



UNESCO/IOC – NOAA ITIC Training Program in Hawaii (ITP-TEWS Chile)
TSUNAMI EARLY WARNING SYSTEMS
AND THE PACIFIC TSUNAMI WARNING CENTER (PTWC) ENHANCED PRODUCTS
TSUNAMI EVACUATION PLANNING AND UNESCO IOC TSUNAMI READY PROGRAMME
19-30 August 2024, Valparaiso, Chile

Tsunami Warning and Mitigation System Overview Chile Example

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Associate Director, ITIC



Presentation Overview

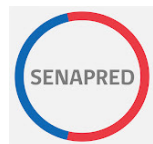
- National Tsunami Hazard Risk Assessment
 - National Protocol
 - Communication Process
 - Data
 - Flooding Maps
- Tsunami Warning Center (SNAM)
 - Operations overview
 - Science and technology
 - Training
 - Outputs

National Protocol

- Define clear responsibilities.
- Communication protocols.
- System limitations.
- Preventive Evacuation.
- Yearly reviewed.



Seismological
Centre



NDMO

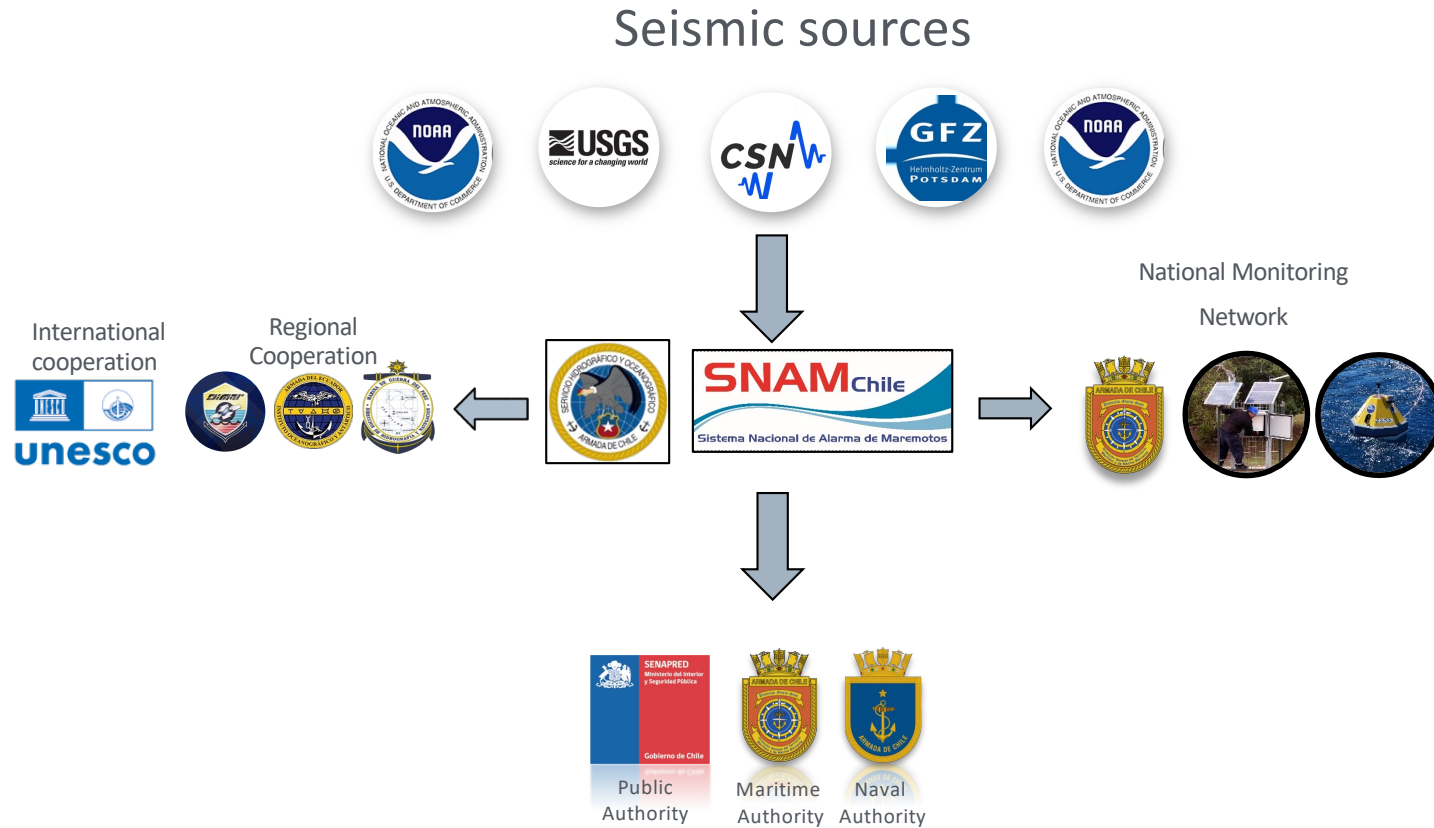


NTWC

UNESCO/IOC-NOAA SHOA
International Tsunami Information Center



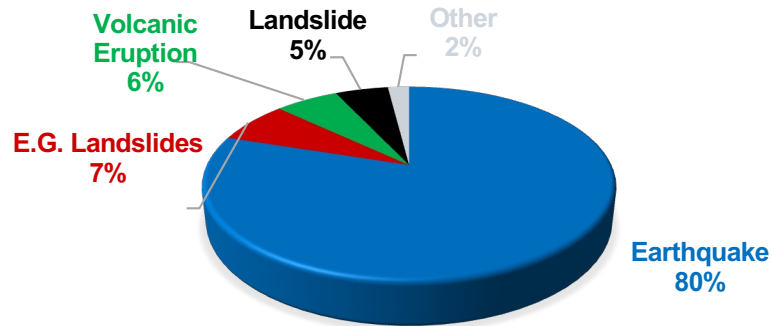
Communication Process



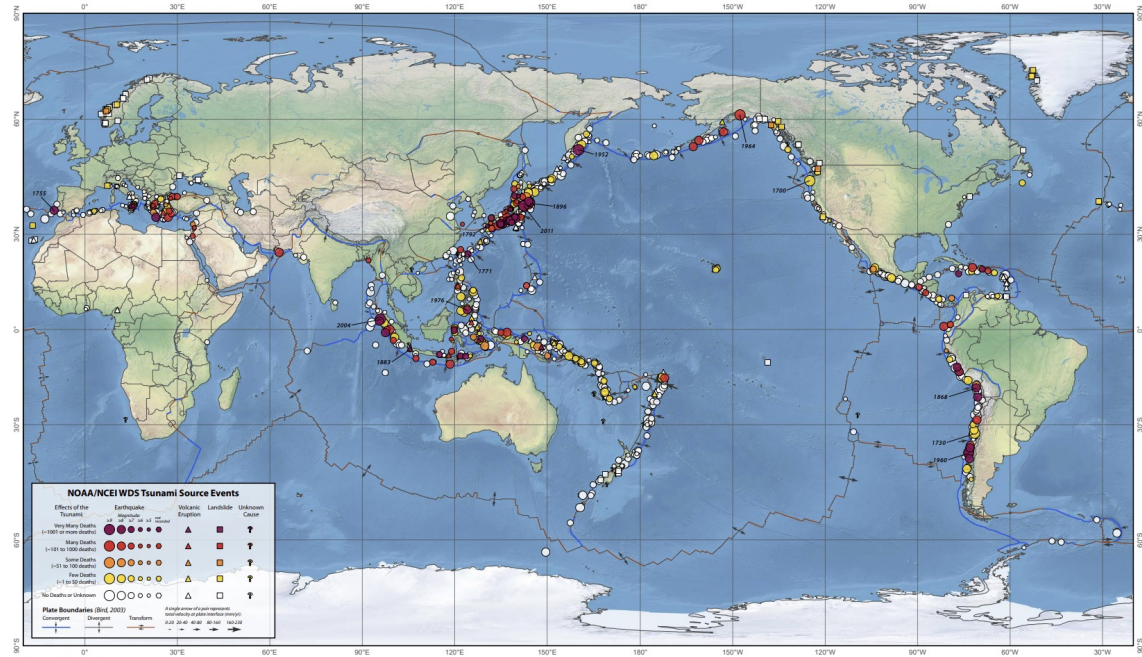
Data

■ Tsunami source:

- Seismic
- E.G. Landslide
- Landslides
- Volcanic Eruptions
- Others



Tsunami Sources 1610 B.C. to A.D. 2022
From Earthquakes, Volcanic Eruptions, Landslides, and Other Causes



NOAA/NCEI WDS Tsunami Source Events

Effects of the Tsunami:

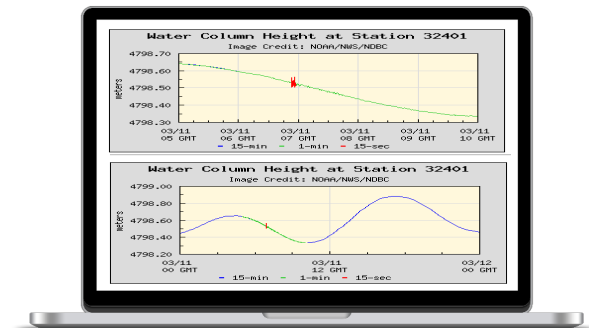
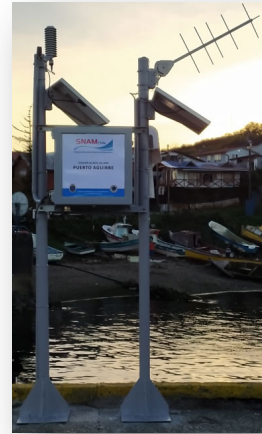
Deaths	Earthquake	Volcanic Eruption	Landslide	Unknown Cause
Very Many Deaths (1-1000 or more deaths)	Large red circle	Large red triangle	Large red square	Large red upward arrow
Many Deaths (1-100 or more deaths)	Medium red circle	Medium red triangle	Medium red square	Medium red upward arrow
Some Deaths (1-10 or more deaths)	Small red circle	Small red triangle	Small red square	Small red upward arrow
Few Deaths (1-1 or more deaths)	Very small red circle	Very small red triangle	Very small red square	Very small red upward arrow
No Deaths or Unknown	White circle	White triangle	White square	White upward arrow

Plate Boundaries (IOC, 2003):

- Convergent: red line with triangles
- Divergent: blue line with triangles
- Transform: black line with triangles

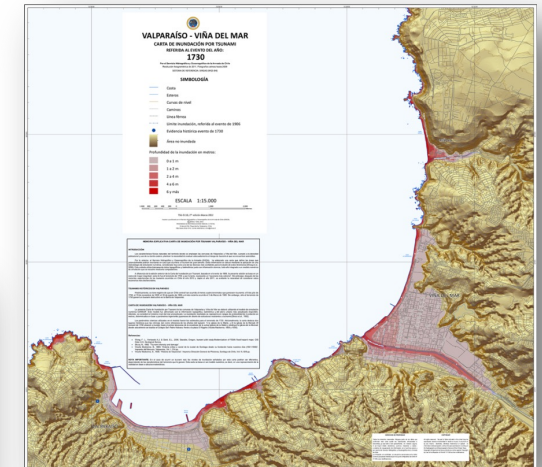
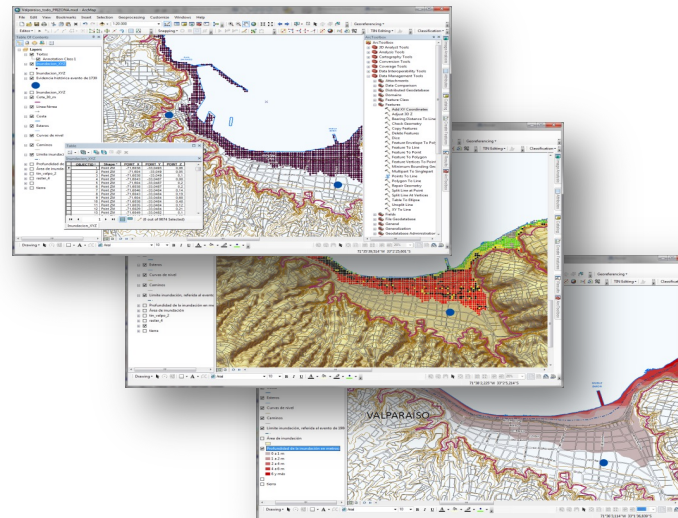
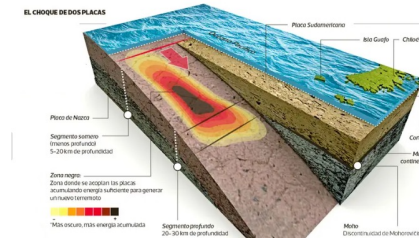
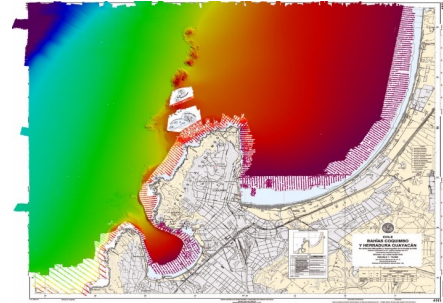
Data

- Tsunami Data:
 - Tide Gauges
 - DART Buoys
 - Field Observers
 - Others (SMART Cables, Tsunami bulletins, etc.)



Flooding Maps

- Bathymetry
- Digital Elevation Model
- Tsunami sources
- Tsunami modelling:
 - Generation
 - Propagation
 - Inundation
- Put all together



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 - Procedures
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UNESCO/IOC-NOAA SHOA

Tsunami Information Center

SNAM Operations Overview

- ❑ Advanced technology systems, with national scientific contribution.
- ❑ High level of professionalism and training.
- ❑ Redundancy in monitoring, command/control and communications systems.
- ❑ High cost of maintenance and renovation.
- ❑ Operation under national and international protocols.

UNESCO/IOC-NOAA SHOA
International Tsunami Information Center



SNAM Operations Overview



Activation

- PTWC ,
CSN, USGS,
NTWC, GFZ

Reception of
Information

00:00

- It is disseminated to:
- SENAPRED
 - MARITIME
 - NAVY

Dissemination

05:00

- Ways of dissemination:
- VHF NDMO / MARITIME / CSN
 - DATAMAR2 SYSTEM
 - SNAM Fax
 - Fixed and satellite telephones
 - E-mails

Cancellation

>06:00



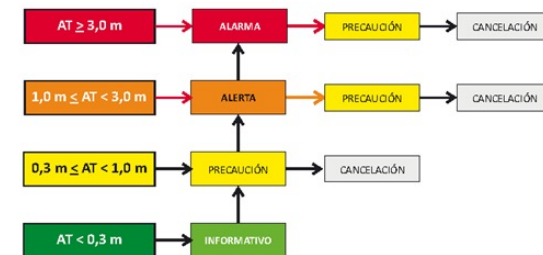
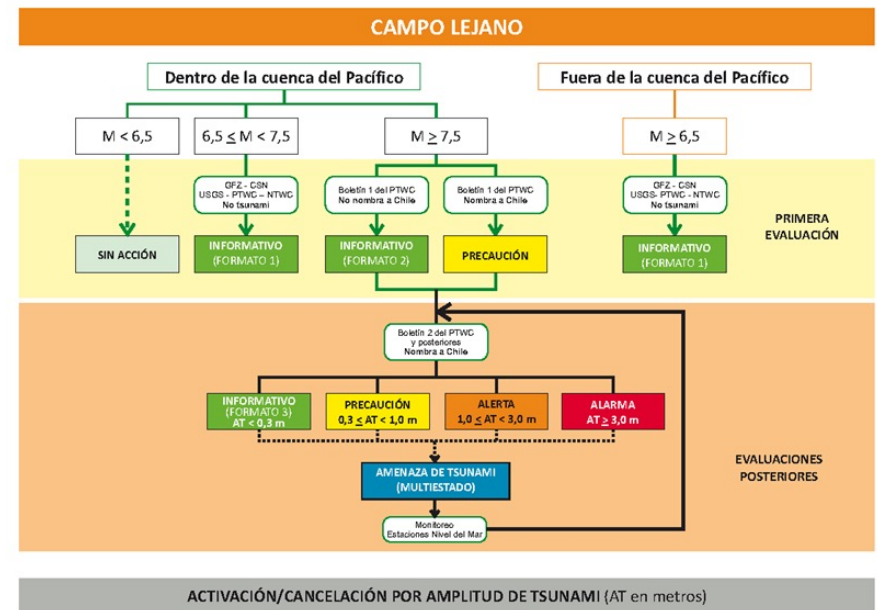
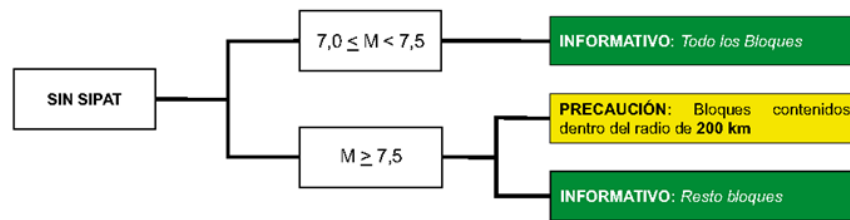
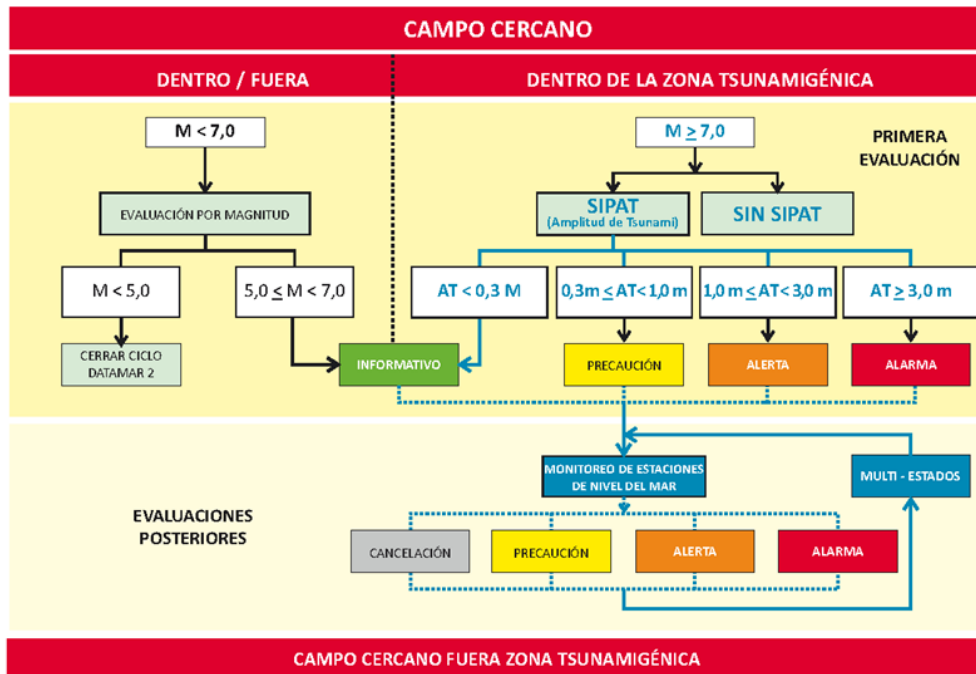
- Amplitude records
- Flood model comparison
- Field observers

Assessment

Monitoring

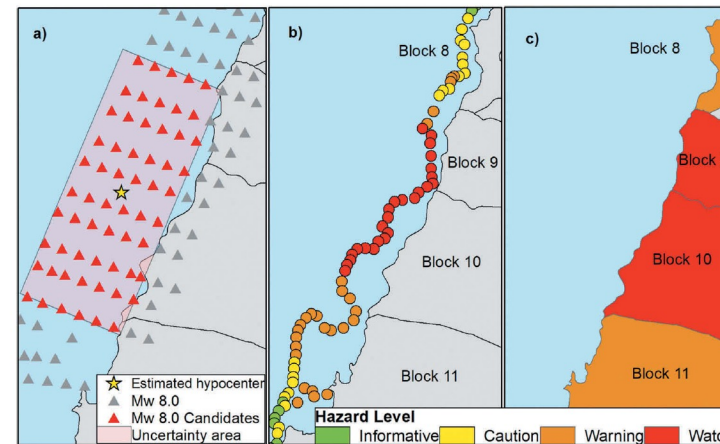
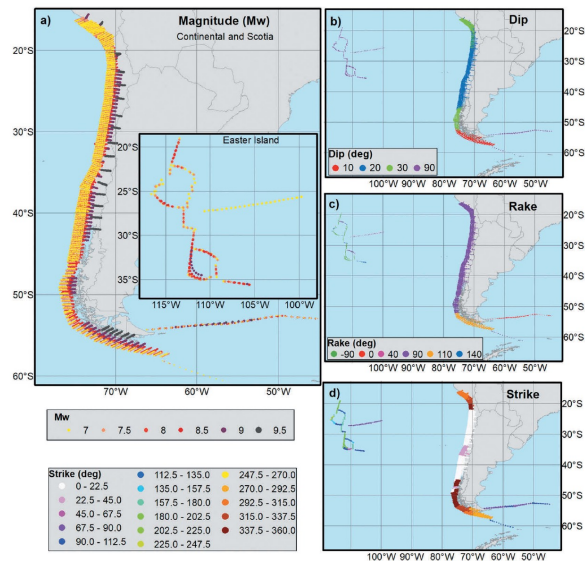


Procedures

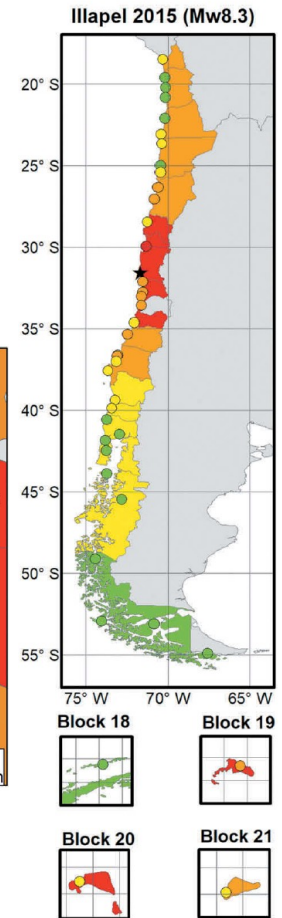


SNAM Science and Technology

- National Evaluation tools
- SSD/SIPAT
 - Pre-computed scenarios

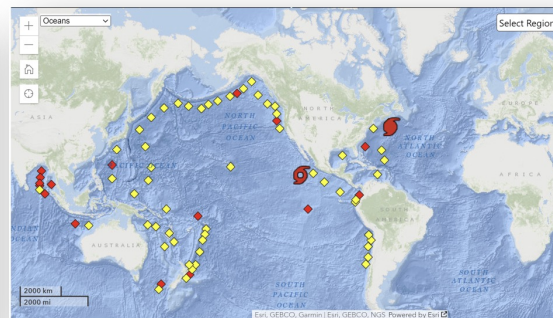
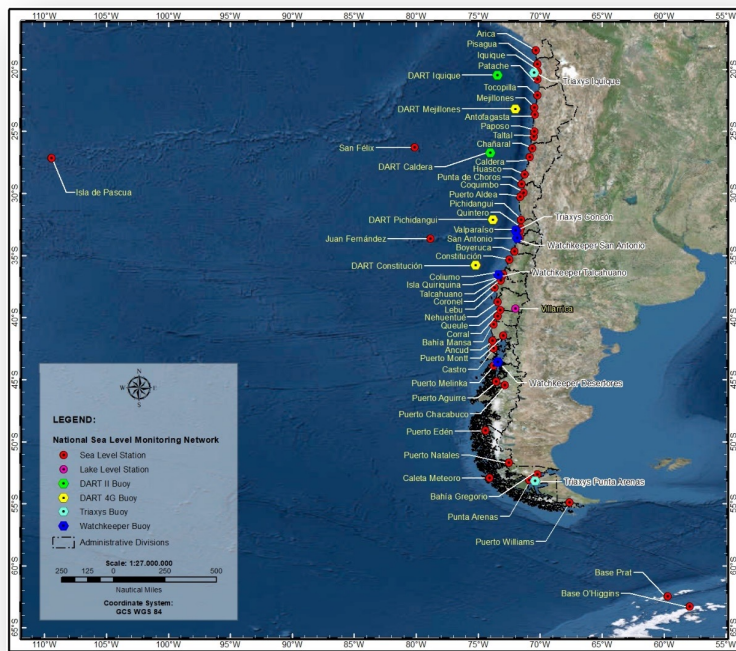


Source: Catalán et al. (2020)

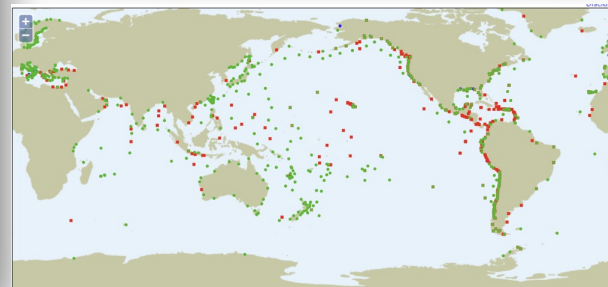


SNAM Science and Technology

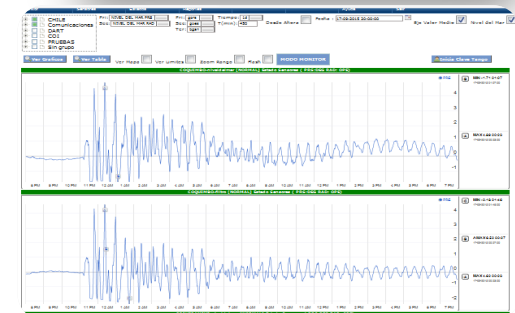
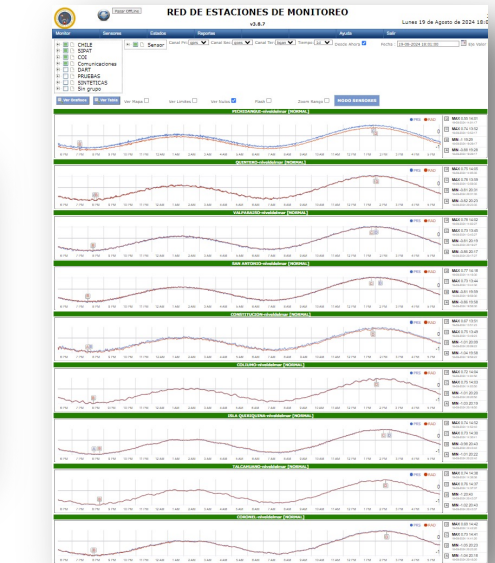
Monitoring tools



Source: <https://www.ndbc.noaa.gov/obs.shtml>

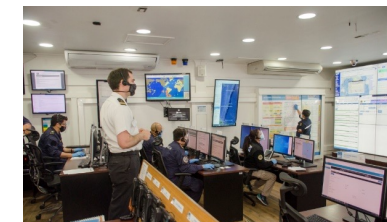


Source: <https://www.ioc-sealevelmonitoring.org/map.php>

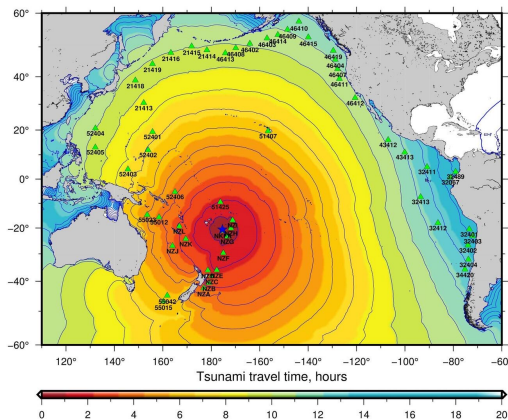


SNAM Training

- Levels and scopes of training:
 - Capacity Building
 - Testing personal
 - Maintenance of training
 - Stress the system (normal operation and failure simulations)
 - System Communications / Protocol (between agencies)
 - Regional Cooperation
 - Ocean basin Collaboration



SNAM Outputs



Type of tsunami	Expected amplitude	EVACUATION AREAS	Threat Status
Instrumental	< 0.3m	No action required	INFORMATIVE
Minor	0.3 to 1m	Evacuation of the population outside the Precautionary zone, which includes areas of beaches, rocky shores, wetlands, estuaries, river mouths, coastal walks (pedestrians), marinas, waterfronts (vehicular), coves, ports and docks.	WATCH
Intermediate	1 to 3m	Evacuation of the population towards the Security Area (or Safe Zone), established at a height greater than 30 meters or as provided by local authorities.	ADVISORY
Major	≥ 3.0m		WARNING



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Thank You

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