INOCAR

CENTRO DE MONITOREO OCEÁNICO

CNAT – ECUADOR




TNFG-SU Christiam Gómez Bonilla

Instituto Oceanográfico y Antártico de la Armada
Instituto Oceanográfico y Antártico de la Armada

Instituto Oceanográfico y Antártico de la Armada

- The Oceanographic and Antarctic Institute of the Ecuadorian Navy – INOCAR, was created on February 2, 1932.
- Since 1976, it has been Ecuador's focal point for the Pacific Tsunami Warning System – PTWS.
- It serves as the National Tsunami Warning Center – CNAT, for the monitoring and diagnosis of tsunamis that could affect the continental and insular coasts of Ecuador.
- In 2009, it implemented the Insular Hydrographic and Oceanographic Service (SHOIAR), which functions as a mirror and Regional Tsunami Information Center – CRIT.
- In 2016, the Northern Hydrographic and Oceanographic Service (SHONOR) was created in Esmeraldas (northern sector).

RECORDED TSUNAMIS IN ECUADOR

Event 1:

Mw= 8.4 on January 31, 1906

A destructive tsunami occurred 30 minutes after the earthquake, severely affecting the low and flat coasts from Río Verde to the north. It is estimated that between 1000 and 1500 people died.

Event 2:

Mw= 6.9 on October 2, 1933

The earthquake generated a tsunami that impacted the Santa Elena Peninsula with waves of 2.5 to 3 meters in height. A submarine cable broke south of Salinas, and the sea receded from the coast immediately after the earthquake.

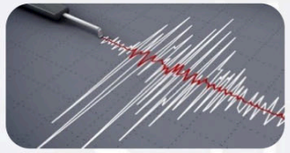
GENERAL PROCEDURES OF CNAT

Ocean Monitoring Center (C.M.O.)

Improve reception/sending times and information analysis in the monitoring of natural events of geological, oceanic, and atmospheric origin that affect Ecuadorian territory.

Technical protocol for tsunami alert evaluation and definition.
PROT-004-10-2022

Occurrence of a coastal or oceanic earthquake



Confirmation of earthquake parameters

Instituto Geofísico – Escuela Politécnica Nacional

National Weather Service – Pacific Tsunami Warning Center

USGS

Determination of tsunami threat

Armada del Ecuador – Instituto Oceanográfico

Secretaría de Gestión de Riesgos

Official dissemination of the alert to the population

Armada del Ecuador – Dirección Regional de los Espacios Acuáticos Insular

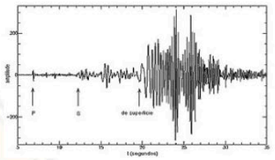
DIRNEA

SOURCES OF INFORMATION FROM CNAT

Local o Regional

Swift

Seiscomp3



CISN California Integrated Seismic Network

California's Partner to the Advanced National Seismic System ANSS

Lejano

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

National Weather Service

Pacific Tsunami Warning Center

USGS

UNESCO
United Nations
Educational, Scientific and
Cultural Organization
Intergovernmental
Oceanographic
Commission

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INSTITUTO OCEANOGRÁFICO Y ANTÁRTICO

TECHNICAL PROTOCOL FOR TSUNAMI ALERT EVALUATION AND DEFINITION
PROT-004-10-2022

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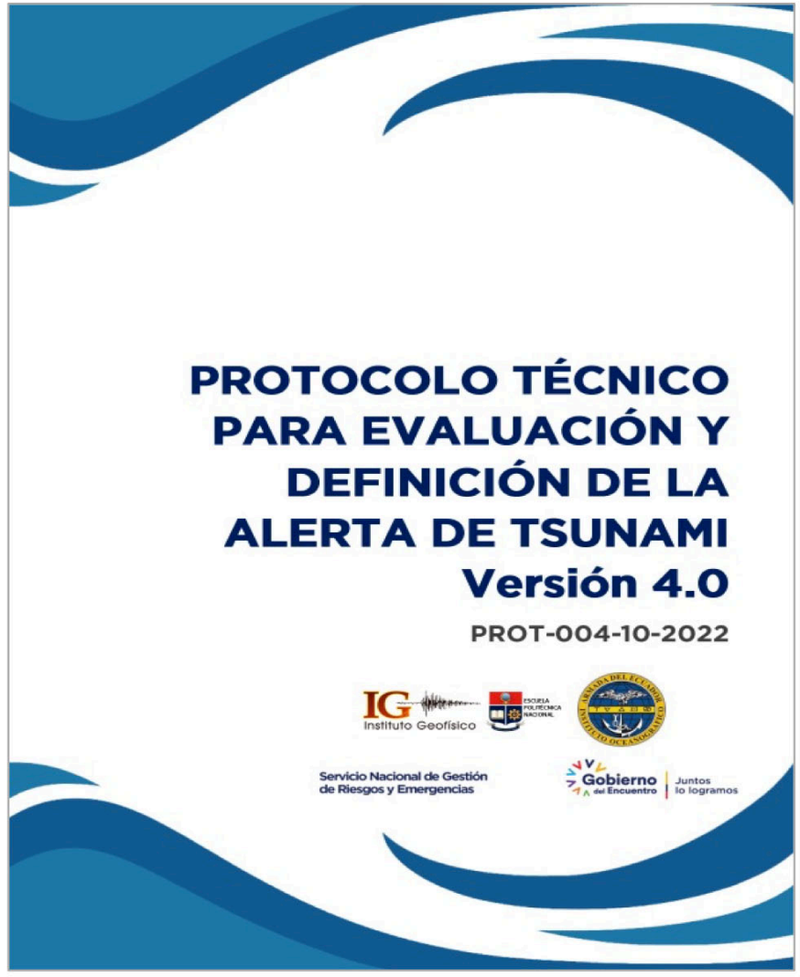
ARMADA DEL ECUADOR
INSTITUTO OCEANOGRÁFICO Y ANTÁRTICO

Secretaría de Gestión de Riesgos



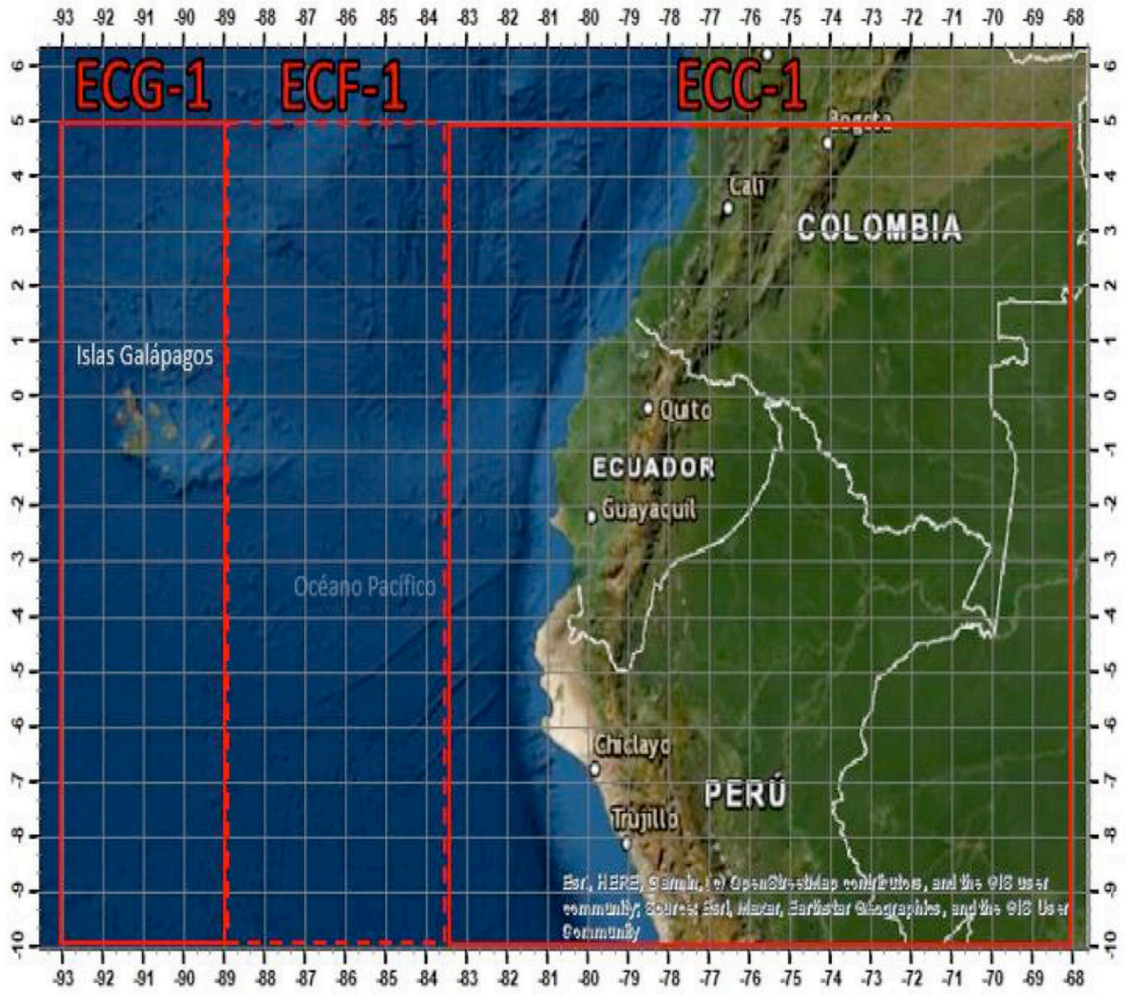
TECHNICAL PROTOCOL FOR TSUNAMI ALERT EVALUATION AND DEFINITION
PROT-004-10-2022

Instituto Geofísico

Domain 1 (ECC-1): Uses the SEISCOMP3 and SWIFT systems to locate and analyze earthquakes. If the preliminary magnitude exceeds 5.5, SWIFT recalculates key seismic parameters, such as magnitude and focal mechanism, within a specific area.

Domain 2 (ECG-1): Covers the Galápagos Islands, where SEISCOMP3 determines the location and average magnitude of earthquakes.

Domain 3 (CECF-1): Uses data from USGS and PTWC for events outside the first two domains, including the area between 83°W and 89°W, beyond the reach of the National Seismograph Network.



TECHNICAL PROTOCOL FOR TSUNAMI ALERT EVALUATION AND DEFINITION
PROT-004-10-2022

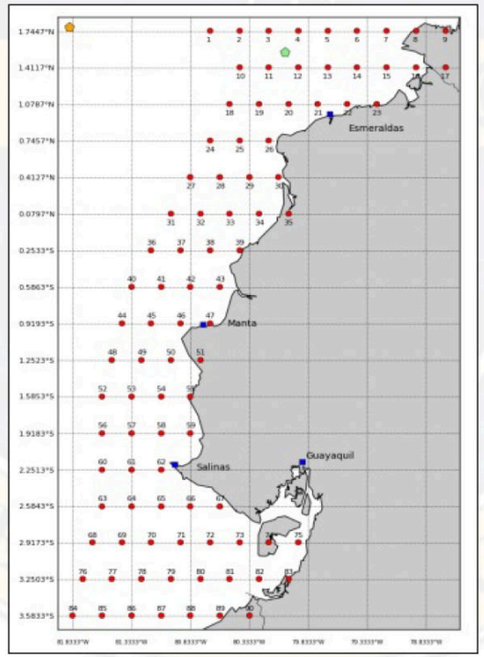
BOLETÍN	CRITERIO
ALERTA	Existe un peligro inminente de que se genere un tsunami.
ADVERTENCIA	Existe una alta probabilidad de que se genere un tsunami.
OBSERVACIÓN	Existe una probabilidad de que se genere un tsunami de origen lejano/ El evento requiere resultados de simulación para su evaluación.
INFORMACIÓN	Las características del sismo no reúnen las condiciones necesarias para generar un tsunami en las costas del Ecuador.
CANCELACIÓN	En base al monitoreo de las estaciones de nivel del mar, la amenaza de tsunami ha cesado en una zona determinada. La cancelación podrá ser parcial o total.

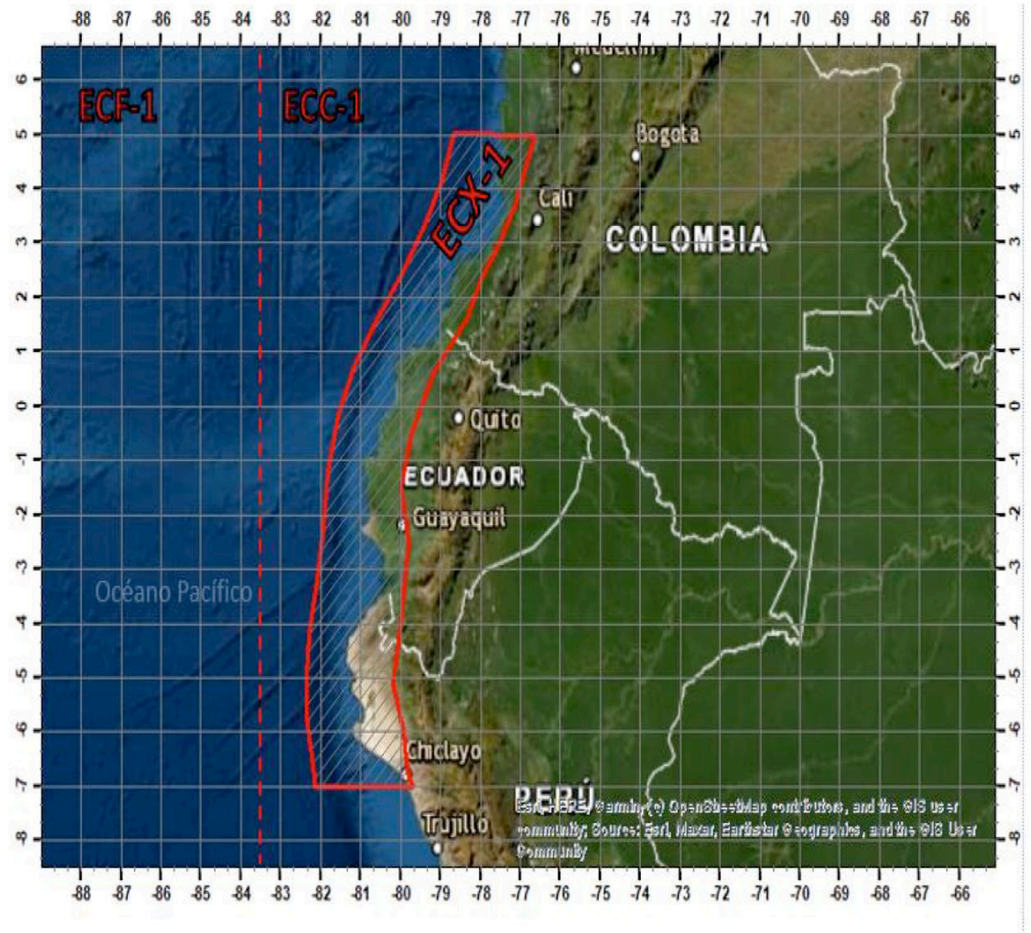
Tabla 1: Tipos de boletines o mensajes emitidos por INOCAR durante una emergencia por tsunamis.

TECHNICAL PROTOCOL FOR TSUNAMI ALERT EVALUATION AND DEFINITION
PROT-004-10-2022

DOMAIN 1 – ECC1

The tsunami alert protocol is based on technical and scientific criteria, using information from numerical simulations of 8,370 scenarios for local events. The goal is to reduce response time in issuing a tsunami alert bulletin.



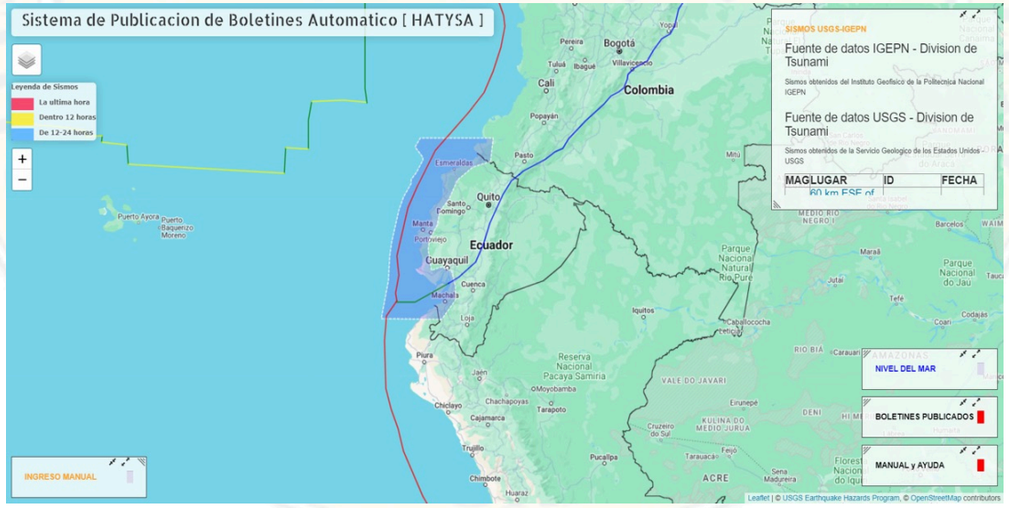


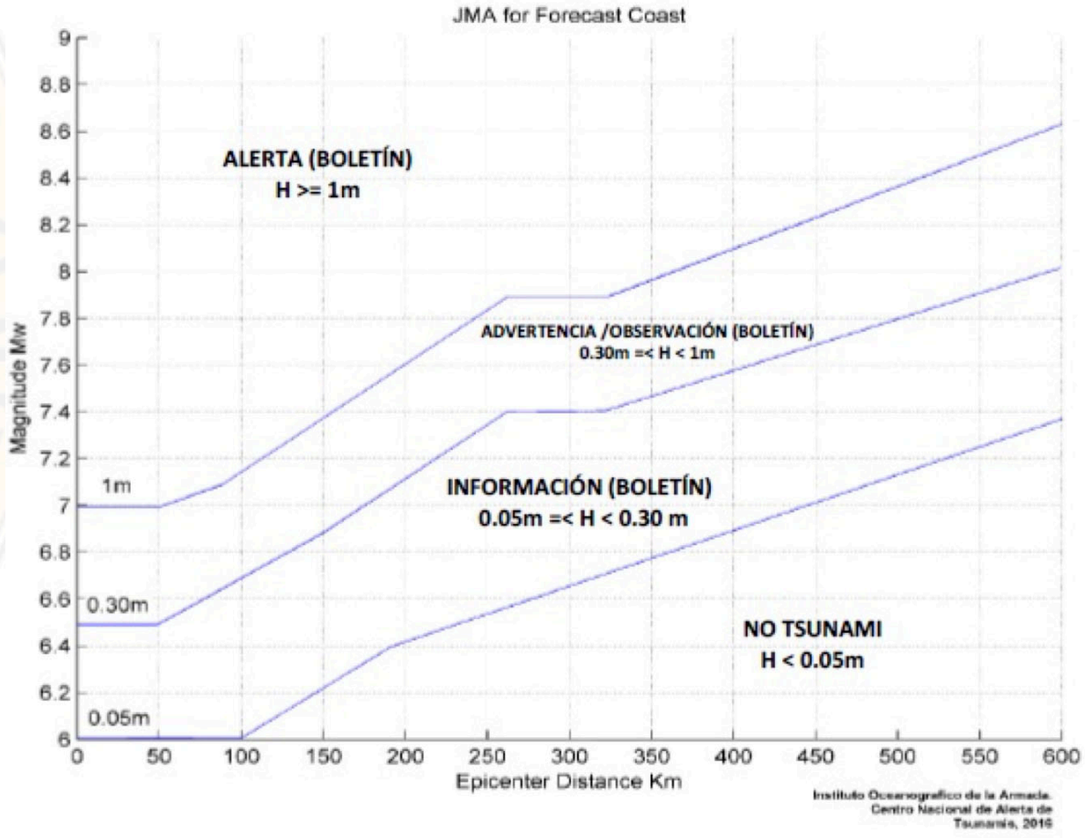
TECHNICAL PROTOCOL FOR TSUNAMI ALERT EVALUATION AND DEFINITION
PROT-004-10-2022

DOMAIN 1 – ECC1

The protocol for local tsunamis in Domain ECC-1 uses a JMA diagram, based on 8,370 precomputed scenarios by the Ocean Monitoring Center.

HATYSA

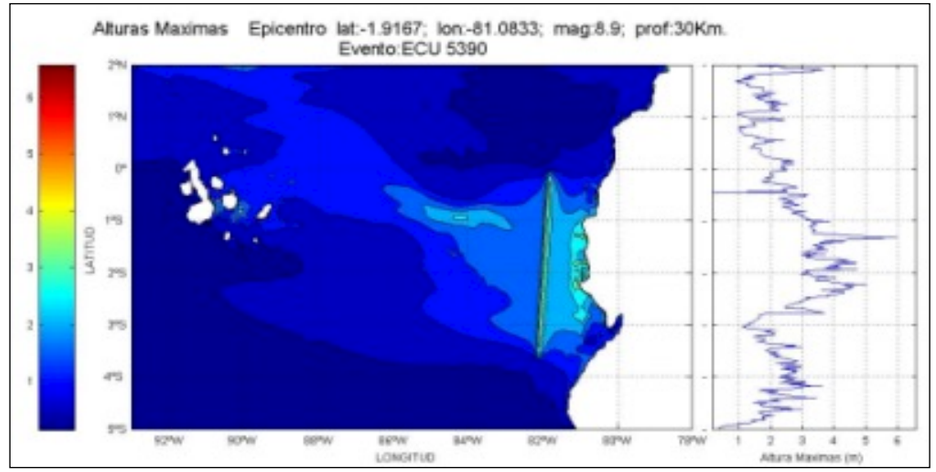


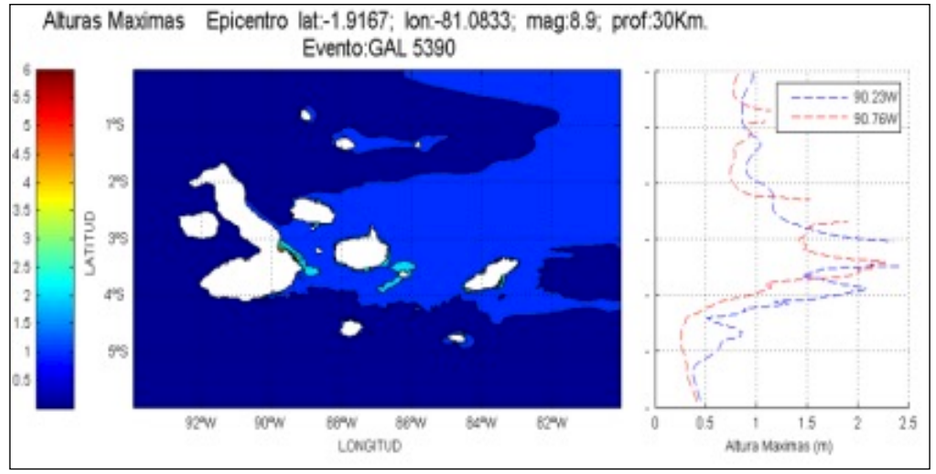


TECHNICAL PROTOCOL FOR TSUNAMI ALERT EVALUATION AND DEFINITION
PROT-004-10-2022

DOMAIN 1 – ECC1

An alert bulletin will be issued if an earthquake in Domain ECC-1 has a magnitude of 6.9 or higher. The alert message will contain the earthquake parameters, a list of 39 locations with the estimated arrival time of the first tsunami wave, the tsunami evaluation, and the estimated wave amplitudes for the northern, central, southern, and insular sectors, once these values are confirmed.





ARMADA DEL ECUADOR
INSTITUTO OCEANOGRÁFICO Y ANTÁRTICO
CENTRO NACIONAL DE ALERTA DE TSUNAMIS
GUAYAQUIL
-O-

19/5/2022 9:20:44 Hora Local

BOLETÍN DE TSUNAMI Nº 1

PARA: SERVICIO NACIONAL DE GESTIÓN DE RIESGOS Y EMERGENCIAS.

Este boletín se aplica a todas las áreas de los sectores de la costa continental e insular de nuestro país.

MENSAJE DE ALERTA DE TSUNAMI

Este es un mensaje de alerta de tsunami.

Un sismo ha ocurrido con los siguientes parámetros reportados por el Instituto Geofísico de la Escuela Politécnica Nacional:

Fecha hora local del evento	
19-05-202209:19:51	
Fecha UTC	19-05-2022
Hora UTC	14:19:51
Latitud	-2.24
Longitud	-81.65
Magnitud	8.2
Profundidad	50
Localización	Frente a las costas de Santa Elena
ID del evento:	2020051992043

* Fecha y hora UTC del evento: __ - __ -2022 __:__:__

EVALUACIÓN

Un gran terremoto ha ocurrido, existe un peligro inminente de que se genere un tsunami. La amenaza para las costas de Ecuador se mantiene en evaluación.

ESTADO DE MAREA

COSTA CONTINENTAL:

COSTA INSULAR:

El tiempo de arribo de la onda inicial de tsunami para diferentes puntos dentro de la región de amenaza está dado a continuación. Los tiempos de arribo pueden ser diferentes y la onda inicial puede no ser la de mayor amplitud.

Ubicación	Hora local continental(GMT-5)	Longitud	Latitud
ESMERALDAS	_____,_____2021 __:__:__	-79.6605	0.9952
LA LIBERTAD	_____, __ _____ 2021 __:__:__	-80.9181	-2.2118
BALTRA,	_____, __ _____ 2021 __:__:__	-90.2841	-0.4389
SANTA CRUZ	_____, __ _____ 2021 __:__:__	-90.2987	-0.7537

*Las estaciones localizadas en Galápagos deben considerar que la Hora Local Insular, corresponde a una hora menos de la Hora Local Continental detallada en la tabla.

ACCIONES RECOMENDADAS

Este mensaje es emitido como orientación a las agencias gubernamentales responsables de las alertas para seguridad pública.

Las personas que se encuentran en las costas amenazadas deben estar atentas a las instrucciones de las autoridades nacionales y locales.

La alerta de tsunami recomienda la evacuación de las zonas de evacuación por tsunamis principalmente en donde exista mayor riesgo de afectación.

INFORMACIÓN TRASCENDENTE

Un tsunami es una serie de ondas y el tiempo entre crestas de las ondas puede variar entre cinco minutos y una hora. El peligro puede persistir por muchas horas después del arribo de la primera onda.

La primera onda no siempre suele ser la más grande.

Un tsunami costero de amplitud de 1 metro por encima del nivel de la marea causa fuertes corrientes en un puerto, además de ser peligroso para los bañistas, embarcaciones y buques en las radas.

Los impactos de inundación pueden variar significativamente en la costa debido a la batimetría local, la forma y la elevación de la línea de costa.

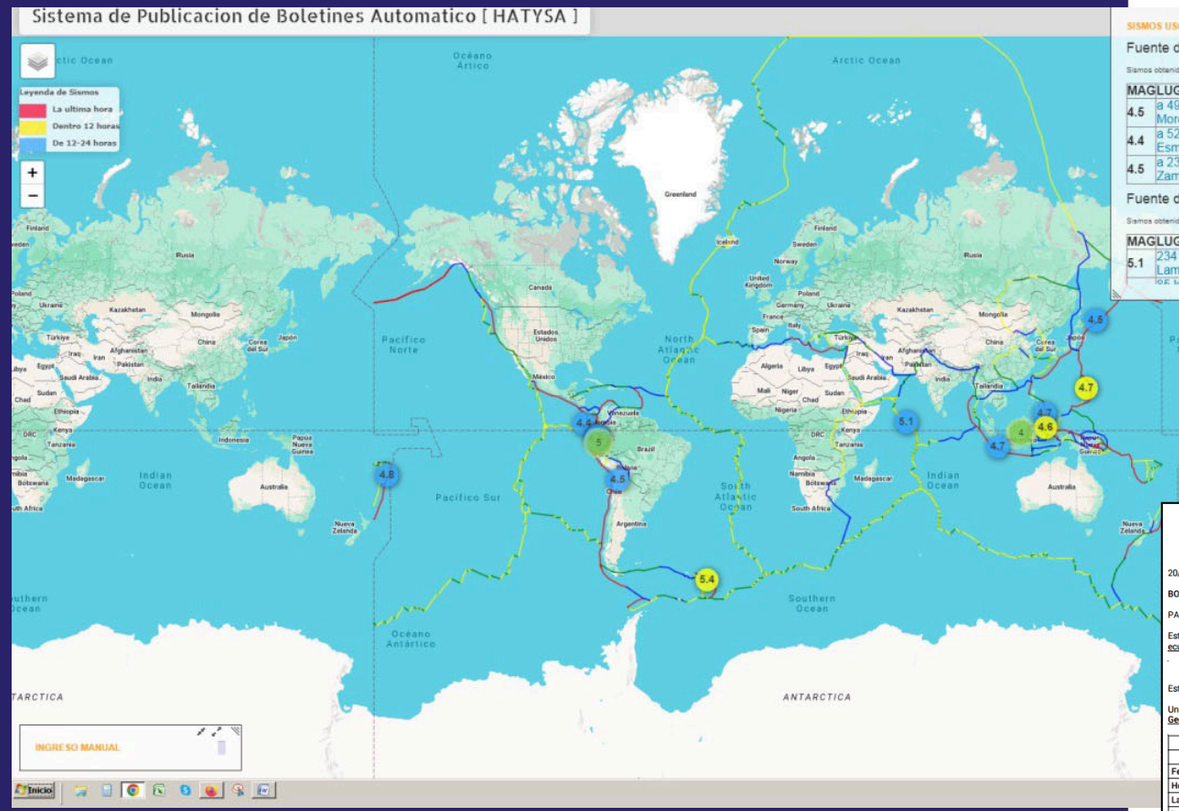
PRÓXIMA ACTUALIZACIÓN

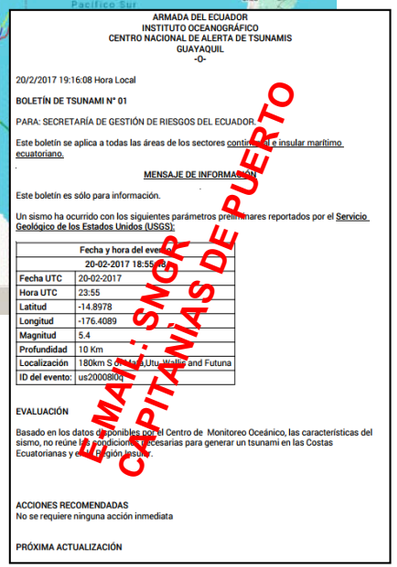
El siguiente mensaje del Centro Nacional de Alerta de Tsunami se emitirá a medida que se cuente con nueva información disponible.

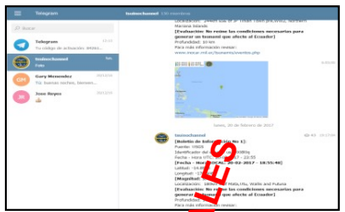
Información autorizada y confiable sobre este evento se puede encontrar en www.inocar.mil.ec/web/.

Centro Nacional de Alerta de Tsunami
Instituto Oceanográfico y Antártico de la Armada
Av.25 de Julio Vía Puerto Marítimo, Base Naval Sur
Guayaquil - Ecuador

Instituto Oceanográfico y Antártico de la Armada







TECHNICAL PROTOCOL FOR TSUNAMI ALERT EVALUATION AND DEFINITION
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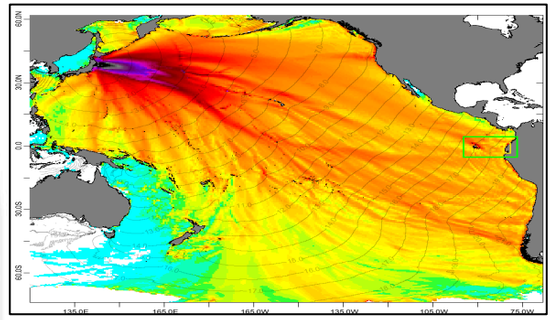
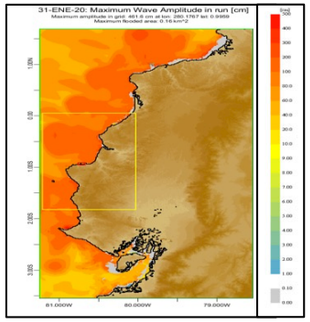
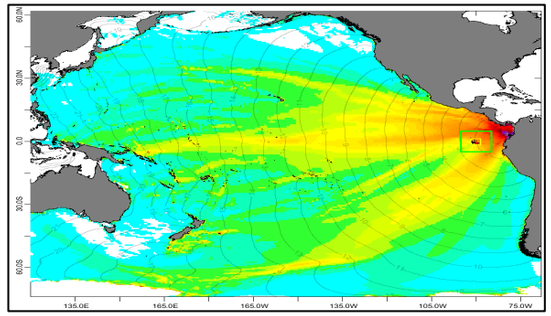
DOMAIN 2 Y 3 – ECG1 Y ECF1

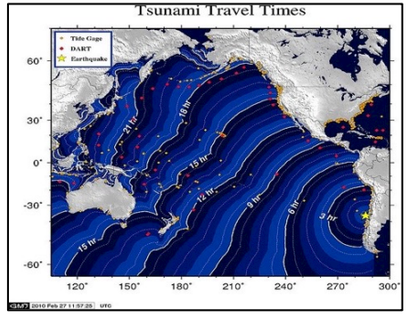
TIPO DE BOLETÍN	AMPLITUD DE ONDA COSTERA	NIVEL DE ALERTA	TIEMPO ESTIMADO DE ARRIBO (ETA) EN LA COSTA
BOLETÍN DE ALERTA	H ≥ 1m	ALERTA	ETA < 3 hrs
BOLETÍN DE ADVERTENCIA	0.3m ≤ H < 1m	ADVERTENCIA	ETA < 3 hrs
BOLETÍN DE OBSERVACIÓN	H ≥ 0.3m	OBSERVACIÓN	3hrs ≤ ETA < 6hrs
BOLETÍN INFORMATIVO	H ≥ 0.3m	INFORMATIVO	ETA ≥ 6hrs
BOLETÍN INFORMATIVO	H < 0.3m	INFORMATIVO	---
BOLETÍN INFORMATIVO	H ≥ 1m Muy alejado de las costas del Ecuador	INFORMATIVO	ETA > 3hrs

Tabla 4: Criterios para la activación del protocolo y tipo de boletines debido a un sismo con dominio 3 ECF-1 (Tsunamis regionales y lejanos)









TECHNICAL PROTOCOL FOR TSUNAMI ALERT EVALUATION AND DEFINITION
PROT-004-10-2022

PROCESS FOR THE EVALUATION AND DEFINITION OF THE ALERT FOR TSUNAMIS GENERATED BY VOLCANIC ERUPTION

- **ECVF-1:** Events generated by volcanic sources within the Pacific Basin, excluding the Galápagos Islands.
- **ECVG-1:** Submarine or coastal volcanic events in the Galápagos Islands.

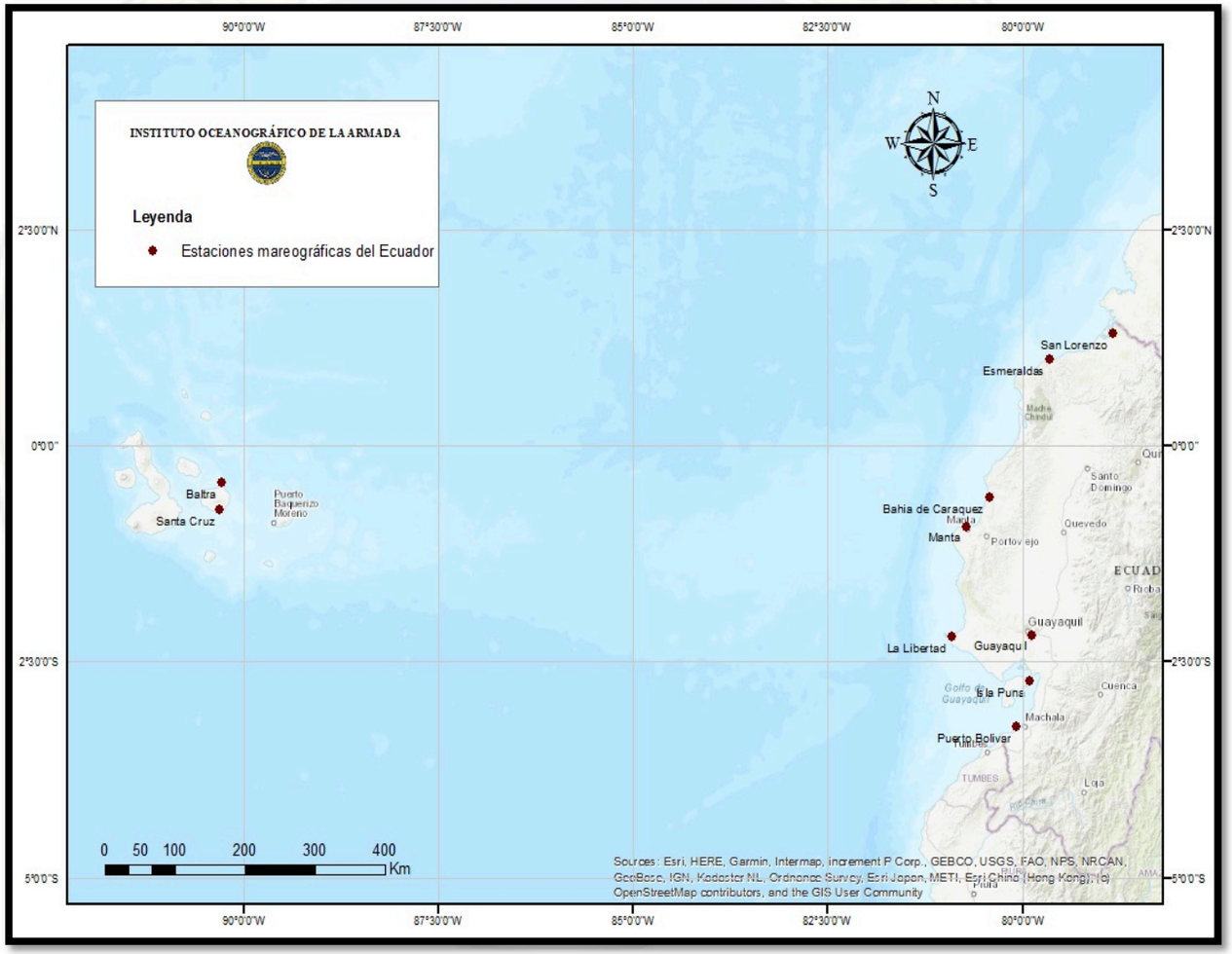
In Domain ECVF-1, a bulletin will be issued to the SNGRE and Naval Authorities for volcanic activity in the Pacific Basin (except Galápagos) that may generate a tsunami.

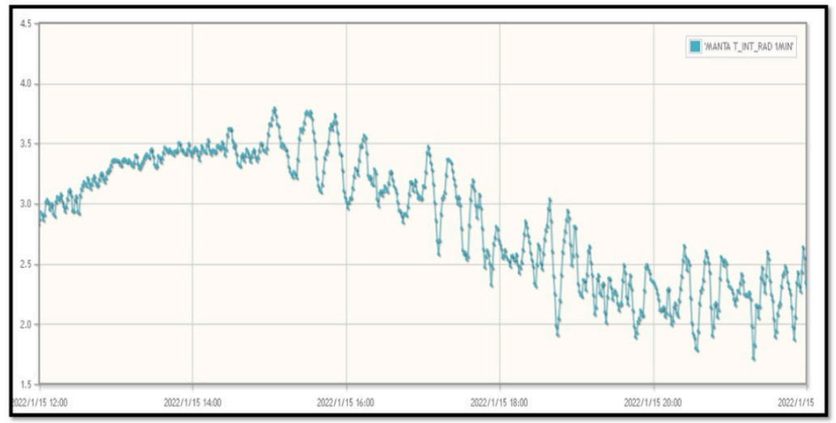
If waves exceeding 0.3 m are detected, threat bulletins and updates will be issued, and the alert will be canceled when the waves decrease below this amplitude.

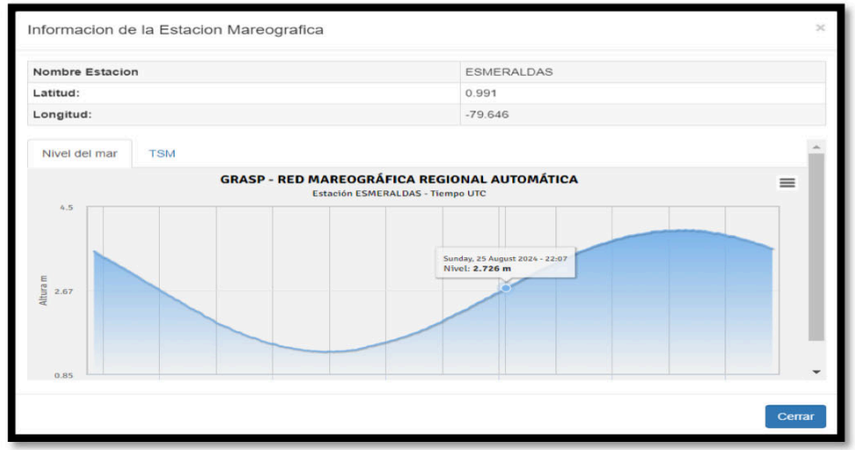
In Domain ECVG-1, for eruptions in the Galápagos, a threat bulletin will be issued, and buoys and coastal stations will be monitored.

MONITORING OF THE TSUNAMI THREAT

SEA LEVEL MONITORING

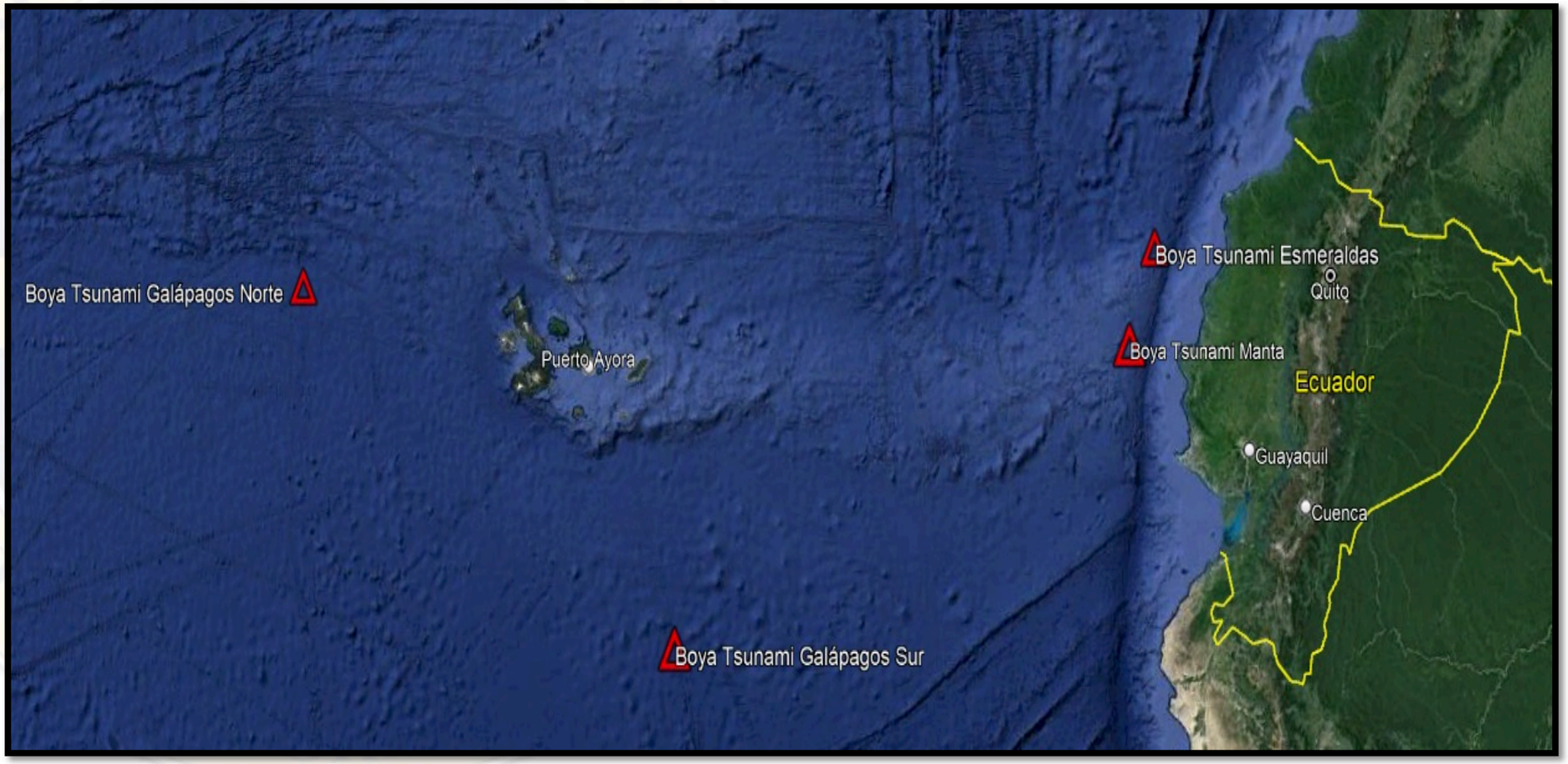






MONITORING OF THE TSUNAMI THREAT

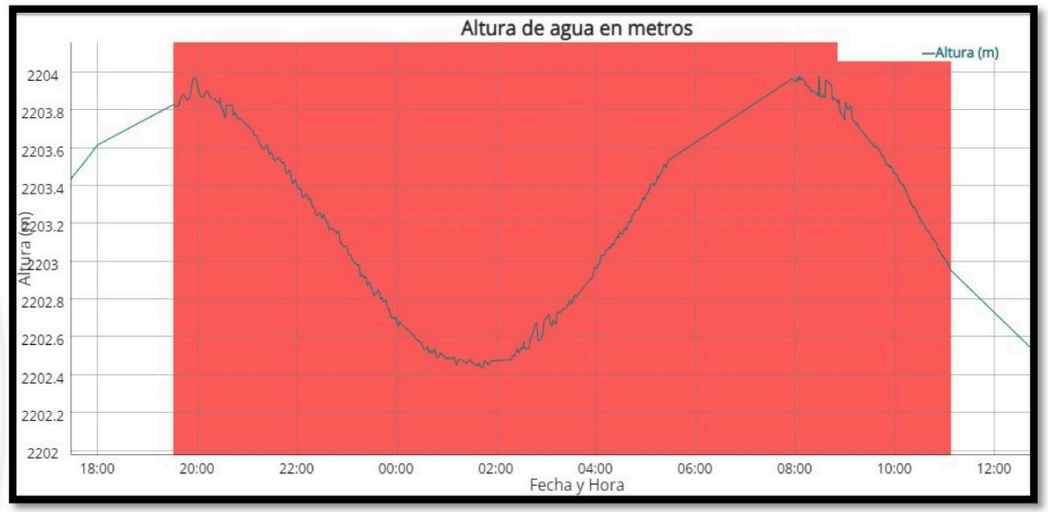
TSUNAMI BUOYS



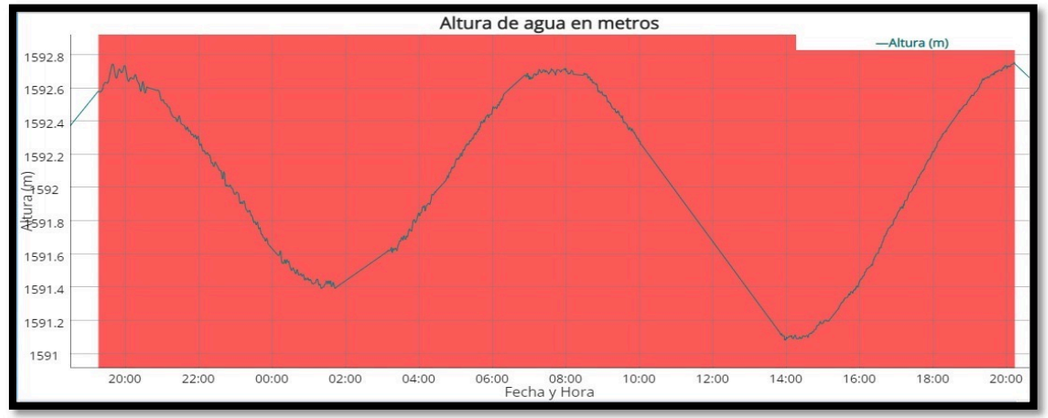
MONITORING OF THE TSUNAMI THREAT

TSUNAMI BUOYS

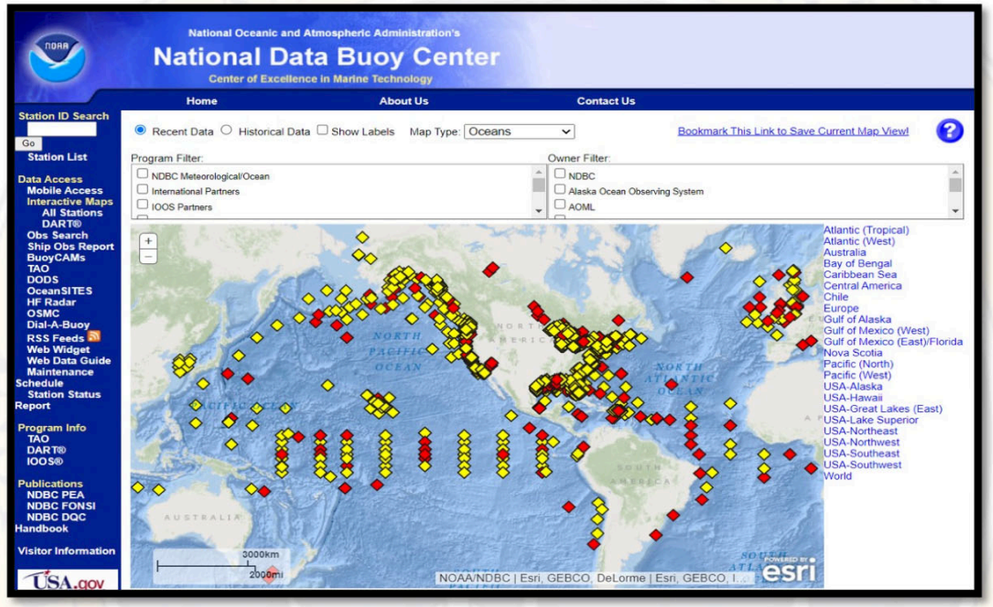
Boya EBM24-TS No. 32069 Esmeraldas

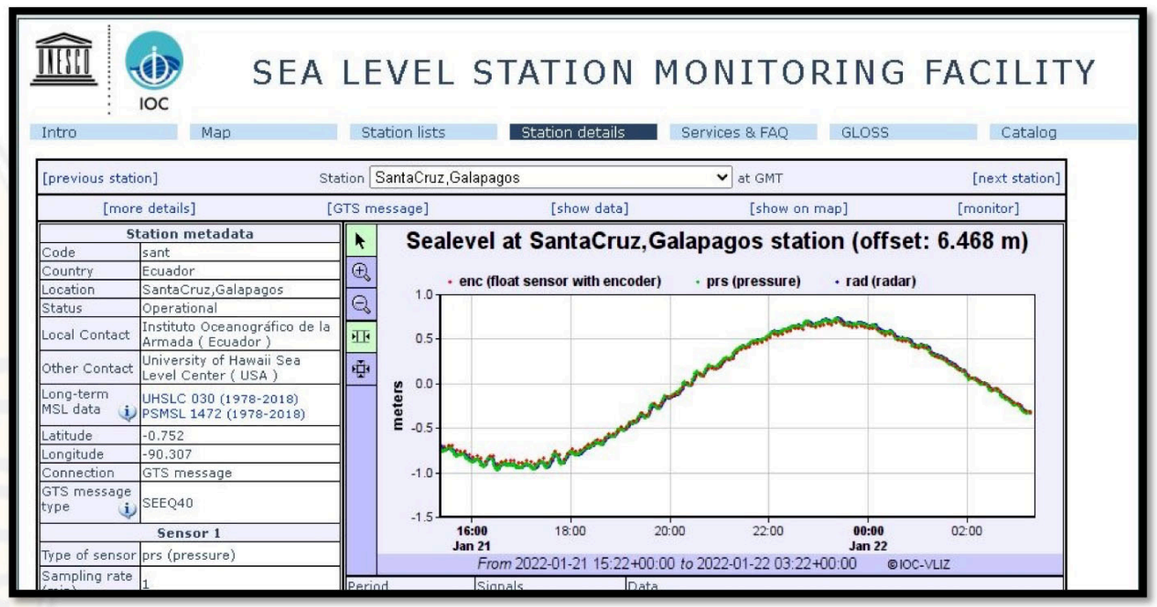


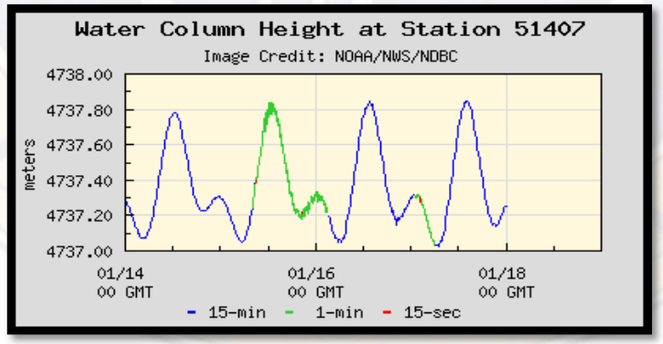
Boya EBM24-TS 32068 Manta

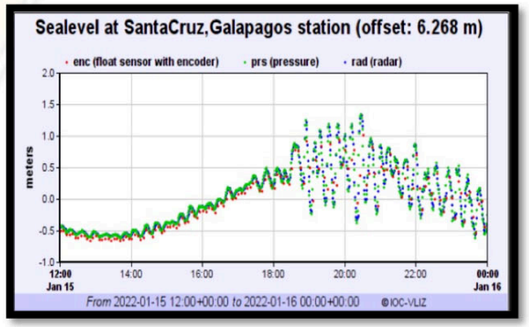


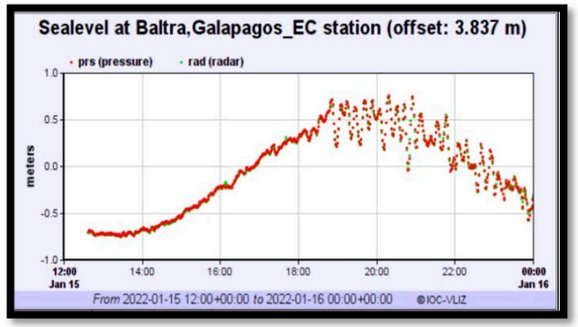
MONITORING OF THE TSUNAMI THREAT











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CENTRO DE MONITOREO OCEÁNICO

TSUNAMY READY PROGRAM
GALÁPAGOS

Instituto Oceanográfico y Antártico de la Armada

Instituto Oceanográfico y Antártico de la Armada

EL NUEVO ECUADOR

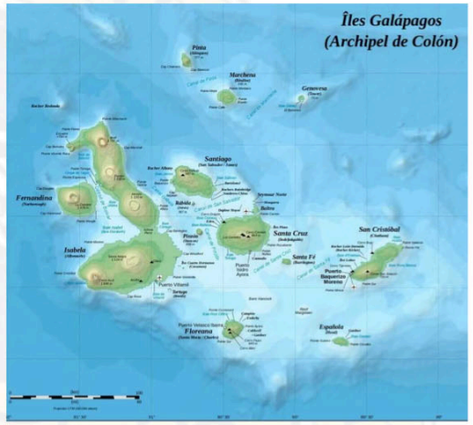
Chile 2010

Japón 2011

TSUNAMI READY PROGRAM

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

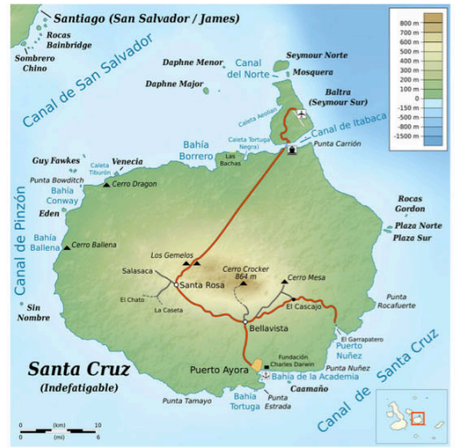


Tsunami Ready

- Propuesta del programa Tsunami Ready para Ecuador . GT/ATPS – COI-UNESCO 2016 - 2017.

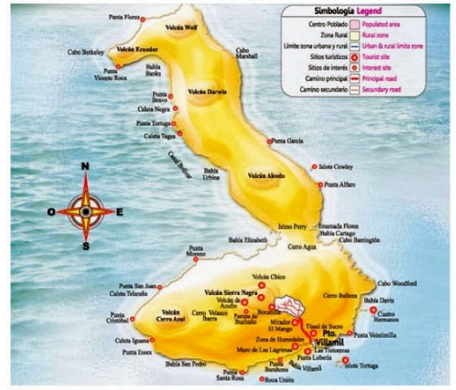
Provincia de Galápagos (región insular)- Ecuador

Puerto Ayora Santa Cruz

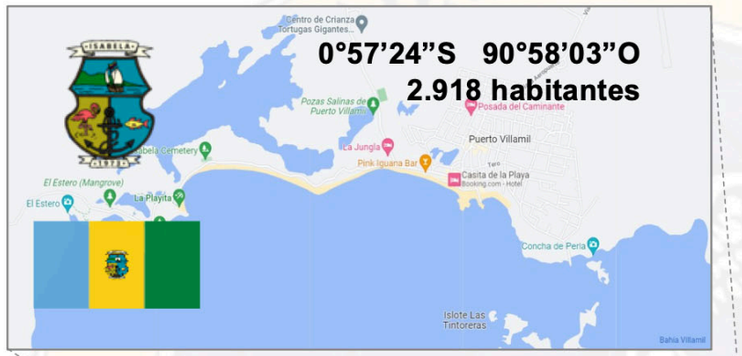


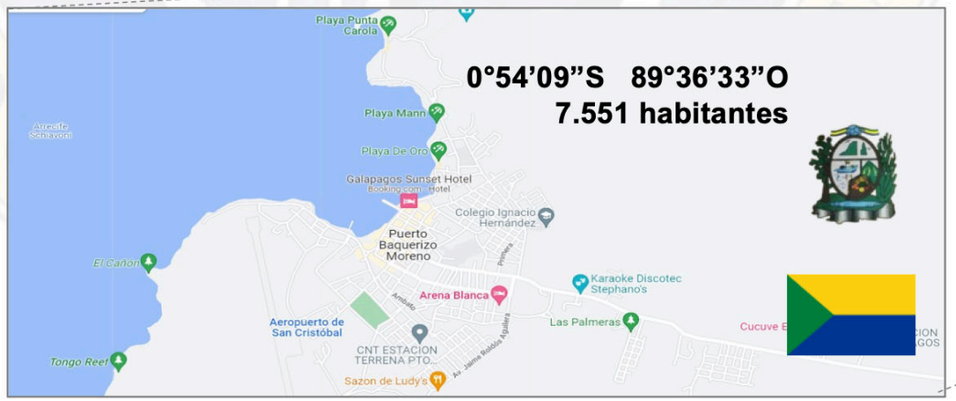
Puerto Baquerizo Moreno San Cristóbal

Puerto Villamil Isabela



TSUNAMI READY PROGRAM





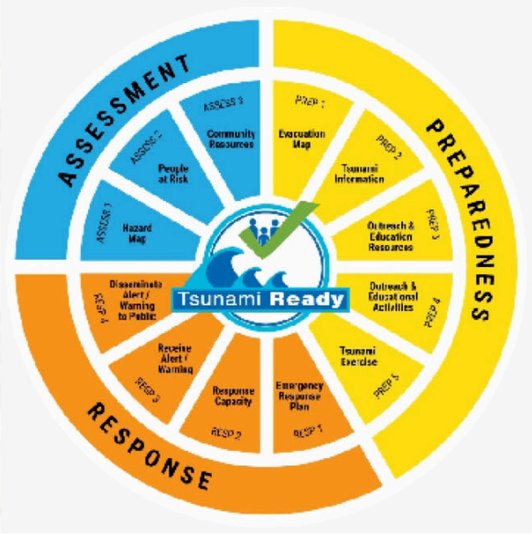
2024

2.918 habitantes – Isabela
20.302 habitantes – Santa Cruz
7.551 habitantes – San Cristóbal
30.771 habitantes


SERVICIO HIDROGRAFICO Y
OCEANOGRAFICO INSULAR DE
LA ARMADA

PUERTO AYORA – ISLA SANTA CRUZ

83 %



Repository Organization	*Website Display*		File Name*
	Documents	Format/Size	
	Tsunami Ready Recognition		

(Folder: TR_Recognition)	• Application (delete sensitive/private info??)
	• Recognition and Appreciation Certificates
	• Tsunami Ready Sign
	• Media – News
	  ○ Media 1
	  ○ Media 2
		• PDF (date signed, DaMonYYYY)
		• PDF
		• JPEG/PNG/PDF
		• PDF/Link (list each – name of org, date)
			• CC_application_signed-by-VT
			• CC_TR_certificate
			• CC_TR_sign
			• CC_TR_media-news

	Tsunami Ready Indicators		
(Folder: ASSESS) **(Sub-Folder: A-1)** **(Sub-Folder: A-2)** **(Sub-Folder: A-3)**	**Assessment (ASSESS)** 1. Hazard Map 2. People at Risk 3. Community Resources	 • JPEG/PNG/PDF • PDF (date) • PDF (1 file - date)	 • CC_hazard_map • CC_people_at_risk • CC_community_resources

(Folder: PREP)
(Sub-Folder: P-1)
(Sub-Folder: P-2)
(Sub-Folder: P-3)
(Sub-Folder: P-4)
(Sub-Folder: P-5)
	Preparedness (PREP)
	1. Evacuation Map
	2. Tsunami Information
	3. Outreach & Education Resources
	  ○ Name of Resource 1
	  ○ Name of Resource 2
	4. Outreach & Educational Activities
	  ○ Name of Activity 1
	  ○ Name of Activity 2
	5. Tsunami Exercise
		
		• JPEG/PNG/PDF (date)
		• JPEG/PNG/PDF (1 file – zip)
		• JPEG/PNG/PDF/Link (list each or 1 zip file)
		• JPEG/PNG (list each or 1 zip file)
		• JPEG/PNG/MP4 (date)
			
			• CC_evacuation_map
			• CC_tsunami_information
			• CC_OE_resources
			• CC_OE_activities
			• CC_tsunami_excercise

(Folder: RESP) **(Sub-Folder: R-1)** **(Sub-Folder: R-2)** **(Sub-Folder: R-3)** **(Sub-Folder: R-4)**	**Response (RESP)** 1. Emergency Response Plan 2. Response Capacity 3. Receive Alert / Warning 4. Disseminate Alert / Warning to Public	 • PDF (name, date) • PDF • JPEG/PNG/PDF • JPEG/PNG/PDF	 • CC_response_plan • CC_response_capacity • CC_receive_alert • CC_disseminate_alert
	Evaluation		
(Folder: Evaluation)	• Verification Visit	• JPEG/PNG (date) Verification Team (VT) Visit (photos of meetings)	• CC_verification_visit

*Find the country code (CC) on https://www.unece.org/cefact/locode/service/location.html
If the recognition is at community level, add the region/town/villa initials at the end of the file names. For example: GD_plan_SP (for St. Patrick, Grenada); GD_plan_C-PM (for Carriacou and Petite Martinique, Grenada); GD_evacuation_map_SP; GD_evacuation_map_C; GD_evacuation_map_PM).

PUERTO BAQUERIZO MORENO – ISLA SAN CRISTÓBAL

100 %

Repository Organization	*Website Display*		File Name*
	Documents	Format/Size	
	Tsunami Ready Recognition		

(Folder: TR_Recognition)	• Application (delete sensitive/private info??)
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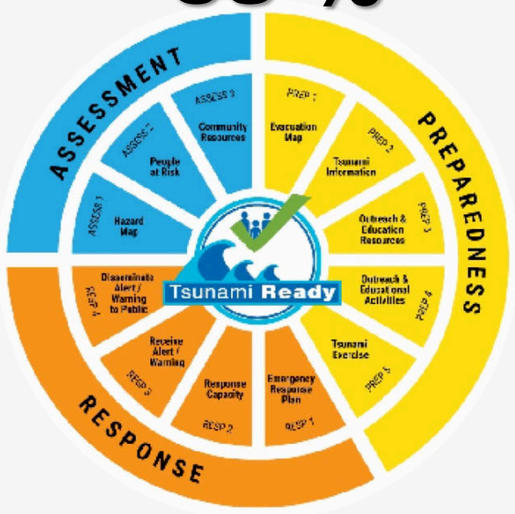
PUERTO VILLAMIL – ISLA ISABELA

58 %



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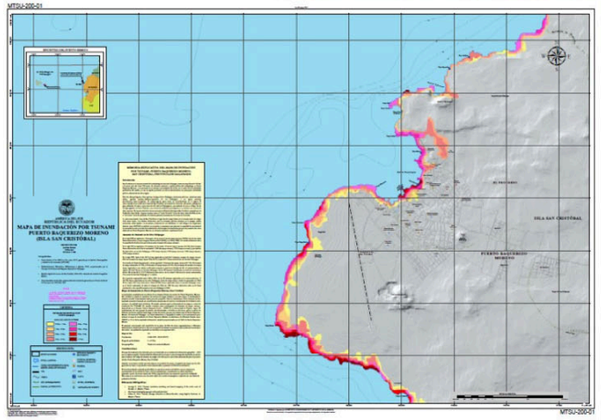


San Cristóbal
ALCALDÍA

PLAN DE CONTINGENCIA POR EVENTO PELIGROSO TSUNAMI

CANTÓN SAN CRISTÓBAL DE LA PROVINCIA DE GALÁPAGOS

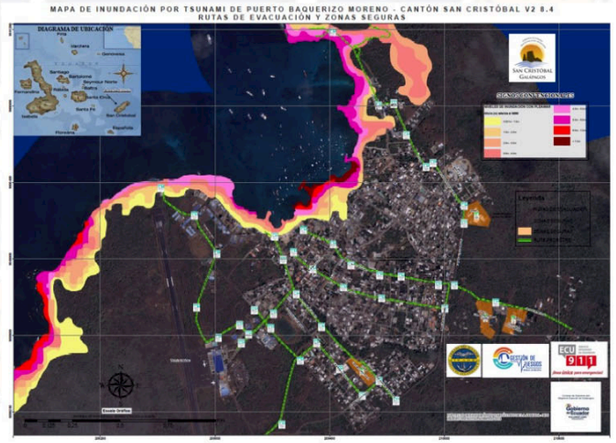
AÑO:
2024 – 2027

www.gadmsc.gob.ec

INFORME DE LA UBICACIÓN DE LAS SEÑALÉTICAS EN PUERTO BAQUERIZO MORENO CANTÓN SAN CRISTÓBAL - PROVINCIA DE GALÁPAGOS

ZONA DE PELIGRO DE INUNDACIÓN – INUNDATION HAZARD ZONE

ID	DIRECCIÓN O LUGAR DE REFERENCIA	NORTE	ESTE
1	Malecón	9900159	209241
2	Muelle Ecoturístico Tiburón Martillo	9900322	209343
3	Muelle Ecoturístico	9900386	209424
4	Playa de Oro	9900417	209537
5	Muelle de Pescadores	9900510	209564



United Nations
Educational, Scientific and
Cultural Organization

Intergovernmental
Oceanographic
Commission

Tsunami Ready

2024

Gracias

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