliquen S. (2017) D7.2. Recommendations for an automatic RT or NRT QC for selected EOVs (T&S, Current, Oxygen, CHla, Nitrate, Carbon, Sea level)

Appendix - Data to be processed

This table assumes that the data are not currently being processed by national agencies or international data centres. We will contact providers where possible to ensure there is no duplication of effort.

Data managers at PSMSL have been in contact with the tide gauge operators in the Caribbean to establish the availability of data from the operational gauges. The contacts from Aruba, Brazil and Panama have indicated that some of their data are not currently being quality controlled. We will be in contact with those operators to obtain the raw data directly from them.

The data to be retrieved from the IOC Sea Level Monitoring Facility is made available in XML, JSON or ASCII format. They are accessed using a REST web service. Data are made available from National Oceanic and Atmospheric Administration (NOAA) in XML, JSON or CSV format. The data will be retrieved using web services.

BODC will process data from the UK South Atlantic Sea Level Network (www.psmsl.org/links/programmes/uk_sa_network.php) as part of the UK's contribution to GLOSS and include them in the South Atlantic dataset.

Station Name	Country	LAT	LON	Start date of data to be QCd	End date of data to be QCd	Data URL	Operator
Barbuda	AG	17.6	-61.82	10/06/2011	23/03/2018	https://tidesandcurrents.noaa.gov/waterlevels.html?id=9761115	NOAA / National Ocean Service
Parham (Camp Blizard)	AG	17.2	-61.78	11/06/2013	25/10/2014	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=parh&output=tab&period=0.5	CPACC/MACC
Oranjestad	AW	12.5	-70.03	11/02/2017	23/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=oran&output=tab&period=0.5	Departamento Meteorologico Aruba
Cananéia	BR	-25	-47.92	2016	2017	http://www.mar.mil.br/dhn/chm/oceanografia/acesso_dados_produtos.html	Instituto Oceanográfico da Universidade de São Paulo
Fortaleza	BR	-3.72	-38.48	2008	2017	PSMSL + http://www.ioc-sealevelmonitoring.org/bgraph.php?code=fort&output=tab&period=0.5	Instituto Brasileiro de Geografia e Estatística

Ilha de Fernando de Noronha	BR	-3.83	-32.4	Unknown	Unknown	http://www.mar.mil.br/dhn/chm/oceanografia/acesso_dados_produtos.html	Instituto Nacional de Pesquisas Espaciais
Imbituba	BR	-28.2	-48.65	2008	2017	PSMSL + http://www.mar.mil.br/dhn/chm/oceanografia/acesso_dados_produtos.html	Instituto Brasileiro de Geografia e Estatística
Ponta da Madeira (Cais da Vale)	BR	-2.57	-44.38	2016	2017	http://www.mar.mil.br/dhn/chm/oceanografia/acesso_dados_produtos.html	Instituto Brasileiro de Geografia e Estatística
Rio Grande	BR	-32.1	-52.1	2014	2017	http://www.mar.mil.br/dhn/chm/oceanografia/acesso_dados_produtos.html	Diretoria de Hidrografia e Navegação Marinha do Brasil
Salvador	BR	-13	-38.52	2008	2017	PSMSL + http://www.mar.mil.br/dhn/chm/oceanografia/acesso_dados_produtos.html	Gerência Geral do Porto de Ponta da Madeira da Companhia Vale
St Peter and St Paul Rocks	BR	0.92	-29.35	2008	2017	http://www.mar.mil.br/dhn/chm/oceanografia/acesso_dados_produtos.html	Instituto Nacional de Pesquisas Espaciais
Tubarão Harbor	BR	-20.3	-40.24	2008	2017	http://www.mar.mil.br/dhn/chm/oceanografia/acesso_dados_produtos.html	Instituto Brasileiro de Geografia e Estatística
Ubatuba	BR	-23.5	-45.05	2017	2017	http://www.mar.mil.br/dhn/chm/oceanografia/acesso_dados_produtos.html	Instituto Oceanográfico da Universidade de São Paulo
Carrie Bow Cay	BZ	16.8	-88.08	14/04/2016	23/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=cabc&output=tab&period=0.5	Smithsonian Marine Station at Fort Pierce
Coveñas	CO	9.41	-76.21	25/08/2015	29/10/2017	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=cove&output=tab&period=0.5	Dirección General Marítima
Isla Naval	CO	10.2	-75.75	15/09/2015	23/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=inav&output=tab&period=0.5	Dirección General Marítima
Santa Marta	CO	11.2	-74.22	12/09/2012	23/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=sama&output=tab&period=0.5	Dirección General Marítima
Sapzurro	CO	8.66	-77.37	19/08/2015	23/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=sapz2&output=tab&period=0.5	Dirección General Marítima
Puerto Estrella	CO	12.4	-71.31	04/09/2015	30/09/2016	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=estr&output=tab&period=0.5	Dirección General Marítima
Bullen Bay	CW	12.2	-69.02	16/10/2013	23/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=bull&output=tab&period=0.5	Meteorological Department Curaçao
Punta Cana	DO	18.5	-68.38	24/06/2010	23/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=ptca&output=tab&period=0.5	Oficina Nacional de Meteorología / University of Hawaii Sea Level Center (UHSLC)

Roseau	DO	15.3	-61.39	13/05/2011	19/09/2017	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=rose&output=tab&period=0.5	University of Hawaii Sea Level Center (UHSLC)
Santo Domingo/p.San Andres	DO	18.4	-69.63	28/02/2010	14/12/2017	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=sdom&output=tab&period=0.5	Oficina Nacional de Meteorología
Banjul	GM	13.4	-16.57	04/09/2015	14/06/2017	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=bnjl&output=tab&period=0.5	Department of Water Resources
Cap Haitien	HT	19.8	-72.19	02/12/2011	23/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=caph&output=tab&period=0.5	Service Maritime et de Navigation d´Haiti
Jacamel	HT	18.2	-72.54	11/12/2013	08/02/2017	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=jaca&output=tab&period=0.5	Service Maritime et de Navigation d´Haiti
La Ceiba Cabotaje Harbor	HN	15.8	-86.76	04/05/2015	22/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=ceib&output=tab&period=0.5	Comision Permanente de Contingencias
Roatan Island Punta Gorda Harbor	HN	16.4	-86.54	04/05/2015	23/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=rtas&output=tab&period=0.5	Comision Permanente de Contingencias
Tela Harbor	HN	15.8	-87.45	04/05/2015	12/12/2016	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=tela&output=tab&period=0.5	Comision Permanente de Contingencias
Utila Island	HN	16.1	-86.89	04/05/2015	06/06/2016	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=util&output=tab&period=0.5	Comision Permanente de Contingencias
Nouadhibou	MR	20.8	-17.04	17/08/2015	23/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=noua&output=tab&period=0.5	Office National de la Météorologie
Frontera	MX	18.2	-94.27	26/08/2010	23/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=frtr&output=tab&period=0.5	Universidad Nacional Autónoma de México
Lerma Campeche	MX	19.8	-90.59	14/10/2016	23/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=camt&output=tab&period=0.5	Universidad Nacional Autónoma de México
Puerto Morelos	MX	21.4	-86.75	01/01/2013	23/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=pumo2&output=tab&period=0.5	Universidad Nacional Autónoma de México
Sisal	MX	21.2	-90.05	07/12/2016	21/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=sisa&output=tab&period=0.5	Universidad Nacional Autónoma de México
Sian Ka'an	MX	19.3	-87.45	17/10/2016	14/01/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=sian&output=tab&period=0.5	Universidad Nacional Autónoma de México
Corn Island	NI	12.3	-83.07	06/10/2014	07/07/2017	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=cois&output=tab&period=0.5	Instituto Nicaragüense de Estudios Territoriales - Hydrological Unit
Bocas Del Toro	PA	9.35	-82.26	17/10/2014	23/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=bdto&output=tab&period=0.5	Smithsonian Tropical Research Institute

El Porvenir	PA	9.56	-78.95	26/08/2012	23/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=elpo&output=tab&period=0.5	Instituto de Geociencias, Universidad de Panamá
Caja de Muertos	PR	17.9	-66.53	14/04/2015	20/09/2017	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=camu&output=tab&period=0.5	Universidad de Puerto Rico
Mayaguez	PR	18.2	-67.16	08/03/2010	20/09/2017	https://tidesandcurrents.noaa.gov/waterlevels.html?id=9759394	NOAA / National Ocean Service
Penuelas (Punta Guayanilla)	PR	18	-66.76	08/03/2010	14/04/2015	https://tidesandcurrents.noaa.gov/waterlevels.html?id=9758053	NOAA / National Ocean Service
Carabane	SN	12.6	-16.7	04/09/2015	Unknown	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=cara&output=tab&period=0.5	Agence Nationale de l'Aviation Civile et de la Météorologie
St. Louis	SN	16	-16.51	16/11/2015	09/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=stlo2&output=tab&period=0.5	Agence Nationale de l'Aviation Civile et de la Météorologie
Gough Island	SH	-40.3	-9.95	11/09/2013	23/03/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=goug&output=tab&period=0.5	Hartebeesthoek Radio Astronomy Observatory
Cedros Bay	TT	10.1	-61.87	28/06/2013	12/01/2018	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=cdtt&output=tab&period=0.5	Trinidad and Tobago Hydrographic Unit
Tortola	VG	18.4	-64.61	16/08/2013	06/09/2017	http://www.ioc-sealevelmonitoring.org/bgraph.php?code=tort&output=tab&period=0.5	Puerto Rico Seismic Network (PRSN)