18th GLOSS Expert Group Meeting, Panama,
11-14 March 2025, https://oceanexpert.org/event/4663

Oc. Jorge Nath – jorge.nath@inocar.mil.ec

ECUADORIAN TIDAL NETWORK

The monitoring network consists of 8 stations that are operated and managed by the Institute Oceanographic and Antarctic Survey (INOCAR), and by 3 stations managed by the University of Hawaii Sea Level Center (UHSLC) maintains the Network of Tide Gauge Stations (Figure 1)

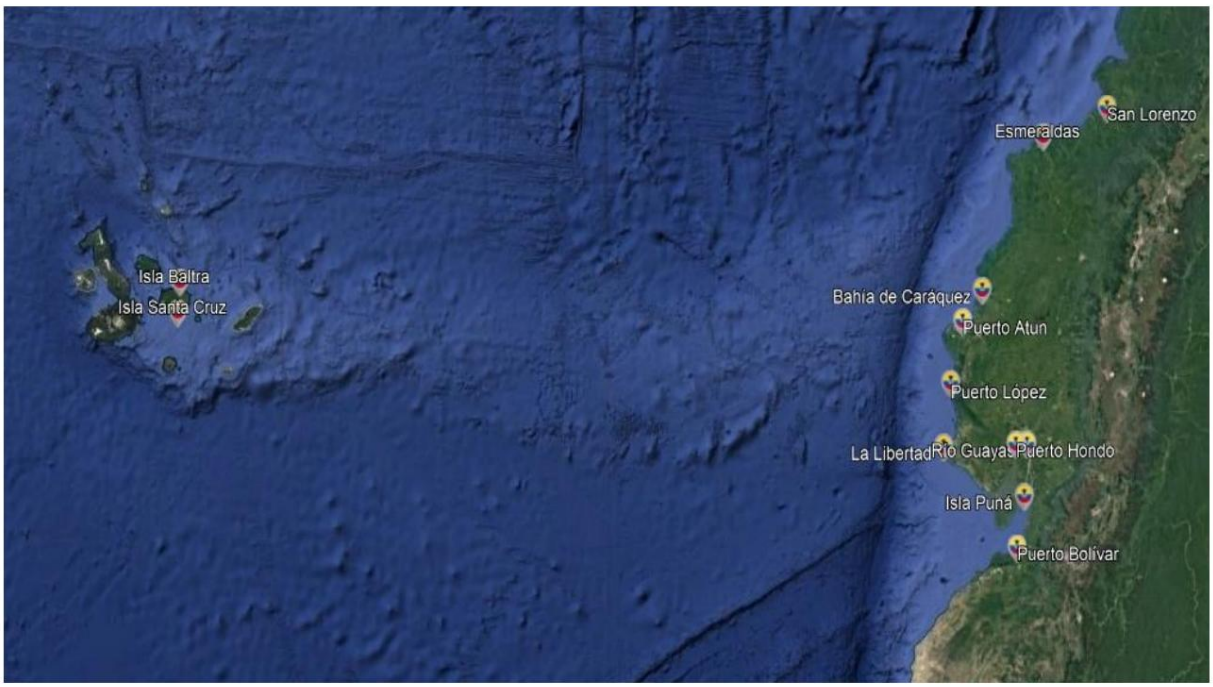

Figure 1. Tidal Network 2025

Since 2018, the stations have been strengthened with autonomous and high-resolution sensors, maintaining sensors in pairs in order to provide continuity to the record (radar-pressure), considering that these monitoring stations have the capacity to include sensors for other parameters, some temperature sensors have been included since 2020. The 08 INOCAR stations transmit
using GPRS modems, while the 03 UHSLC stations transmit using GOES satellite antennas. Annex 1, Table 1 and Table 2 show the characteristics of the stations, geographic positions and sampling dates along the continental and insular coast of Ecuador.

INOCAR - 25 de Julio Avenue No. 2601, via the Maritime Port
Postal code: 090205 / Guayaquil - Ecuador
Telephone: 593-4 3813440

PRODUCTS OPERATIONS FOR THE OBSERVATION OF SEA LEVEL ON THE INSTITUTIONAL WEBSITE

Monitoring stations: This monitoring network allows INOCAR to keep its oceanographic data bank up to date, both for sea level variations and surface temperature. The viewer shows graphs of the station with the information recorded in local time referred to instrumental zero and updated every hour, see access link 1 and figure 2.

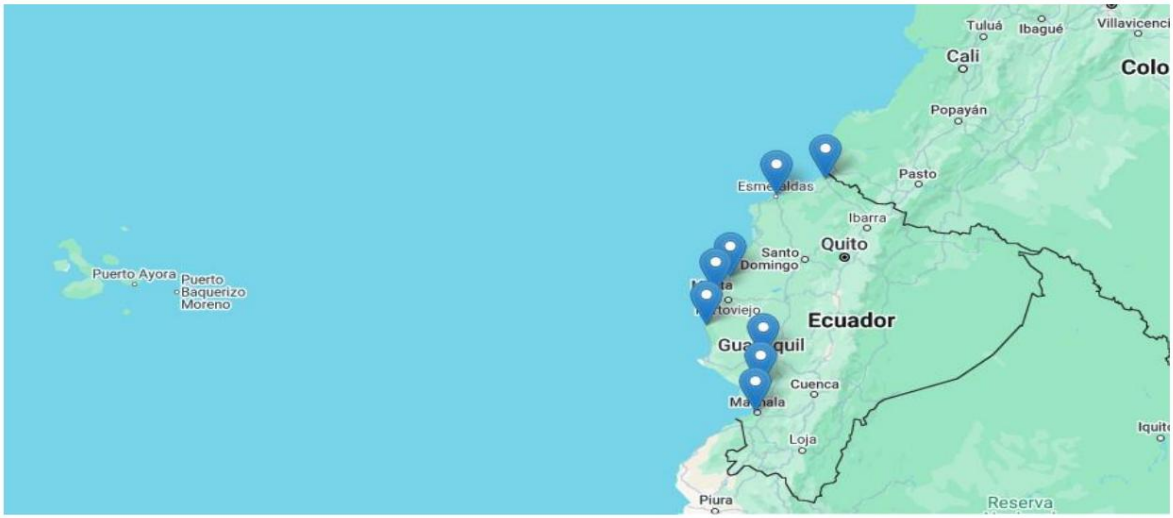

Figure 2. Monitoring stations viewer - INOCAR

1- https://www.inocar.mil.ec/web/index.php/productos/estaciones-de-monitoreo

Tide table of Ecuadorian ports: The collection of observed data on sea level variation along the continental and island coast (see appendix 1) has allowed the development of annual tide predictions in main locations and ports, which are edited in Tide Tables and published on the institutional website.

The Tide Table presents the tide height in meters and referred to an official reference level called MLWS (mean low tide syzygy) at its most critical moments (high tides - low tides). These data are presented for 25 locations.

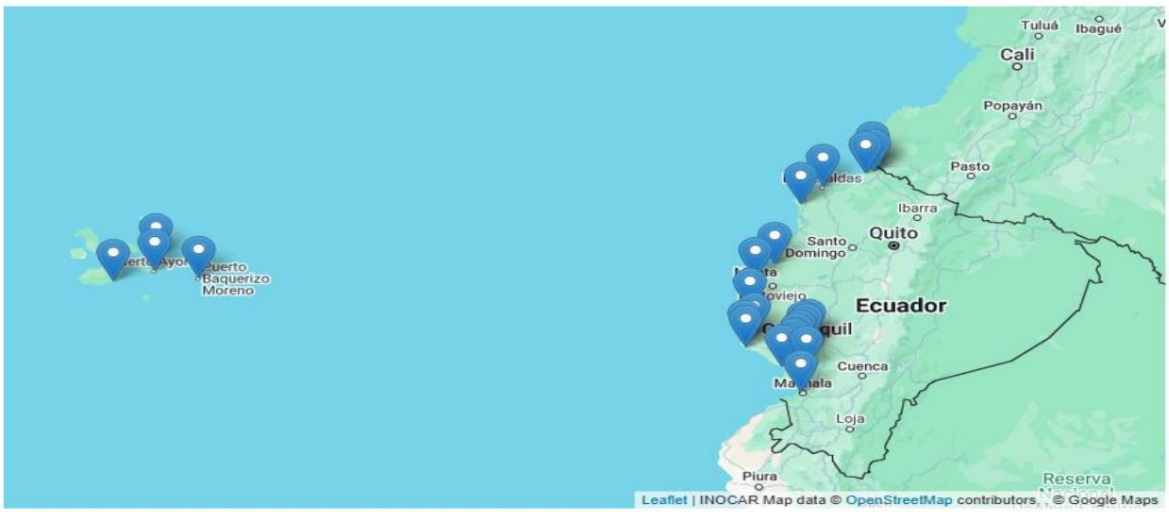

Figure 3. Tide table viewer - INOCAR

The products presented are the occurrence and height of high and low tide at the selected location, on the current day, before and after, as well as general information on the harmonic components of the tide, a PDF file of the current quarter of the forecast and an hourly graph at different reference levels (NMM-MLHS), see access link 2 and figure 3.

2 - https://www.inocar.mil.ec/web/index.php/productos/tabla-mareas

PRODUCTS OPERATIONS FOR THE OBSERVATION OF THE SEA LEVEL ON WEB PAGE INTERNATIONAL

GRASP -CPPS

Ecuador is an active member and currently holds the presidency of the Regional Alliance of the Global Ocean Observing System (GOOS) for the Southeast Pacific - GRASP for the period 2024-2025. This alliance is made up of the countries of Colombia, Ecuador, Peru and Chile.

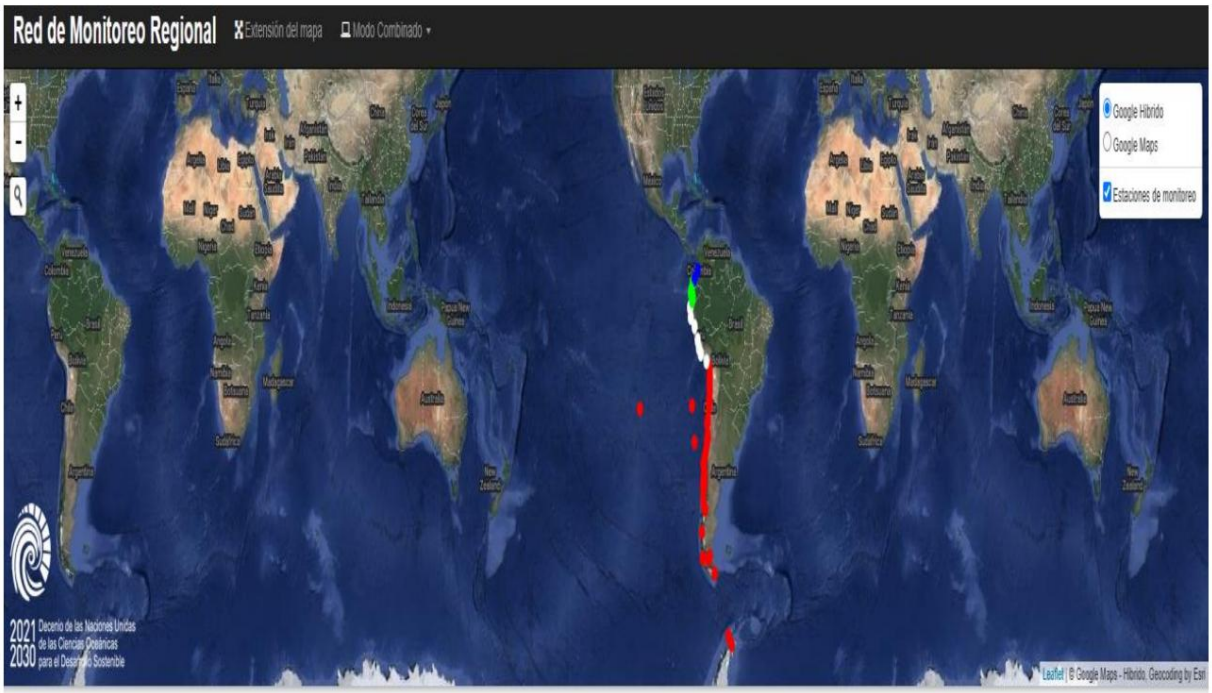

Figure 4. Regional Monitoring Network Viewer – GRASP

In 2021, it receives recognition and positioning from the Alliance within the framework of the Decade of Ocean Sciences for Sustainable Development, by contributing to the Regional Tide Network, currently the Regional Monitoring Network, comprising to date a total of 63 observation stations for sea level, surface temperature and atmospheric pressure, this viewer is linked to the institutional website of the CPPS, being the body in charge of publishing the products of the member countries of the GRASP and monitoring their functionality and availability, see the access link
3, 4 and figure 4

3 - https://www.cpps-int.org/index.php/grasp-productos
4 - https://coos.inocar.mil.ec/visores/red_mareografica/

GLOBAL SEA LEVEL OBSERVING SYSTEM CENTRAL NETWORK

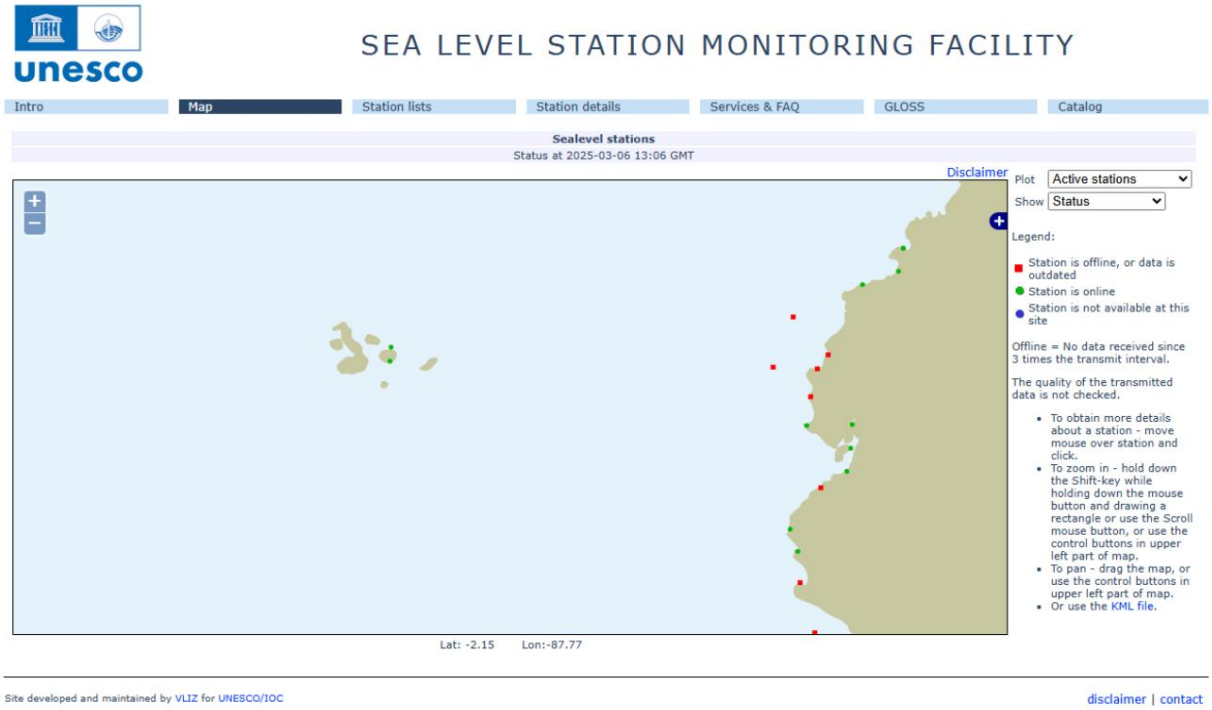

Figure 5. Core network of the global sea level observing system – IOC

5 - https://www.ioc-sealevelmonitoring.org/map.php

Between September 27 and 30, 2022, in the city of Valparaíso, Chile, the workshop “Shared Access to Sea Level Data: Tool for an Effective Regional Response to Tsunami Emergencies” was held. This activity was attended by speakers from the Pacific Tsunami Warning Center (PTWC); the Flemish Marine Institute (VLIZ) and SHOA, with the assistance of representatives from the Tsunami Warning Centers of Colombia, Ecuador and Peru. This allowed Ecuador to integrate all its tide gauge stations and Tsunami buoys into the IOC network through web service transmission, see access link 5.6, figures 5 and 6.

Stations kindly provided by Instituto Oceanográfico de la Armada (Ecuador)

Status at 2025-03-05 21:22 GMT : 14 stations listed ordered by delay

Show: All known stations Info: General information

Code	GLOSS ID	Country	Location	Connection	DCP ID	Last observation Level	Last observation Time in GMT	Delay	Transmit Interval	View
dmab		Ecuador	DART West of Manta	web		-999	-down-	3658d	6h	[open]
dpea		Ecuador	DART West of Pedernales	web		-999	-down-	2562d	6h	[open]
mant		Ecuador	Manta	web		1.92	2024-09-19 12:49	167d	10'	[open]
dmaa		Ecuador	DART West of Manta	web		1681.33	2025-01-04 09:00	61d	6h	[open]
dpeb		Ecuador	DART West of Pedernales	web		2299.18	2025-01-19 18:00	45d	6h	[open]
patu		Ecuador	Puerto Atún - Manta	web		1.1	04:59	16h	10'	[open]
bcar		Ecuador	Bahía de Caráquez	web		1.71	20:49	33'	10'	[open]
slor		Ecuador	San Lorenzo	web		3.35	20:59	23'	10'	[open]
pbol		Ecuador	Puerto Bolívar	web		1.99	20:59	23'	10'	[open]
puna		Ecuador	Puná	web		1.34	20:59	23'	10'	[open]
esme		Ecuador	Esmeraldas	web		2.37	20:59	23'	10'	[open]
sant		Ecuador	SantaCruz,Galapagos	SEEQ40	932085F0	9.31	21:16	6'	5'	[open]
balt	169	Ecuador	Baltra,Galapagos EC	SEEQ40	932040EE	-0.28	21:17	5'	5'	[open]
lali	172	Ecuador	La Libertad EC	SEPO40	3540B126	2.24	21:18	4'	5'	[open]

Figure 6. Ecuador monitoring stations in SLSMF - IOC

6 - https://www.ioc-sealevelmonitoring.org/list.php?order=delay&dir=asc&showall=all&contact=27

REGIONAL STUDY OF THE EL NIÑO PHENOMENON

The monitoring network allows INOCAR to monitor sea level variations in real time on a daily and continuous basis. Figure 7 shows the monitoring station in La Libertad (1947) and the Baltra-GALAPAGOS station (1972) where increases and decreases in sea level can be observed, allowing the influence of the El Niño/La Niña phenomenon to be defined.

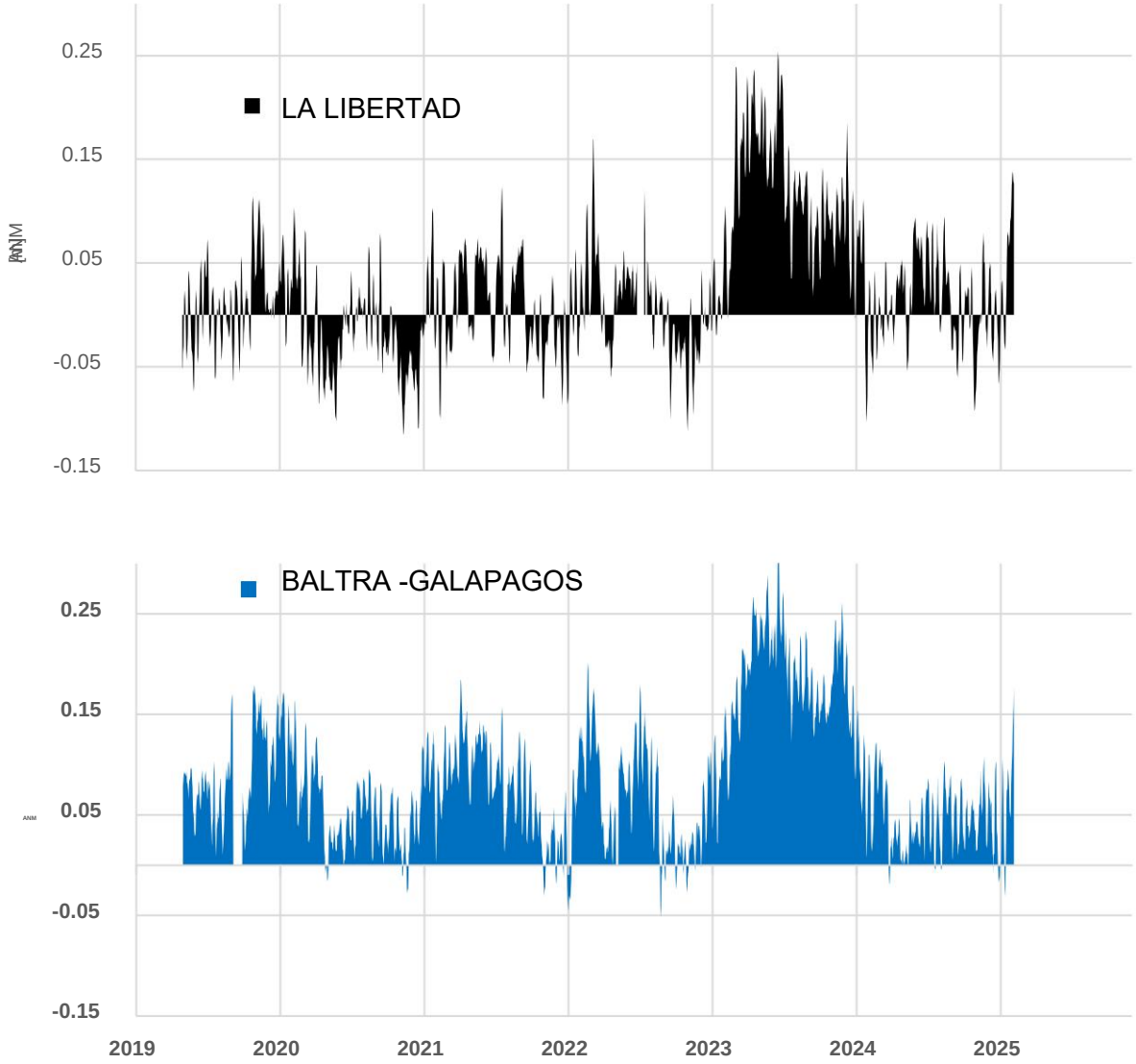

Figure 7. Daily variation of sea level at monitoring station

waves have arrived off the coast of Ecuador, the destructive effects of which have been greater or lesser depending on their intensity and the arrival time of the first waves. The study of sea level and development of forecasts has allowed the risks to be minimized. At 00:36 (local time) on February 27, 2010, an earthquake of 8.8 degrees of magnitude occurred off the coast of Chile. Figure 8 shows the arrival of the first tsunami wave during the low tide phase. Data recorded at La Libertad station. For more details, see link 7.

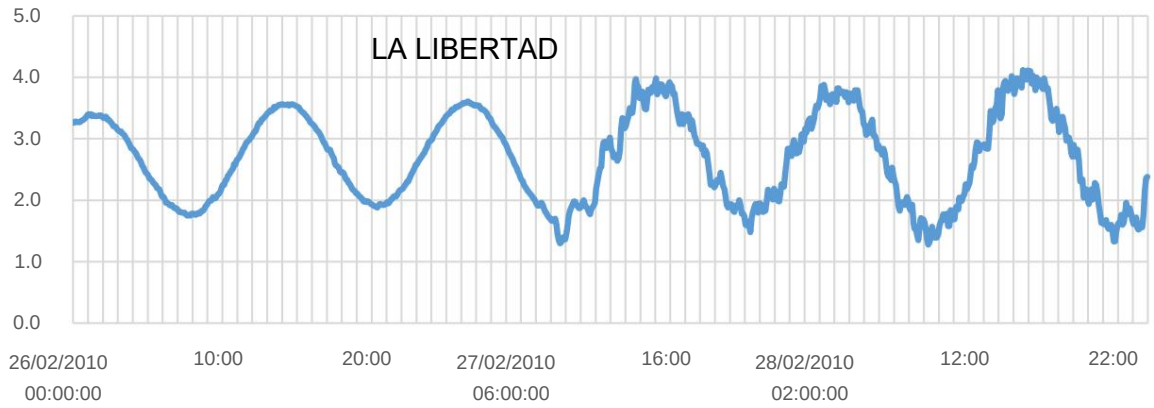

Figure 8. Arrival of tsunami waves on the Ecuadorian coast, February 26-28, 2010

7 - https://www.inocar.mil.ec/web/index.php?view=article&id=872:tsunami-de-chile-2010&catid=46

A 9.0 magnitude earthquake occurred off the coast of Japan on March 11, 2011, at 14:46:23 (local time). Through an analysis of the time of arrival to the coast of Ecuador (20 h), it is possible to verify the mitigating actions to be taken based on tide predictions, in Figure 9.
The arrival of the first tsunami wave was at high tide, data recorded at the La Libertad station,
For more details see access link 8.

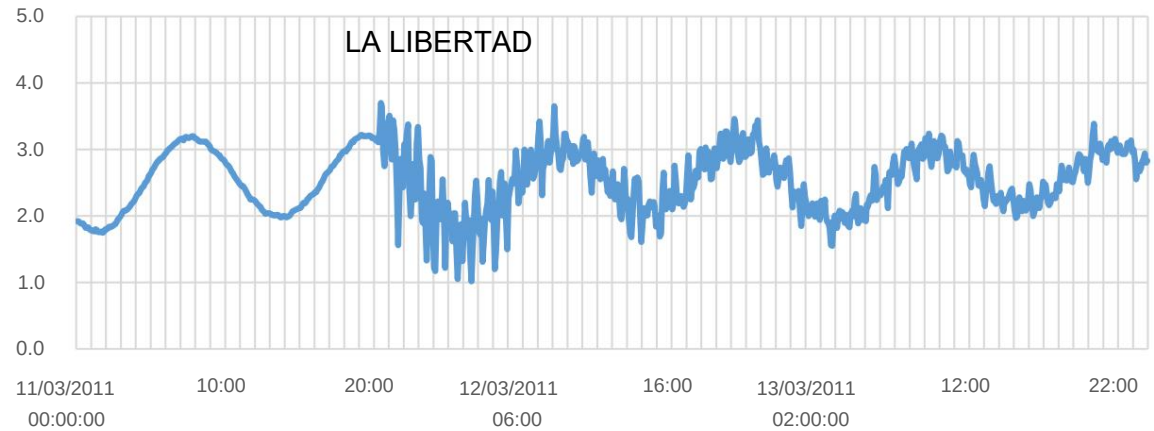

Figure 9. Arrival of tsunami waves on the Ecuadorian coast, March 11-13, 2011

8 - https://www.inocar.mil.ec/web/index.php?view=article&id=873&catid=46

INOCAR - 25 de Julio Avenue No. 2601, via the Maritime Port
Postal code: 090205 / Guayaquil - Ecuador
Telephone: 593-4 3813440

ANEXO 1

Tabla1. Descripción de estaciones mareográficas ECUADOR.

Estación	Latitud	Longitud	Tipo Sensor	Registro intervalo	Transmisión intervalo	Situación /
				(minutos)	(minutos)	Estado
San Lorenzo	1.2956	78.8421	Presión, Radar, temperatura	1	10	Operativa - INOCAR
Esmeraldas	0.9909	79.6466	Radar 1, Radar 2, temperatura	1	10	Operativa - INOCAR
Bahía de Caráquez	-0.6064	80.4229	Presión, Radar , temperatura	1	10	Operativa - INOCAR
Puerto Atún	-0.9257	-80.6658	Radar	1	10	Operativa - INOCAR
Puerto López	-1.5609	-80.8170	Radar 1, Radar 2	1	10	Operativa - INOCAR
Isla Puná	-2.7346	79.9119	Presión Radar, temperatura	1	10	Operativa - INOCAR
Puerto Bolívar	-3.2612	80.0860	Radar 1, Rada 2, temperatura	1	10	Operativa - INOCAR
Guayaquil	-2.1953	79.8798	Presión, Radar, temperatura	1	10	Operativa - INOCAR
La Libertad-	-2.2177	-80.9064	Presión, Radar 1, Radar 2	1, 1, 5	5	Operativa - UHSLC
Baltra – Galápagos	-0.4330	-90.2830	Presión, Radar 1, Radar 2	1, 1, 5	5	Operativa - UHSLC
Santa Cruz – Galápagos	-0.7520	-90.3070	Presión, Radar 1, Radar 2	1, 1, 5	5	Operativa - UHSLC

Tabla 2. Registros de posiciones geográficas y fechas de estaciones de monitorea los largo de la costa continental e insular de Ecuador

Estación	Latitud	Longitud	frecuencia de medición	fecha inicial mm/dd/yyyy	fecha final mm/dd/yyyy	Duración (años)
La Libertad	2°13'2.17"S	80°54'23.04"O	60 minutos, 10minutos; 1 minuto;	10/25/1948	06/30/2024	75.732
Puerto Bolívar	3°15'39.89"	80° 0'5.04"O	60 minutos, 10minutos; 1 minuto;	01/01/1970	06/30/2024	54.532
Puerto Maritimo	02°16'42.4"S	79°54'43.55"O	5 minutos, 60 minutos	11/01/1970	08/02/2024	53.789
Baltra	0°26'11.48"S	90°17'7.80"O	60 minutos, 10minutos; 1 minuto;	11/01/1972	06/30/2024	51.696
Manta	0°56'23.07"S	80°43'33.24"O	60 minutos, 10minutos; 1 minuto;	01/01/1973	06/14/2023	50.482
Rio Guayas	2°11'42.61"S	79°52'48.00"O	60 minutos, 10minutos; 1 minuto;	06/30/1976	06/30/2024	48.033
Santa Cruz	0°45'18.17"S	90°18'46.08"O	60 minutos, 10minutos; 1 minuto;	10/19/1978	06/30/2024	45.729
Esmeraldas	0°59'24.02"N	79°38'57.84"O	60 minutos, 10minutos; 1 minuto;	09/02/1979	06/30/2024	44.858
Bahia de Caraquez	0°36'23.21"S	80°25'22.80"O	60 minutos, 10minutos; 1 minuto;	01/15/1980	06/30/2024	44.488
Isla Puna	2°44'3.66"S	79°54'43.20"O	60 minutos, 10minutos; 1 minuto;	04/01/1980	06/30/2024	44.277
Data de Posorja	2°42'59.15"S	80°18'53.28"O	60 minutos; 10 minutos; 1 minuto; 3 minutos	01/01/1983	05/19/2024	41.408
E1	02°24'07"S	80°01'09.87"O	60 minutos, 10minutos; 5 minutos;	03/18/1984	12/31/2020	36.814
Pitahaya	03°25'18.19"s	80°04'45.80"O	60 minutos.	10/22/1988	02/02/2014	25.299
Francisco de Orellana	00°27'0"S	76°58'0"O	07h00-09-11-13-15-17h00	05/21/1983	08/31/2007	24.296
Rocafuerte	0°59'26.17"S	77°48'53.07"O	07h00-09-11-13-15-17h00	05/01/1983	08/31/2005	22.351
San Lorenzo	1°17'44.32"N	78°50'31.48"O	5 minutos	06/14/2002	05/01/2024	21.896
Tres Bocas	02°13'53.64"S	79°57'25.91"O	5 minutos; 10 minutos	11/09/2004	12/31/2023	19.153
Nuevo Rocafuerte	00°55'13"N	75°23'55"O	07h00-09-11-13-15-17h00; 30 minutos; 60 minutos.	06/01/1997	06/30/2016	19.093
Jaramijo	0°56'33.78"S	80°38'18.58"O	15 minutos; 10minutos; 1minuto	03/20/2007	10/13/2018	11.575
C2	02°35'10.75"S	80°07'23.25"O	5 minutos; 10 minutos	10/01/2009	12/31/2020	11.258
Puerto Lopez	1°33'39.24"S	80°49'2.64"O	1minuto	07/12/2013	06/30/2024	10.975
Monteverde	2° 4'4.80"S	80°44'20.40"O	5 minutos;	04/14/2005	11/14/2012	7.592
Limones	1°14'55.14"N	78°58'47.17"O	05 minutos	07/20/2002	02/14/2010	7.578
Pañacocha	00°26'57.16"N	76°04'18.62"O	06h00-12-18h00; 30 minutos	06/02/2006	03/31/2011	4.830
Songa	2°17'8"S	79°51'6"O	1 minuto;	09/13/2019	09/08/2022	2.989
Anconcito	2°19'54.88"S	80°53'9.60"O	1 minuto;	06/14/2013	08/15/2015	2.170
Itaya	00°25'42.62"s	76°32'8.88"O	30 minutos	05/31/2009	07/24/2011	2.148
Salinas	2°11'31.10"S	80°59'7.15"O	5 minutos	08/01/2007	09/16/2009	2.129
D1	02°24'07"S	80°18'09"O	10 minutos	12/16/2018	12/31/2020	2.044
Palma Real	1°26'49.58"N	78°51'36.18"O	5 minutos; 10 minutos	05/21/2010	04/30/2012	1.945
San Cristobal	00° 53' 57.05" S	089° 36' 36.26" O	10 minutos	07/31/2013	06/14/2015	1.871
Isla isabela	0°57'46.80"S	90°57'32.40"O	1minuto	08/02/2013	04/29/2015	1.740
Pez Joya	2°19'45"S	79°50'53"O	5 minuto;	09/06/2009	02/16/2011	1.447
Coca	00°28'24.29"S	76°58'0"O	30 minutos	10/24/2009	01/30/2011	1.268
Pam4	2°32'37.00"S	79°49'6.00"O	10 minuto;	11/26/2009	01/05/2011	1.110
San vicente	0°35'43.39"S	80°24'38.17"O	1 minuto	07/18/2013	07/30/2014	1.033
Punta Piedra	2°25'46.98"S	79°51'21.03"O	60 minuto;	01/01/1984	12/31/1984	1.000