3.8. CATAC Report
Central American Tsunami Advisory Center (CATAC)

at the Instituto Nicaragüense de Estudios Territoriales
(Geociences Institute, INETER)

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Central American Tsunami Advisory Center (CATAC)
at Geociences Institute (INETER), Nicaragua

Dec 2024 - Government imposed a new Governance of CATAC

CATAC is now a General Directorate at INETER on the level of the Director of INETER

(Before: CATAC section (Wilfried) + Seismology Section within General Directorate of Geology)

Assignment of funding and integration in the planning mechanisms of INETER

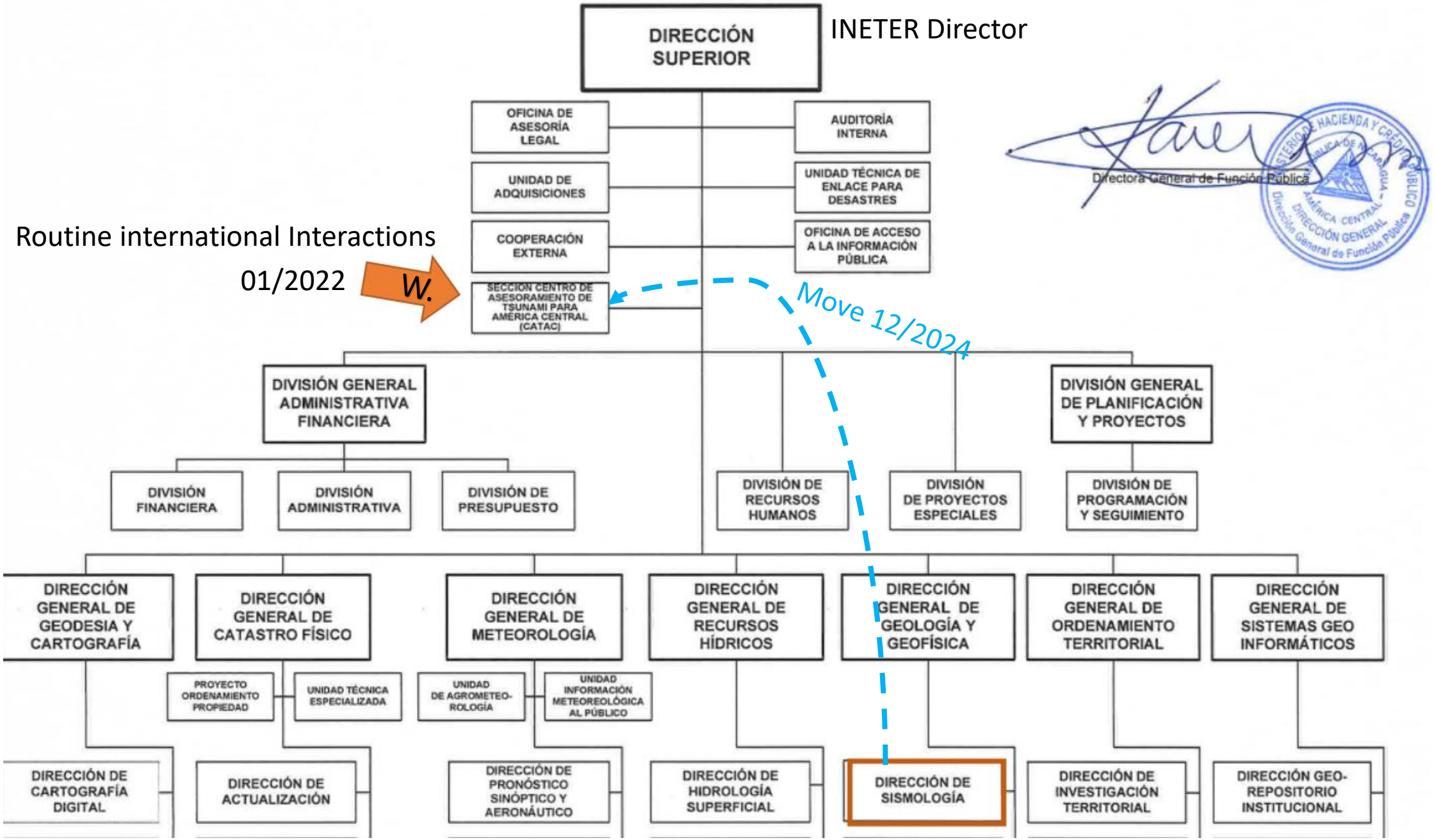
Tasks:

TSP for Central America & Earthquake /Tsunami/Volcano(seismic) Monitoring&Warning for Nicaragua

Personnel: 24

Divisions (directorates):

- Warning Center
- Earthquake/Tsunami Sciences
- Seismometry and Network Maintenance
- Earthquake and Tsunami Engineering Aspects of Early Warning



Permission to interact with foreign NTWC, civil protection, government ??

The Central America Tsunami Advisory Center (CATAC) - a Tsunami Service Provider

created 2016, pilot operation from 2019, interim operation from Dec 2021, routine operation (hopefully) starting 2025

Services: Tsunami advisory, earthquake early warning, seismic and tsunami hazard and risk research. Tsunami hazard and risk research, seismic monitoring of volcanoes (Nicaragua only).

-23 staff. multidisciplinary: seismologists, geophysicists, geologists, electronics, IT

-24x7 service, always 2 capacitated watchstanders + 1 personal for immedeate info to the government

-Streaming and Recording of 400 seismic stations in Central America (+ 300 global stations via IRIS)

-Real-time seismological processing (advanced SeisComP PRO)

-Tsunami assessment with SeisComP TOAST module, GPU based numerical tsunami simulation within seconds

-Public earthquake early warning (SeisComP) in Nicaragua, soon: EEW for TSP recipients in Central America

-EEW in seconds after EQ, Initial seismological and tsunami message in 2minutes

-Tsunami parameter message in less than 10 minutes, including graphical products

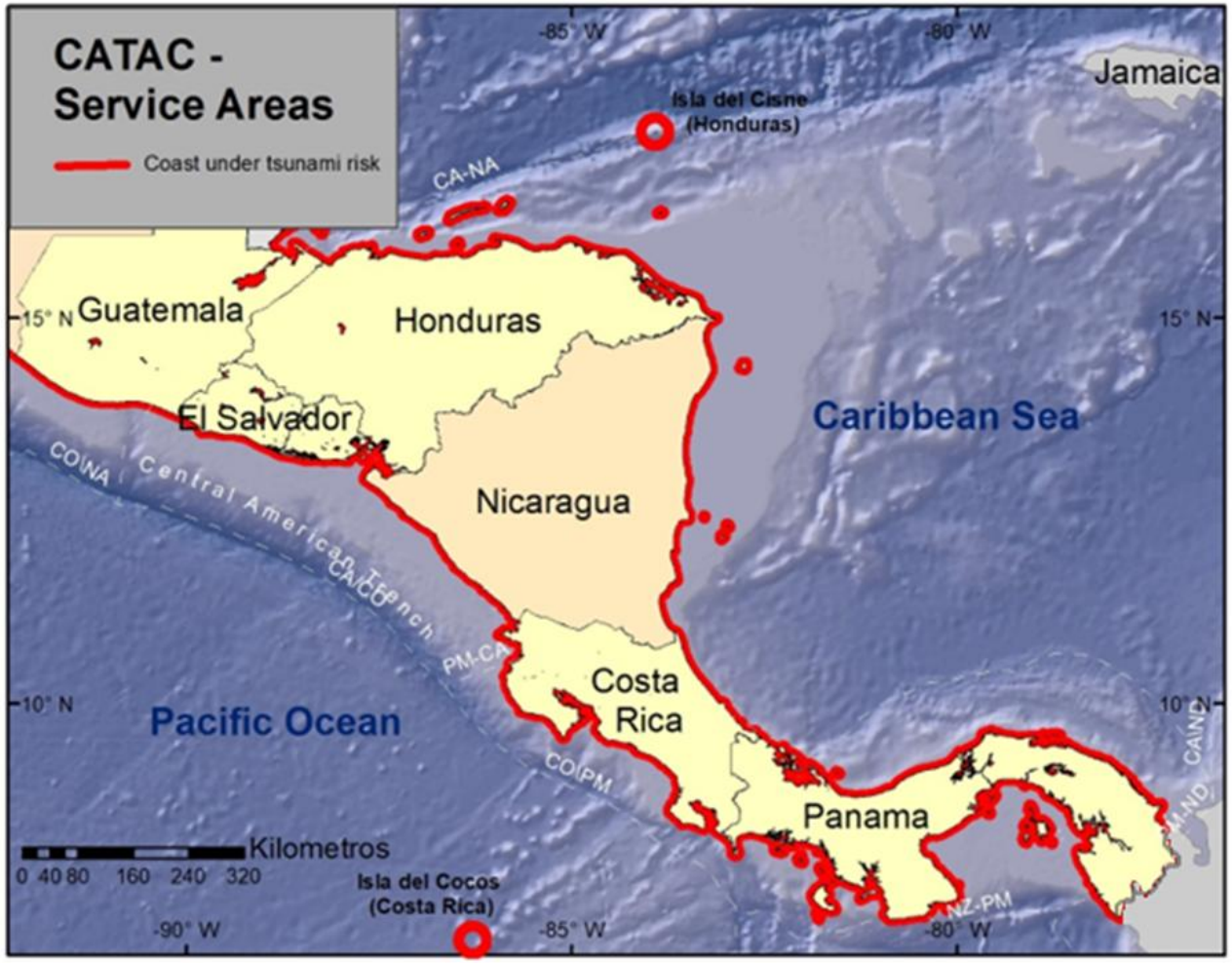
Target recipients:

-11 monitoring/scientific (seismological) institutions in Central America, NTWC

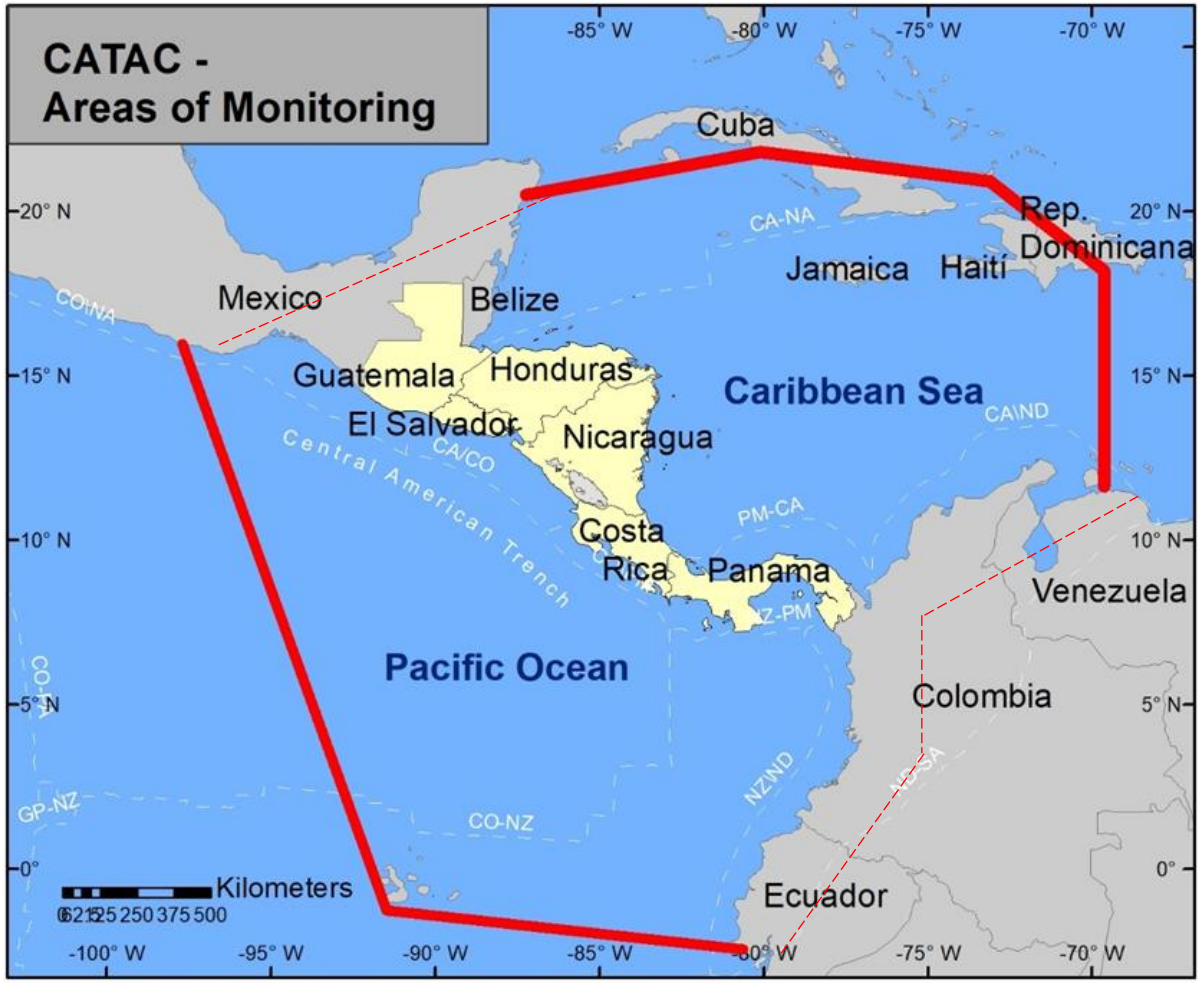
-9 civil protection agencies in Central America,

-regional/international : CEPREDENAC, UNESCO, PTWC, NWPTAC

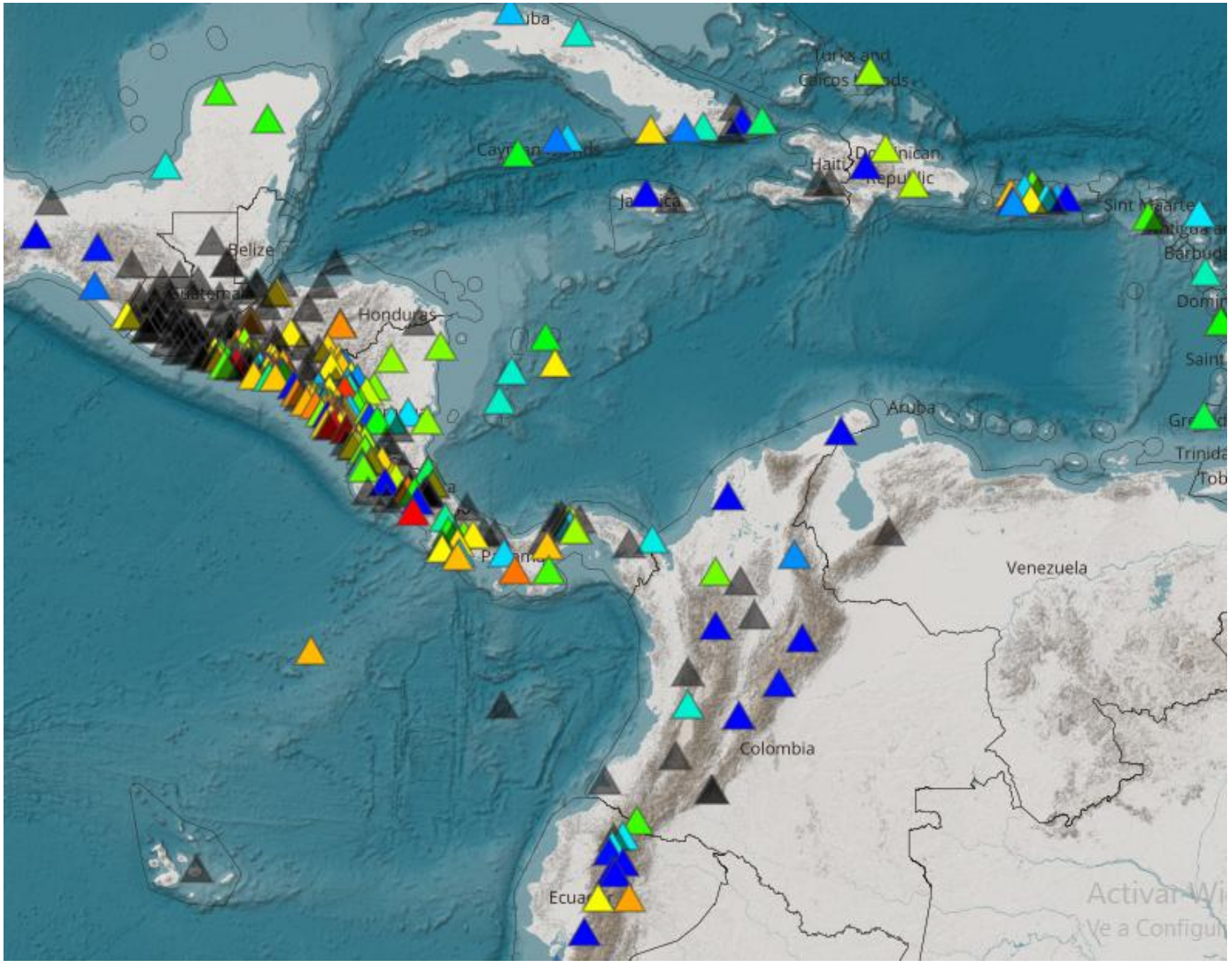
CATAC service areas and monitoring zones



Service áreas: both coasts of Central America



Monitoring zones:
about 1 hour or less tsunami travel time to CA



400+ seismic stations in and around Central America are used by CATAC, 2025

The data are streamed in real time with a sampling rate of 100 o 20 sps to CATAC.

Typically the delays of the data packages are only a few seconds in Central America.


CATAC, Processing and Alert Center

CATAC

Alert Center

Using SeisComP PRO with TOAST


24x7: 2 sismólogists, + 1


Situation room / Meetings/ Capacitations
Capacitation.


Concrete bunker servers and seismometers


Seismometry and Electronics Lab. / Maintenance


Battery backup
20kWh

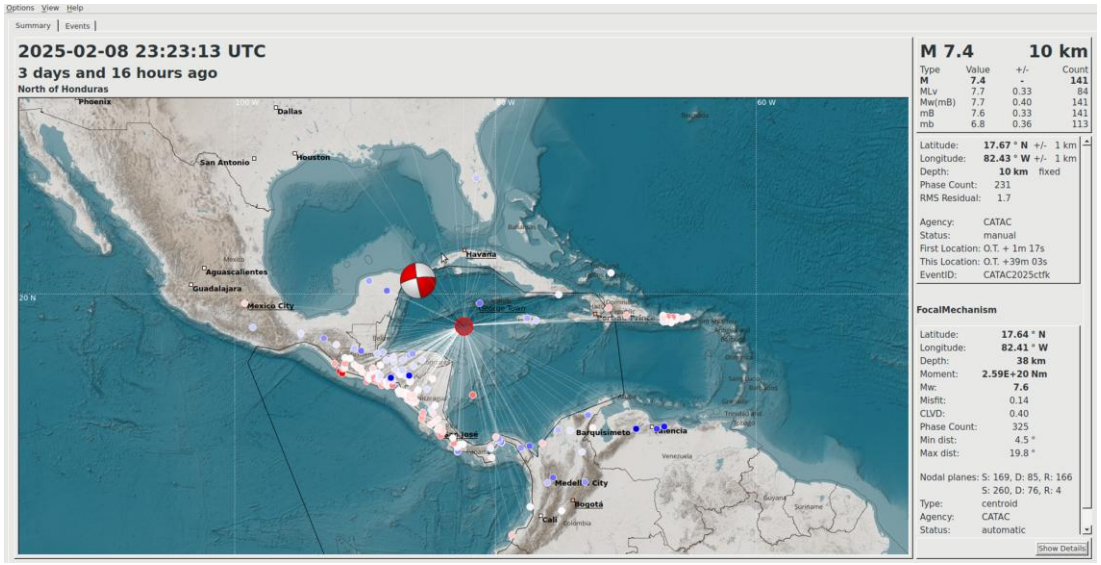

Seismic stations/GPS


Sea gauges

Events 2023 – 2024

- 7400 seismic events located
- 73 events above M 5.0 - Info statements reported to Central America

- Only 1 event with tsunami Hazard: M7.6 Earthquake and Tsunami 8 Feb 2025



M7.6 Earthquake and Tsunami 8 Feb 2025

- CATAC processing was very fast and accurate
  - Initial evaluation based on location, magnitude
  - Moment Tensor solutions
- First message with tsunami evaluation – sent out 2 minutes after EQ was obtained by the 5 affected Central America Countries
- Later email messages failed due to computer problem
- CA countries were attended by phone calls and whatsapp messages
- Technical problems of messaging were solved by a previously already established plan until the end of march 2025

CATAC´s initial automatic message

Instituto Nicaragüense de Estudios Territoriales (INETER)
Centro de Asesoramiento de Tsunamis para América Central
C A T A C

INFORMACION AUTOMATICA PRELIMINAR DE SISMO

Hora de emisión: Febrero 08,2025 **5:25:25**PM de América Central
Febrero 08,2025 6:25:25PM Hora local de Panamá

PARAMETROS DEL SISMO

Tiempo de Origen : Febrero 08,2025 **5:23:09**PM Hora local de América Central

: Febrero 08,2025 6:23:09PM Hora local de Panamá

Epicentro : 17.903 N 82.256 O NEIC 17.65N 82.40°W

Región : 180 Km al suroeste de George Town, Islas Caimán

Profundidad : 5 Km

Magnitud : 7.1 M7.6

EVALUACION:

Posibilidad de un tsunami local destructivo en las costas del Mar Caribe de América Central, confinado a distancias de hasta 100 km del epicentro, debido a su magnitud y profundidad, Se sugiere aplicar planes de respuesta, de acuerdo a sus protocolos de actuaciones.

Los parámetros se calculan usando datos recibidos en tiempo real, con el aporte de estaciones sísmicas de observatorios sismológicos de América Central (INSIVUHEH, MARN, COPECO, INETER, OVSICORI, ICG-UPA, ACP, RSN-UCR-ICE), y de la red sismológica global.

Esta es una información automática y puede contener errores.

Favor consultar nuestra página web: http://catac.ineter.gob.ni/gaps/eqview/

NEIC M7.6 17.65N 82.40°W

Options View Help

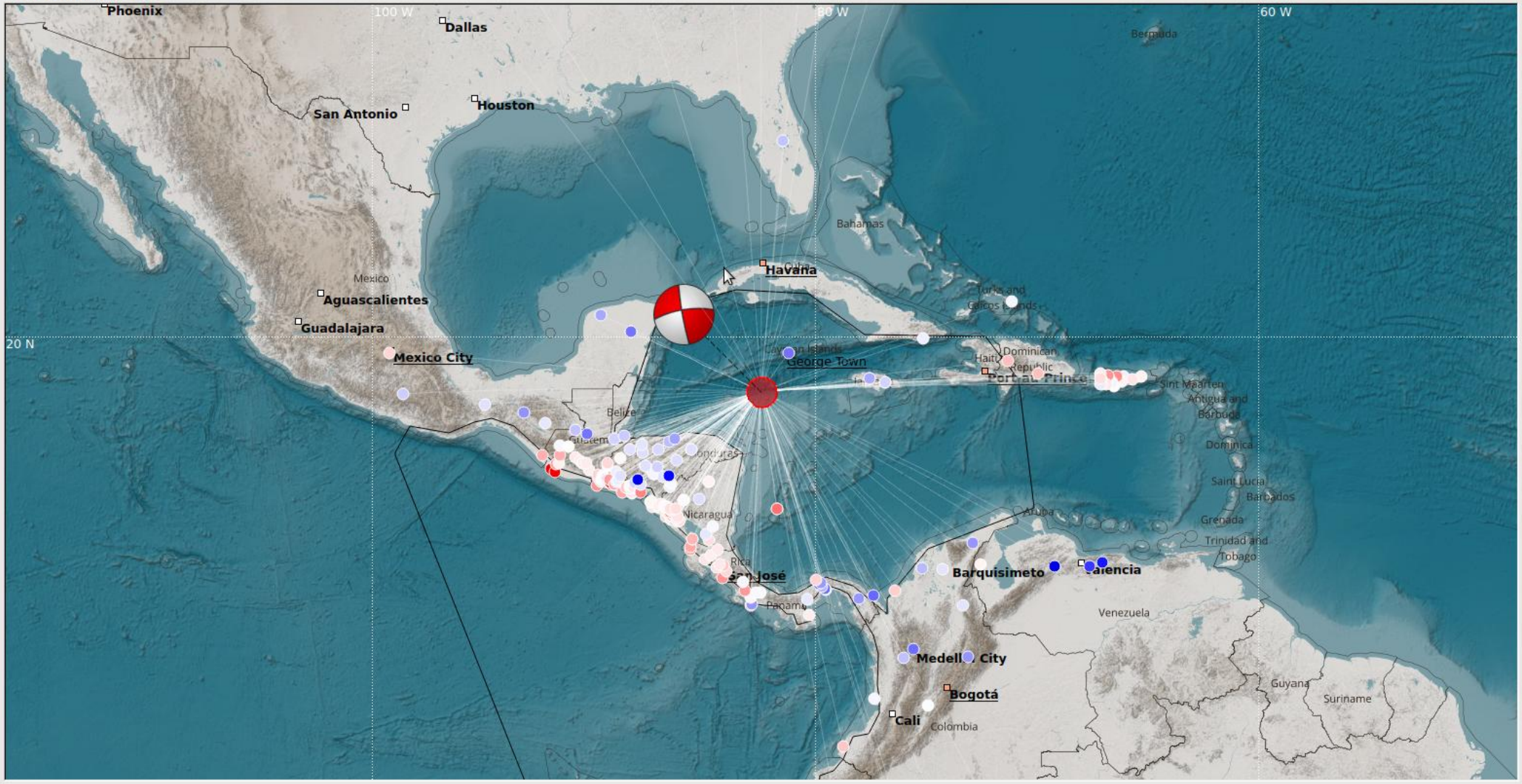
Summary | Events

Final solution

2025-02-08 23:23:13 UTC

3 days and 16 hours ago

North of Honduras



M 7.4 **10 km**

Type	Value	+/-	Count
M	**7.4**	**-**	**141**
MLv	7.7	0.33	84
Mw(mB)	7.7	0.40	141
mB	7.6	0.33	141
mb	6.8	0.36	113

Latitude:	**17.67 ° N**	+/-	1 km
Longitude:	**82.43 ° W**	+/-	1 km
Depth:	**10 km**	fixed	
Phase Count:	231		
RMS Residual:	1.7		
Agency:	CATAC		
Status:	manual		
First Location:	O.T. + 1m 17s		
This Location:	O.T. +39m 03s		
EventID:	CATAC2025ctfk		

FocalMechanism

Latitude:	**17.64 ° N**
Longitude:	**82.41 ° W**
Depth:	**38 km**
Moment:	**2.59E+20 Nm**
Mw:	**7.6**
Misfit:	0.14
CLVD:	0.40
Phase Count:	325
Min dist:	4.5 °
Max dist:	19.8 °
Nodal planes:	S: 169, D: 85, R: 166 S: 260, D: 76, R: 4
Type:	centroid
Agency:	CATAC
Status:	automatic

Show Details

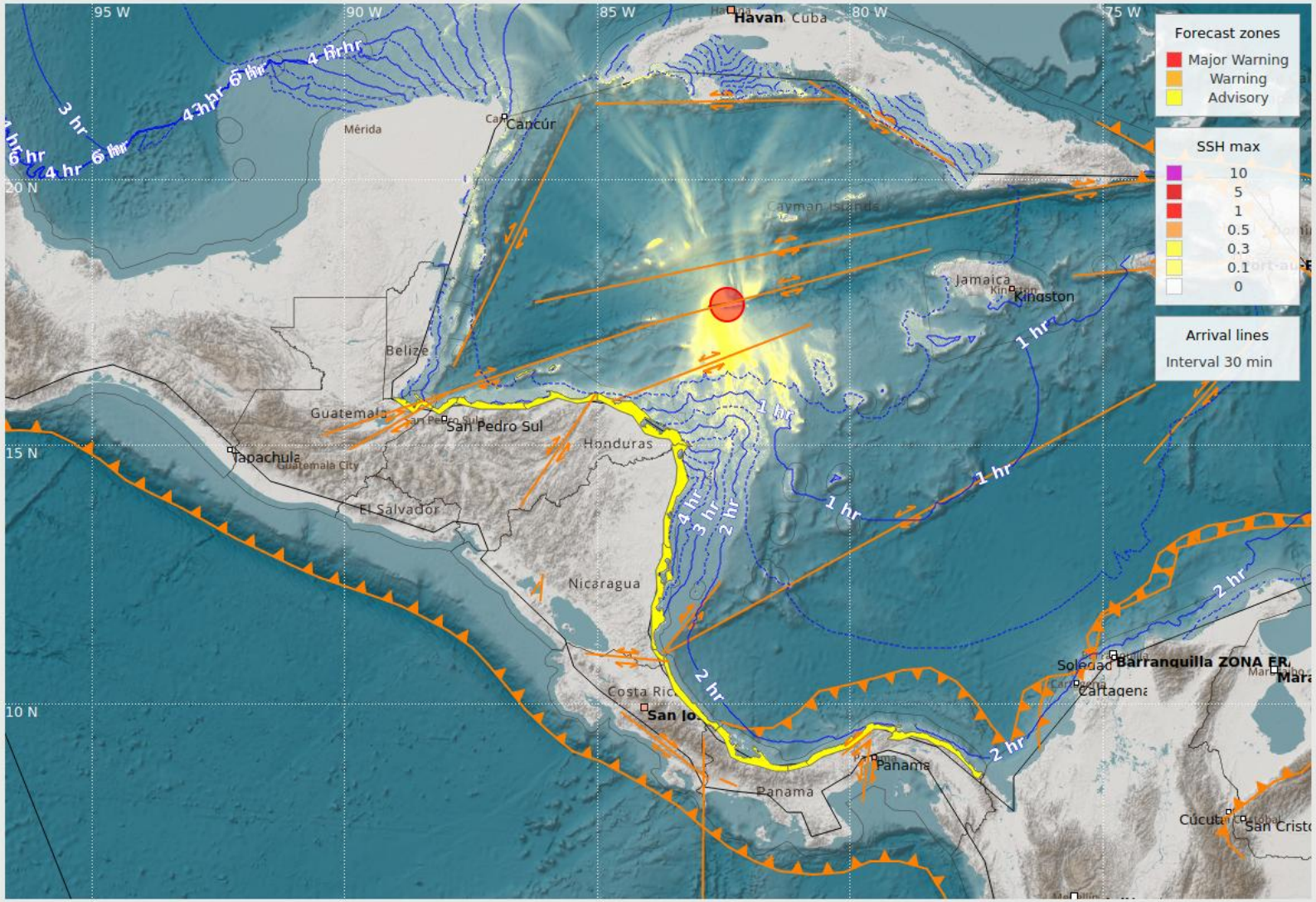
File Settings Simulation Traces View Extras Help

Final simulation

2025-02-08 23:23:13
3d and 15h ago
North of Honduras

FM M 7.4 D 10 km
CATAC2025ctfk

Map | Traces | Forecast Zones | primer mensaje | Video | tercer mensaje | catac mensaje 2 | mensaje ingles | Mensaje de prueba | segundo mensaje de texto | can



Map Layers

Color Profile: DefaultProfile

- Iso chrones
- SSH
- SSH max

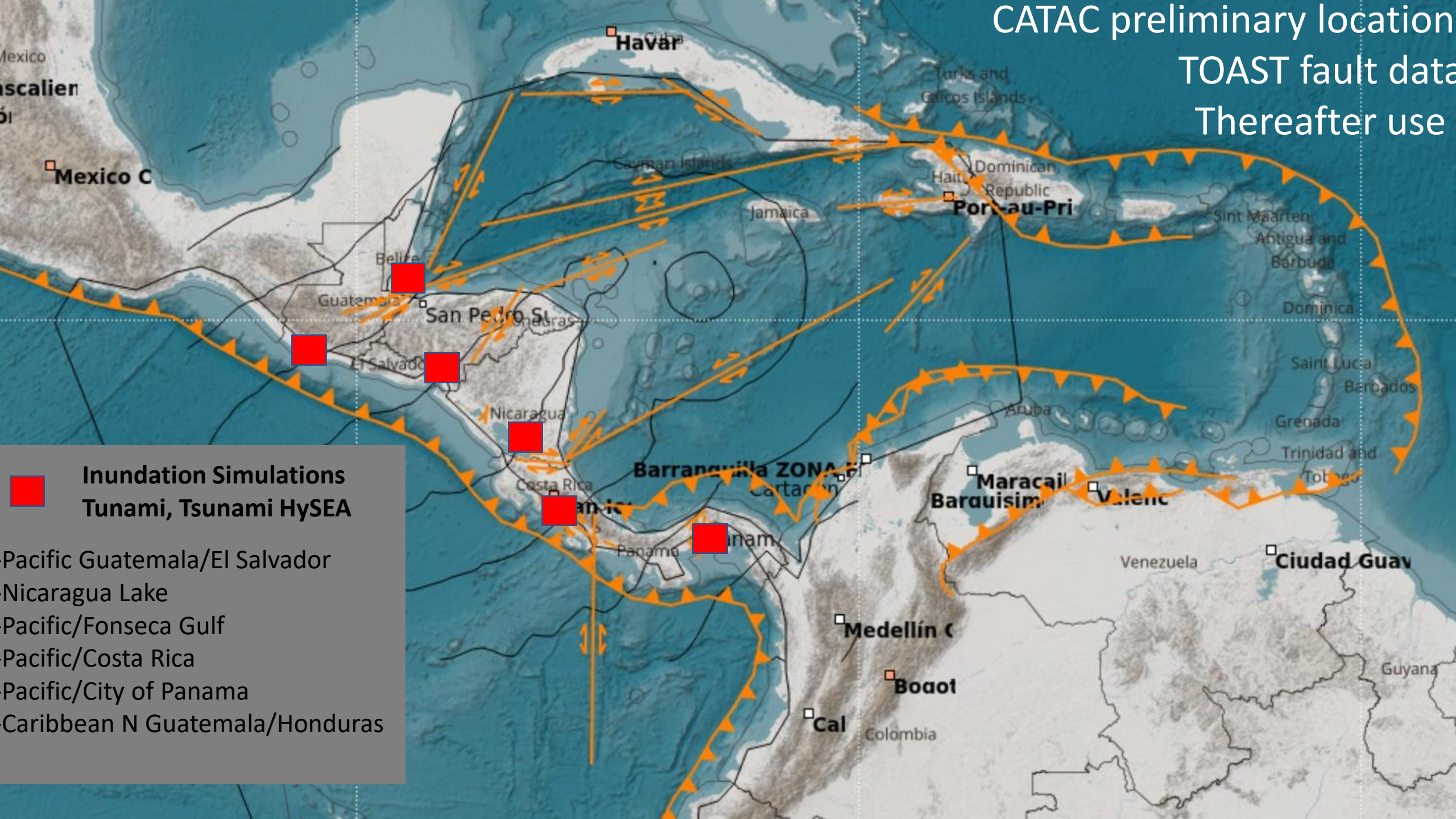
Wave Propagation | Map Layers

Database - Simulations

Simulations: Show all View Sort by: Creation time

Creation time	M	D	Lon	Lat	Residual	FM
2025-02-10 14:35:34	7.4	14 km	-82.43°	17.67°	0.58	
2025-02-09 00:02:46	7.4	15 km	-82.43°	17.67°	0.58	
2025-02-09 00:02:46	7.4	14 km	-82.43°	17.67°	0.58	
2025-02-09 00:02:46	6.8	10 km	-82.43°	17.67°	0.62	
2025-02-08 23:54:42	7.0	10 km	-82.60°	17.80°	0.62	
2025-02-08 23:54:42	7.0	10 km	-82.60°	17.80°	0.62	
2025-02-08 23:40:41	7.0	10 km	-82.57°	17.80°	0.62	
2025-02-08 23:33:19	7.1	10 km	-82.58°	17.74°	0.60	
2025-02-08 23:33:19	7.5	15 km	-82.58°	17.74°	0.58	
2025-02-08 23:29:18	7.3	13 km	-82.83°	17.61°	0.62	
2025-02-08 23:29:18	7.3	13 km	-82.83°	17.61°	0.62	
2025-02-08 23:27:07	7.4	13 km	-82.83°	17.48°	0.62	
2025-02-08 23:26:51	7.7	18 km	-82.40°	17.78°	0.59	
2025-02-08 23:26:18	7.4	14 km	-82.33°	17.61°	0.58	
2025-02-08 23:25:55	7.2	12 km	-82.52°	17.97°	0.62	
2025-02-08 23:25:39	7.2	12 km	-82.41°	18.04°	0.63	
2025-02-08 23:25:39	7.2	12 km	-82.41°	18.04°	0.63	
2025-02-08 23:25:16	7.2	12 km	-82.26°	17.90°	0.61	
2025-02-08 23:25:16	7.2	12 km	-82.26°	17.90°	0.61	
2025-02-08 23:25:16	7.2	12 km	-82.26°	17.90°	0.61	

21/21 simulations shown


CATAC preliminary location
TOAST fault data
Thereafter use
Inundation Simulations
Tunami, Tsunami HySEA
Pacific Guatemala/El Salvador
Nicaragua Lake
Pacific/Fonseca Gulf
Pacific/Costa Rica
Pacific/City of Panama
Caribbean N Guatemala/Honduras
Havar
Mexico C
Cayman Islands
Jamaica
Haiti
Dominican Republic
Belize
Guatemala
San Pedro Sl
Honduras
El Salvador
Nicaragua
Costa Rica
Panama
Aruba
Sint Maarten
Antigua and Barbuda
Dominica
Saint Lucia
Barbados
Grenada
Trinidad and
Venezuela
Medellín
Bogot
Cal
Colombia
Guyana

Identification of coastal areas with a reduced time of possible first impact by local tsunamis

Causes:
1) The source is very close to the coast (Islands to the N of Honduras; San Juan del Norte in Nicaragua, El Limon in Costa Rica, Panama Canal). The faults enter the coastal areas.
2) Between the coast and the source zone there are very deep waters (Gulf of Chiriqui in Panama).
4)A deep sea channel that connects the source with the coast (South of Guatemala).
5) The fault is very near the coast

The existence of these zones imposes on CATAC and Civil Protection agencies the urgency to work very fast. Therefore, CATAC pretends to use Earthquake Early Warning methods and delivers first tsunami evaluations within 2 minutes.

One week Capacitation Courses at CATAC / Managua on

Strengthening of the Use of the Tsunami Warning Products of the CATAC November, 2023, 2024, (2025 in preparation)

2025 Participation:

Representatives of 6 Central American NTWC´s
+ Director Seismological Network Dominican Republic

+ Personnel of CATAC

Topics:

CATAC Procedures, SeisComP&TOAST, CATAC Products

Dsisemination Methods

Earthquake Early Warning Methods

SOPs for Tsunami Warning in the countries

CATAC to support the countries in the updating of their SOP's

Presenters:

CATAC personnel

Course Participants

Gerzon González, Nicaragua, IT Consultant, social Networks

Sakaguchi, Japan, Consultant on EWBS on digital TV, CAP

Cooperation with CEPREDENAC

Center for Prevention of Natural Disasters in Central America

Institution of the Central American System of Integration

Led by directors of Civil Protection Agencies in Central America

Formulates common regional politics on Disaster Prevention and Minigation

2023 asked CATAC to include Belize and Dominican Republic

in its activities about tsunami capacitation and revision of SOP´s

2025 cooperation for the improvement of SOP´s

Participation of CATAC in tsunami exercises

In the intersessional period 2023-2025:

8 national multihazard exercises

1 regional multihazard exercise in Panama

2 Caribewave

1 Pacwave

Earthquake Early Warning (EEW)

Schweizerischer Erdbebendienst
Service Sismologique Suisse
Servizio Sismico Svizzero
Swiss Seismological Service

2016/03 INETER & Swiss Earthquake Service (SED) at ETH/Zurich start the EEW Development Project for Nicaragua,

2016/11 Seismology/INETER with JICA start CATAC Project

Both projects cooperate, for instance on capacitation on SeisComP

2018 CATAC installs 8 accelerometers and 8 bbstations for tsunami

2019 EEW Project integrates El Salvador, Costa Rica, Guatemala

2019 JICA Project finishes, CATAC enters preliminary working mode

2022 CATAC/EEW installs 25 accelerometers, in total 70 accelerographs in CA

2023 EEW project finishes successfully, public EEW running in Nic, Sal, Cor, Gua

2024 ICG/Caribe EWS asks CATAC to develop the use of EEW for the Tsunami Warning process

INETER´s EEW App

INETER
Instituto Nicaragüense de Estudios Territoriales

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

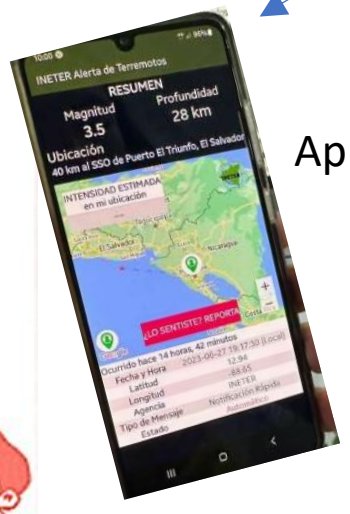
Swiss Technical Cooperation COSUDE
Managua, Nicaragua

Schweizerischer Erdbebendienst
Service Sismologique Suisse
Servizio Sismico Svizzero
Swiss Seismological Service

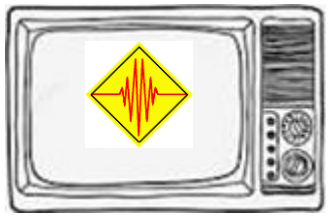
ETH zürich

-EWBS TV digital - 2022 (20,000 recipients, institutions in Managua))

-Public EEW messages via cellphone App - 2023 (2000 users)



App

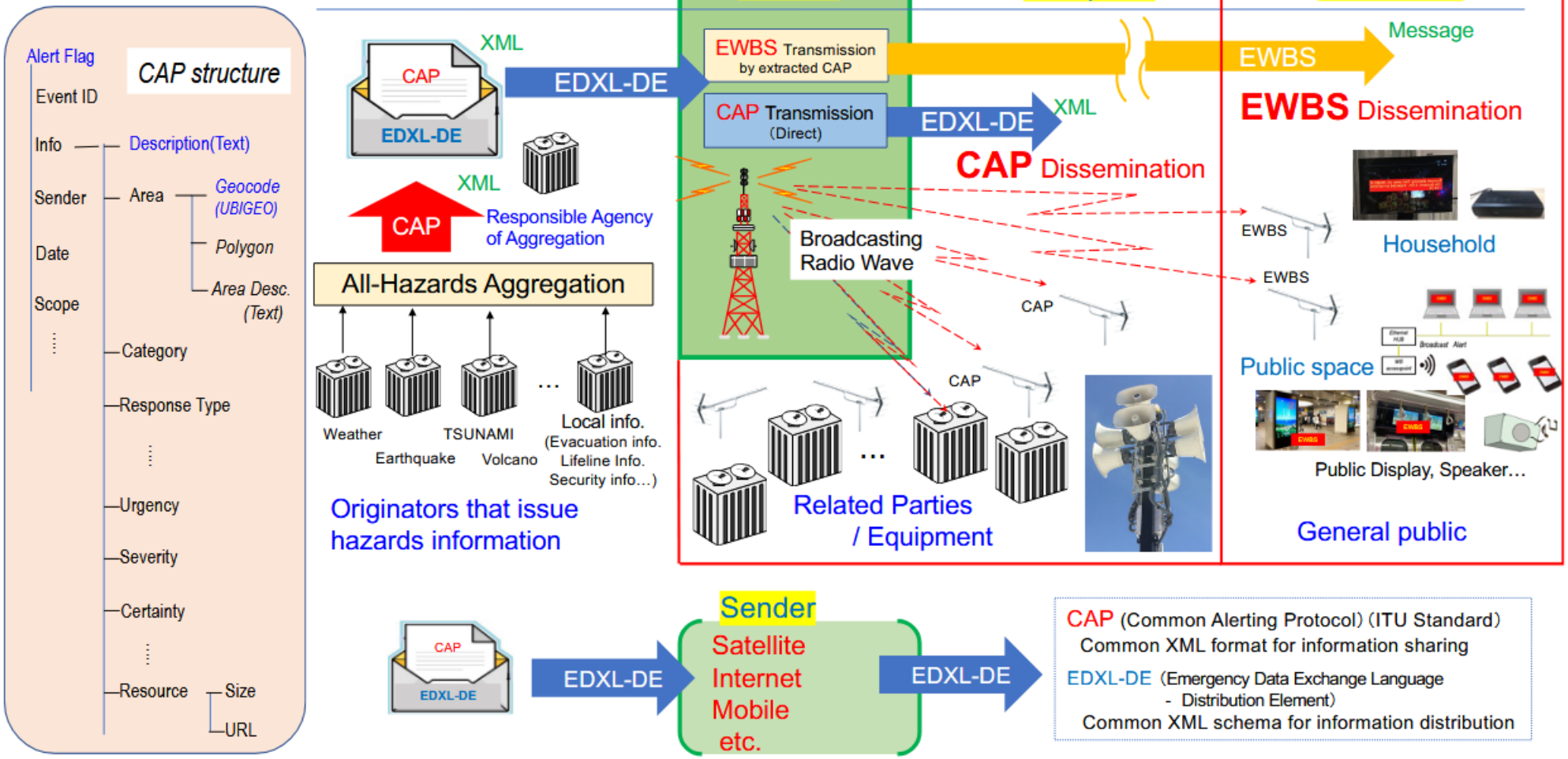


EWBS TV digital

2024 Start of Use of CAP in the Early Warning Broadcasting System of the digital TV in Nicaragua and Central America

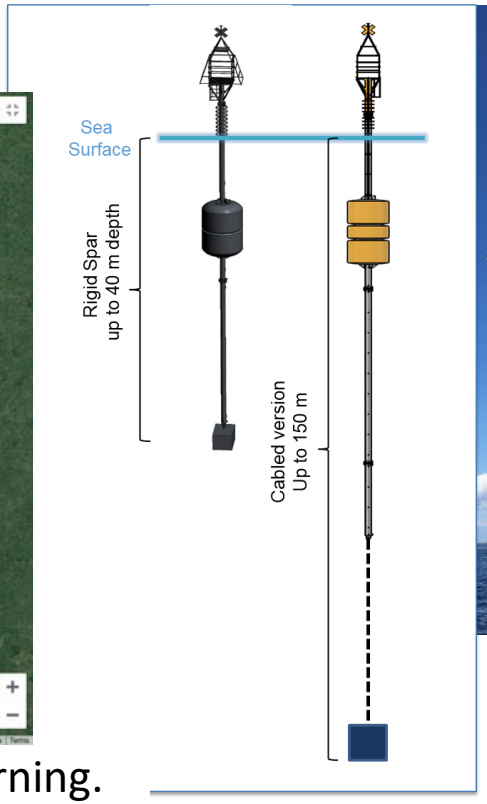
Research & Development Comprehensive ICT Systems for Disaster Management JTEC

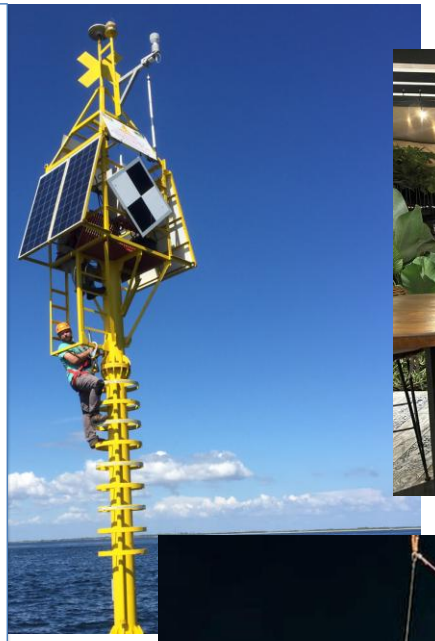
Broadcasting Systems Engineering
JTEC (Japan Telecommunications Engineering and Consulting Service)



- Cooperation with JTEC, Japan
- To receive the text messages via digital TV in CAP format and relais it to computers, phones in local networks.
- Also to CAP compatible equipments like sirens or switches,
- Experimental phase going on also in Costa Rica, El Salvador and Guatemala

GPS/GNSS Spar Buoys in the Nicaraguan & Central American Pacific Ocean





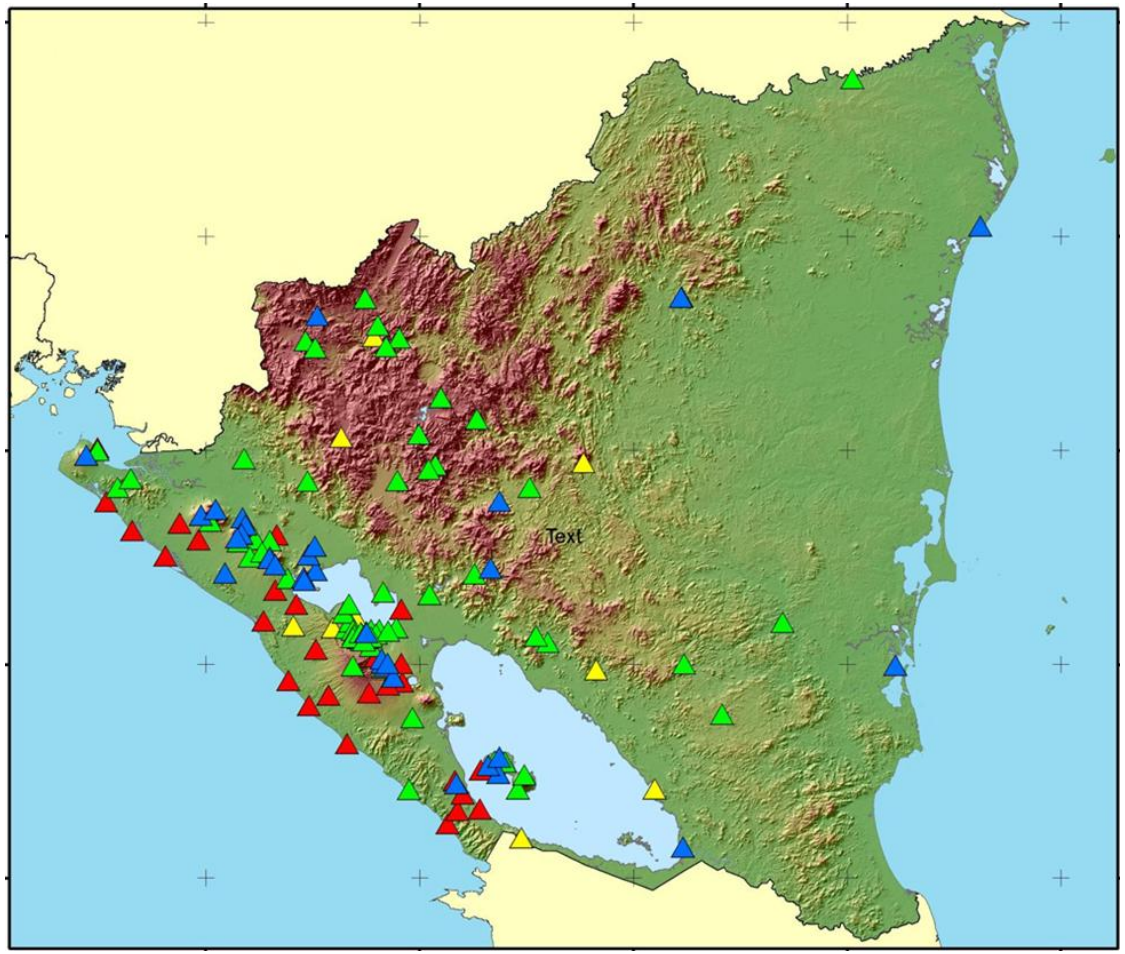
Tectonic/geodetic research. Earthquake/Tsunami Warning.

2025/03: Installation of 3 Spar Buoys with GPS/GNSS at 80-120 km from the Nicaraguan Pacific coast by US Research vessel **Atlantis** (Woods Hole). Anther buoy near Costa Rica. Project of **University of Tampa** (USA) with **CATAC** , OVSICORI (Costa Rica) and other international scientific institutions. Support by Nicaraguan Navy. More buoys may be installed.
Real time data: https://xie.cive.uh.edu/research/gnss-a/

Ref.: Xie et al. (2019) Seafloor Geodesy in Shallow Water With GPS on an Anchored Spar Buoy. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2019JB018242

Improvement of CATAC´s Seismic Network

Part of Nicaragua/China - SINAREM Project for the Enhancement of the Disaster Mitigation System in Nicaragua.

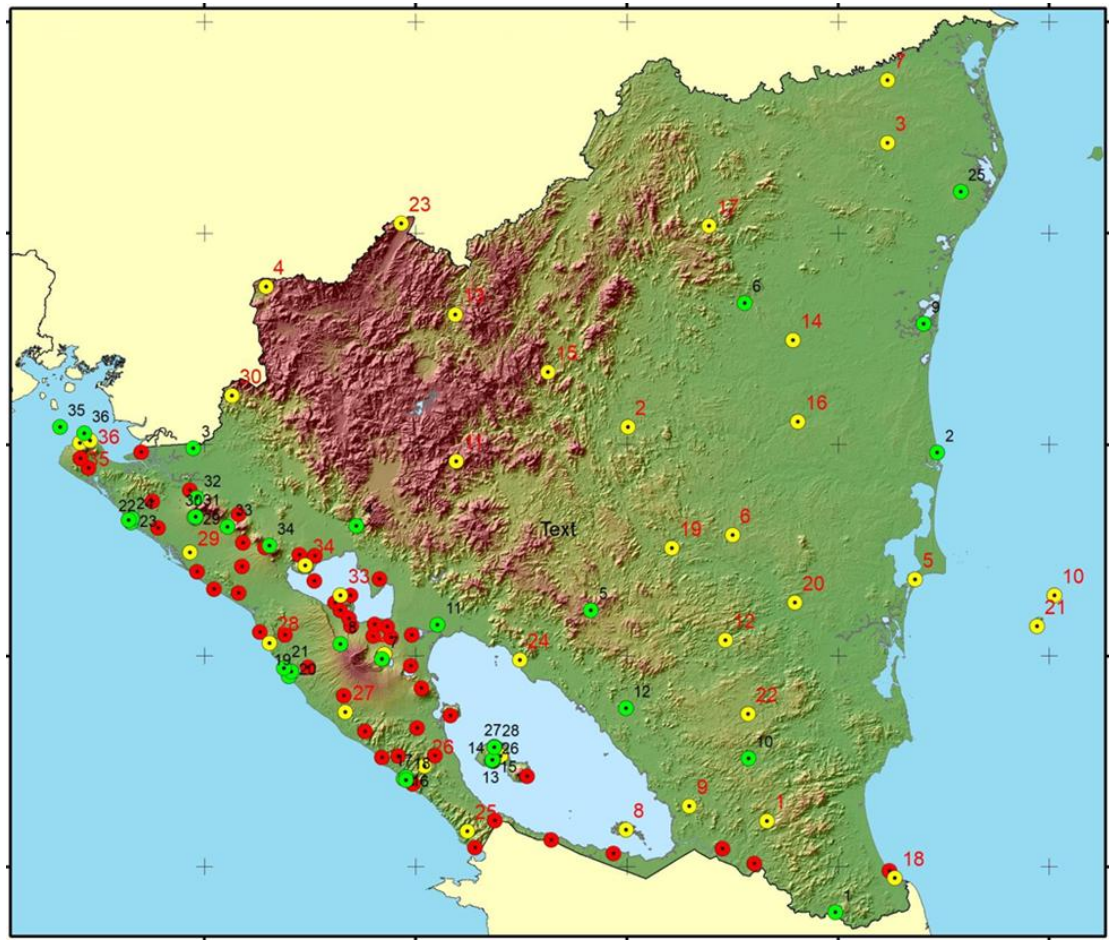


Existing CATAC network
140 stations

To be installed by CATAC

2025
2026

+



129 Stations to be added
50 accelerographs, 36 broad band (120s),
36 Raspberry Shake, 7 infrasound

2024 Improvement of IT hardware and software

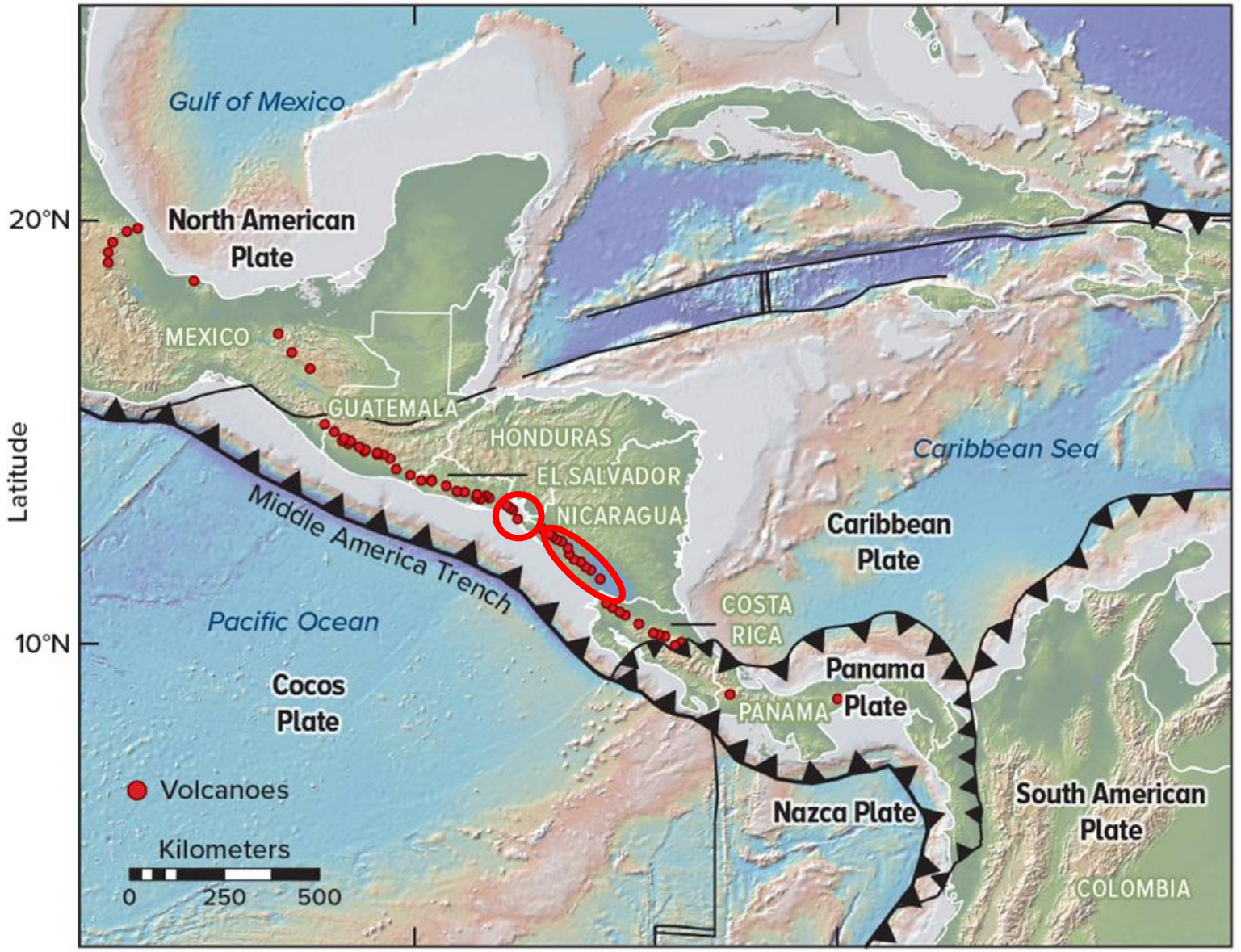
- Update of Licenses for SeisComP PRO version 6, including TOAST

- 2 additional Workstations with GPU Nvidia RTX 4090
  - about 20times faster than previous GPU
  - to run SeisComP in redundant systems for tsunami simulation and waveform correlation methods

2025 June :

3 New licenses for SeisComP PRO modules to be purchased
For seismological array methods, new shakemap routine, immedeate computation of seismic engineering parameters

Volcanoes and Tsunamis



Improvements of Dissemination Methods
(Lerning from the problems with CARIBEWAVE 2024)

- IT consultant contracted to work with CATAC, Nov 24 - March 25

- Methods :
  - 2 Email servers (INETER, Google) tested in Caribewave 2025
  - Telegram, Whatsapp, tested in Caribewave 2025
  - Computer-Computer (using SeisComP) testing with NTWC Guatemala and El Salvador
  - Digital TV (EWBS, CAP) for Nicaragua (
  - Tsunami App (

- Sending Tsunami & Earthquake Early Warning Messages to our recipients in Nicaragua and Central America

New versión of CATAC´s User´s Guide

- According new structure of contents definded by -

  Common PTWS TSP Users' Guide Table of Contents
  as prepared by the WG2 Task Team of TSPs in August 2023

- New info included

- New organizational structure of CATAC
- New dissemination methods
- Volcano related Tsunamis in Central America discussed
- Tsunamis in Big Lakes of Nicaragua discussed

- DOCX & PDF versions available on the ICG/PTWS-XXXI website

- To be presented also at ICG/Caribe EWS, virtual, 7-9 may, 2025