

NOAA/NCEI-WDS Integrated Tsunami Data: Support Research, Forecasts, Warnings, Response, Hazard and Risk Assessments

NOAA National Centers for Environmental Information (NCEI, *formerly National Geophysical Data Center (NGDC)*)
World Data Service for Geophysics (WDS)
Boulder, United States

and

Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, United States,

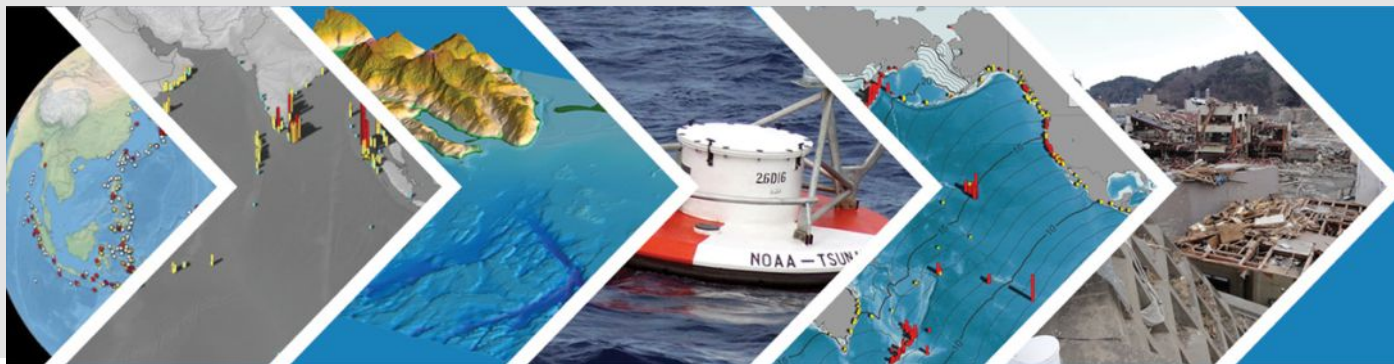


NOAA Satellite and Information Service | National Centers for Environmental Information



ICSU World Data System

- International Council of Science (ICSU)/World Data System (WDS)
 - Created in 2008--Builds on 50-year legacy of the ICSU World Data Centers
 - 87 Regular Members
- NOAA/NCEI Boulder, Colorado, USA and co-located World Data Service (WDS) for Geophysics provide **long-term archive, data management, and access to global tsunami data**
 - global tsunami event data, damage photos, raw and processed water Level data from NOAA observational networks, and development of digital elevation models (DEMs)

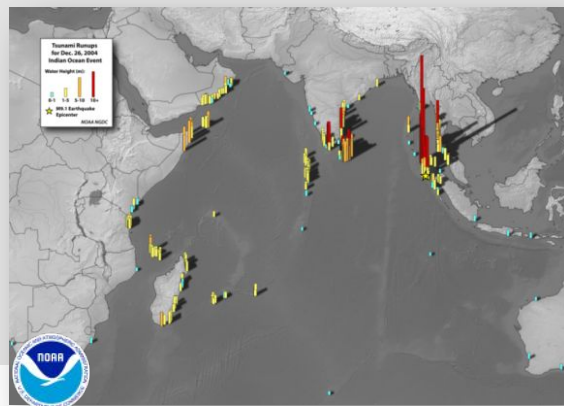


Historical Tsunami Data

Know the past to better understand the future

The historical tsunami database is a scientifically curated list of historical tsunami source events and tsunami water height locations throughout the world that range in date from 2000 B.C. to the present. These data support:

- Forecast and Warning, tsunami model validation, coastal hazard assessments and community resiliency
- **Authoritative source** for historical tsunami event data
- Database is continuously updated based on new sources
- **User interface** provides a REST API for programmatic access, flexible sorting, and filtering of data through a new graphical user interface that will make tsunami datasets more discoverable. <https://www.ngdc.noaa.gov/hazel>



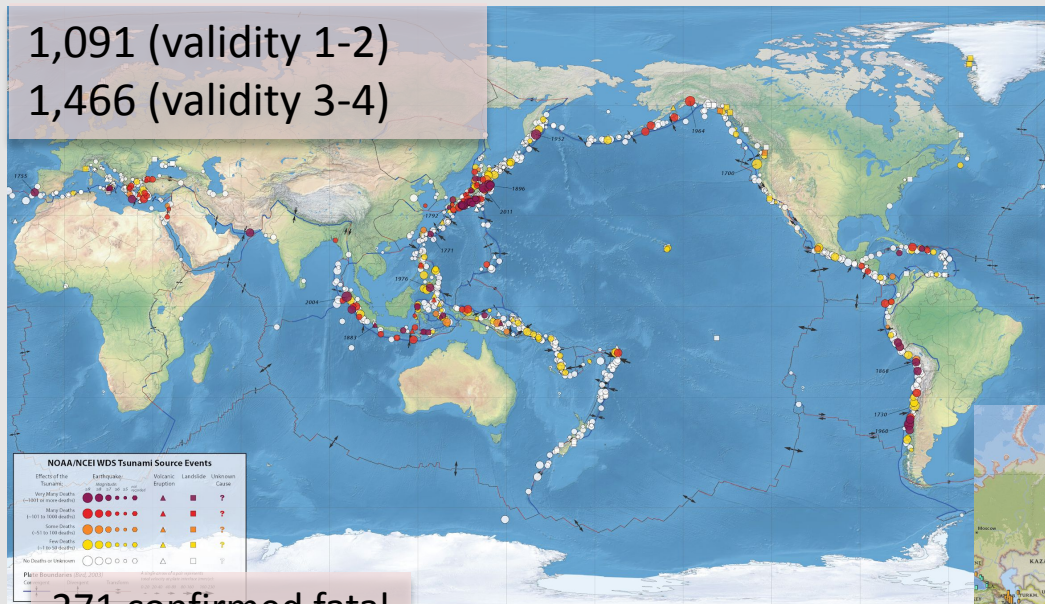
Tsunami Event												
Year	Mo	Da	Ho	Sea	Tsunami Type	Tsunami Cause	Country	Location	Latitude	Longitude	Minimum Water Height (m)	Tsunami Maximum Water Height (m)
2010	1	12	21	03	10	4	HAITI	HAITI & DOMINICAN REPUBLIC	18.457	-72.533	0.21	19.4
NCEI/US Results Found												
Year	Mo	Da	Ho	Sea	Tsunami Type	Tsunami Cause	Country	Location	Latitude	Longitude	Minimum Water Height (m)	Tsunami Maximum Water Height (m)
0	1	1	1	1	1	1	HAITI	JACMEL 3	18.2346	-72.8300	0.21	19.4
0	1	1	1	1	1	1	HAITI	JACMEL 2	18.2328	-72.8100	1.44	83.5
0	1	1	1	1	1	1	HAITI	GRAND-GA VE PETIT PARADES 1	18.4275	-72.4900	1.79	20
0	1	1	1	1	1	1	HAITI	GRAND-GA VE PETIT PARADES 2	18.4348	-72.4916	0.4	1.9
0	1	1	1	1	1	1	HAITI	GRAND-GA VE PETIT PARADES 3	18.4355	-72.5034	2.48	22.6
0	1	1	1	1	1	1	HAITI	GRAND-GA VE PETIT PARADES 4	18.4342	-72.5030	1.36	41.4
0	1	1	1	1	1	1	DOMINICAN REPUBLIC	SANTO DOMINGO	18.4800	-69.9000	0.06	0.06
0	1	1	1	1	1	1	HAITI	ANILE-CO BATHES	18.2362	-72.8272	2.08	16.8
0	1	1	1	1	1	1	HAITI	CAVITE-DE-JACMEL	18.2180	-72.3900	1.3	16.2
0	1	1	1	1	1	1	HAITI	LULUY 1	18.8180	-73.8780	0.2	0.2
0	1	1	1	1	1	1	HAITI	LULUY 2	18.8180	-73.8780	0.2	0.2
0	1	1	1	1	1	1	HAITI	GRAND-GA VE	18.4343	-72.5030	1.39	16.1
0	1	1	1	1	1	1	HAITI	HELL-ANNE	18.2370	-72.8190	1.50	12.2
0	1	1	1	1	1	1	HAITI	GRAND-GA VE 2	18.4275	-72.4900	0.83	6.7
0	1	1	1	1	1	1	DOMINICAN REPUBLIC	HYDRONAL	18.2170	-71.8437	1.12	11
0	1	1	1	1	1	1	HAITI	GRAND-GA VE PETIT PARADES 5	18.4291	-72.5488	1.69	20
0	1	1	1	1	1	1	HAITI	GRAND-GA VE PETIT PARADES 6	18.4316	-72.5031	1.69	52.3
0	1	1	1	1	1	1	USA TERRITORY	ST JOHN CHRISTIANSTED	17.7600	-64.7600	0.01	0.01
0	1	1	1	1	1	1	HAITI	JACMEL 1	18.2324	-72.8174	2.42	24.5
0	1	1	1	1	1	1	HAITI	GRAND-GA VE PETIT PARADES 7	18.4291	-72.5103	3.03	30.9
0	1	1	1	1	1	1	HAITI	PETIT-GA VE	18.4291	-72.6711	0.5	0
0	1	1	1	1	1	1	USA TERRITORY	DEWALT BAY, 250 YDS S OF SAN JAMES	15.2000	-68.2400	0.01	0.01
0	1	1	1	1	1	1	USA TERRITORY	SILA MOHA	18.1000	-67.8000	0.01	0.01
0	1	1	1	1	1	1	HAITI	GRAND-GA VE PETIT PARADES 8	18.4343	-72.5030	1.3	16.4
0	1	1	1	1	1	1	HAITI	U.S. COA. #6 1	18.0939	-72.4649	1.4	1.4

World Data Service for Geophysics

Tsunami Source Events and Observations

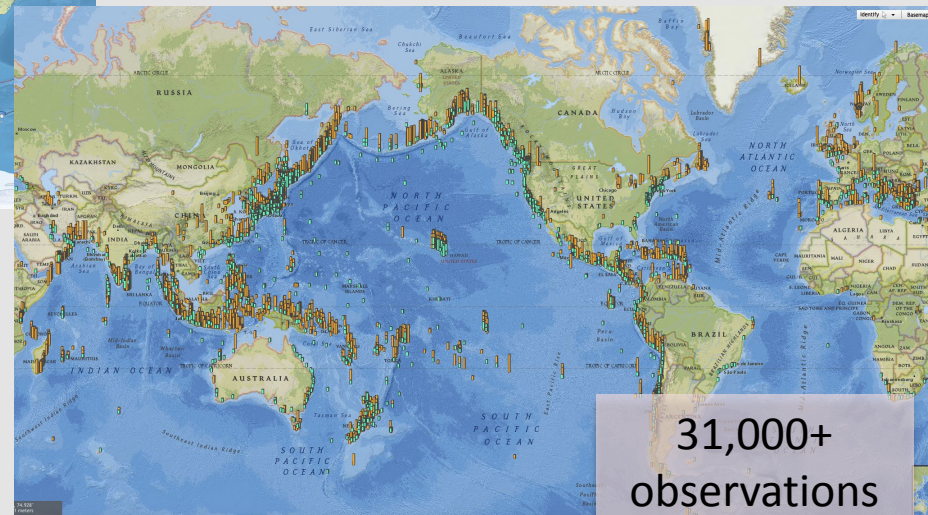
- Date, location, latitude/longitude, cause (e.g. earthquake, volcanic eruption), maximum water height, socio-economic data (deaths, injuries, damage), source references

1,091 (validity 1-2)
1,466 (validity 3-4)



271 confirmed fatal tsunami events.
Deadliest event:
2004 Sumatra with
over 227,000
deaths

- Eyewitness, field survey, tide gauge, DART
 - Location name, latitude/longitude, wave arrival time, water height, socio-economic (deaths, injuries, damage), references



31,000+
observations



Source Documents

Over 8,000 documents that describe damage and effects from tsunami, earthquake, and volcano events. Types of documents:

- Diaries, ships logs, newspaper reports
- Tsunami, Earthquake, Volcano catalogs
- **National Reports** from ICGs (e.g., PTWS, Caribe-EWS)
- NOAA National Weather Service Tsunami Warning Centers
- NOAA/IOC/UNESCO International Tsunami Information Center (ITIC)
- Web articles, e-mail, journal articles
- International Tsunami Survey Teams



Magnitude 7.7 earthquake strikes western coast of Canada, tsunami warning issued

Published October 28, 2012 • Associated Press

VANCOUVER, British Columbia — A magnitude 7.7 earthquake struck off the west coast of Canada and a tsunami warning was issued, authorities said, but there were no immediate reports of major damage.

The U.S. Geological Survey said the quake hit the Queen Charlotte Islands just after 8 p.m. local time Saturday at a depth of about 3 miles (5 kilometers) and was centered 96 miles (155 kilometers) south of Masset, British Columbia. It was one of the biggest earthquakes around Canada in decades and was felt across a wide area around British Columbia.

The National Weather Service issued a tsunami warning for coastal areas of British Columbia, southern Alaska and Hawaii. The first wave of the small tsunami, about 4 inches (101.6 millimeters), hit the southeast Alaska coastal community of Craig.

Dennis Sinnott of the Canadian Institute of Ocean Science said a 69 centimeter (27 inch) wave was recorded off Langara Island on the northeast tip of Haida Gwaii, formerly called the Queen Charlotte Islands. Another 55 centimeter (21 inch) wave hit Winter Harbour on the northeast coast of Vancouver Island.

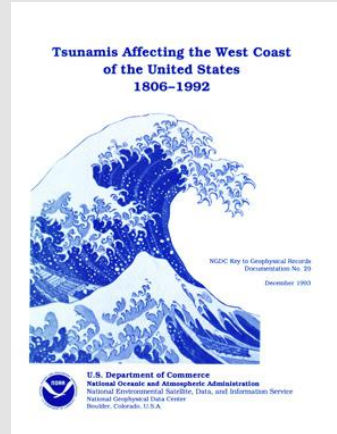
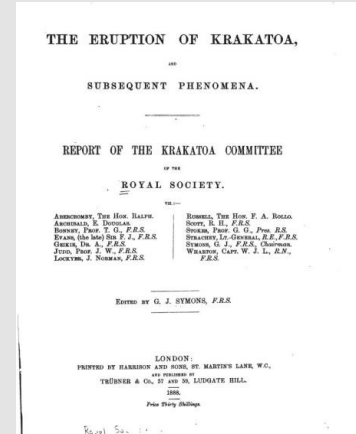
NOVEMBER 2004 - SEPTEMBER 2005 VOLUME XXXVII, NUMBER 1

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ITIC News	19-20	Workshop	24-25
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In this issue, we summarize activities that were observed between November 2004 and September 2005, and the ITIC News section contains the ITIC News and other news items that were the responsibility of the ITIC News Committee and members of 26 December 2004. The year's activities have been characterized by unprecedentedly high levels of activity and the development of the Pacific Tsunami Warning System (PTWS) in the Pacific region. The ITIC News Committee, in coordination with the IOC, Executive Secretary and Finance Secretariat in Paris, and members of the ITIC News Committee have been busy with their work and projects to inform and guide the actions of the Indian Ocean as well as to set up a warning system. An emergency response should be taken and resources be utilized. New survey teams will be set up and commissions to develop immediate and proactive activities, and personnel. New survey teams will be set up and commissions to develop immediate and proactive activities are required so that future generations will never have to witness a constant catastrophe for their shore again.

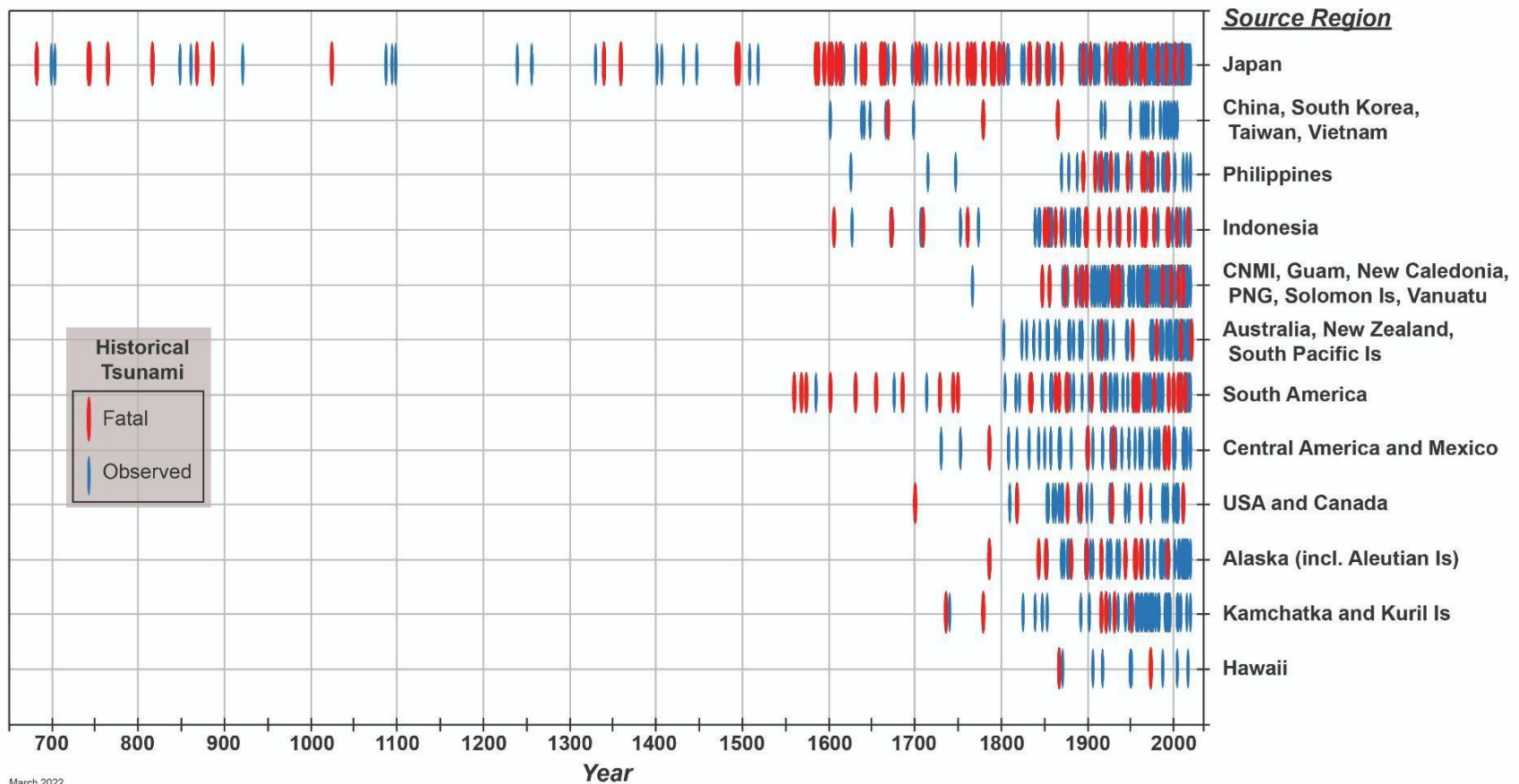
ITIC Director Dr. Lennart King



Gaps in records

Historical Pacific Tsunami Event Records

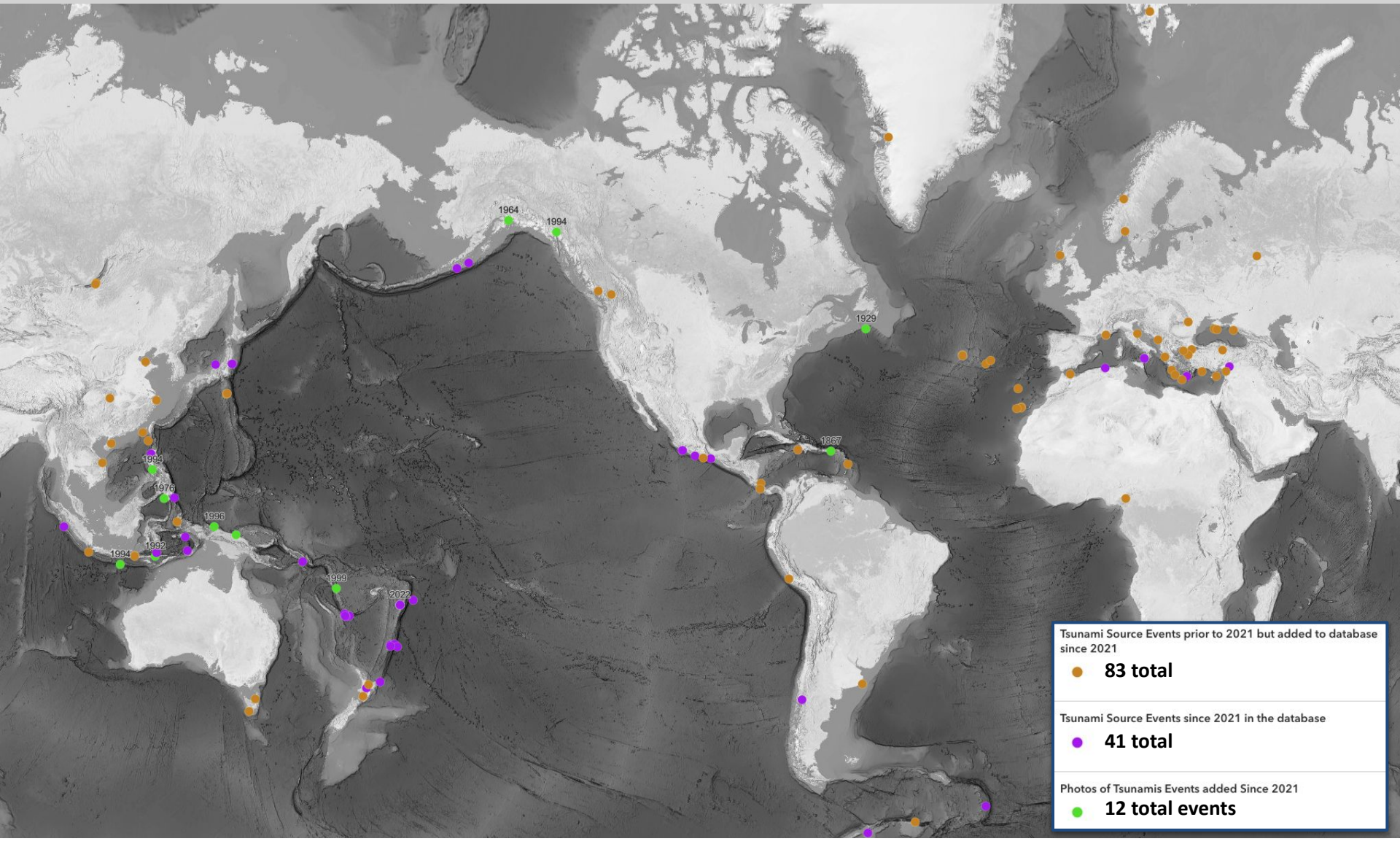
Source: NOAA NCEI/WDS Global Historical Tsunami Database



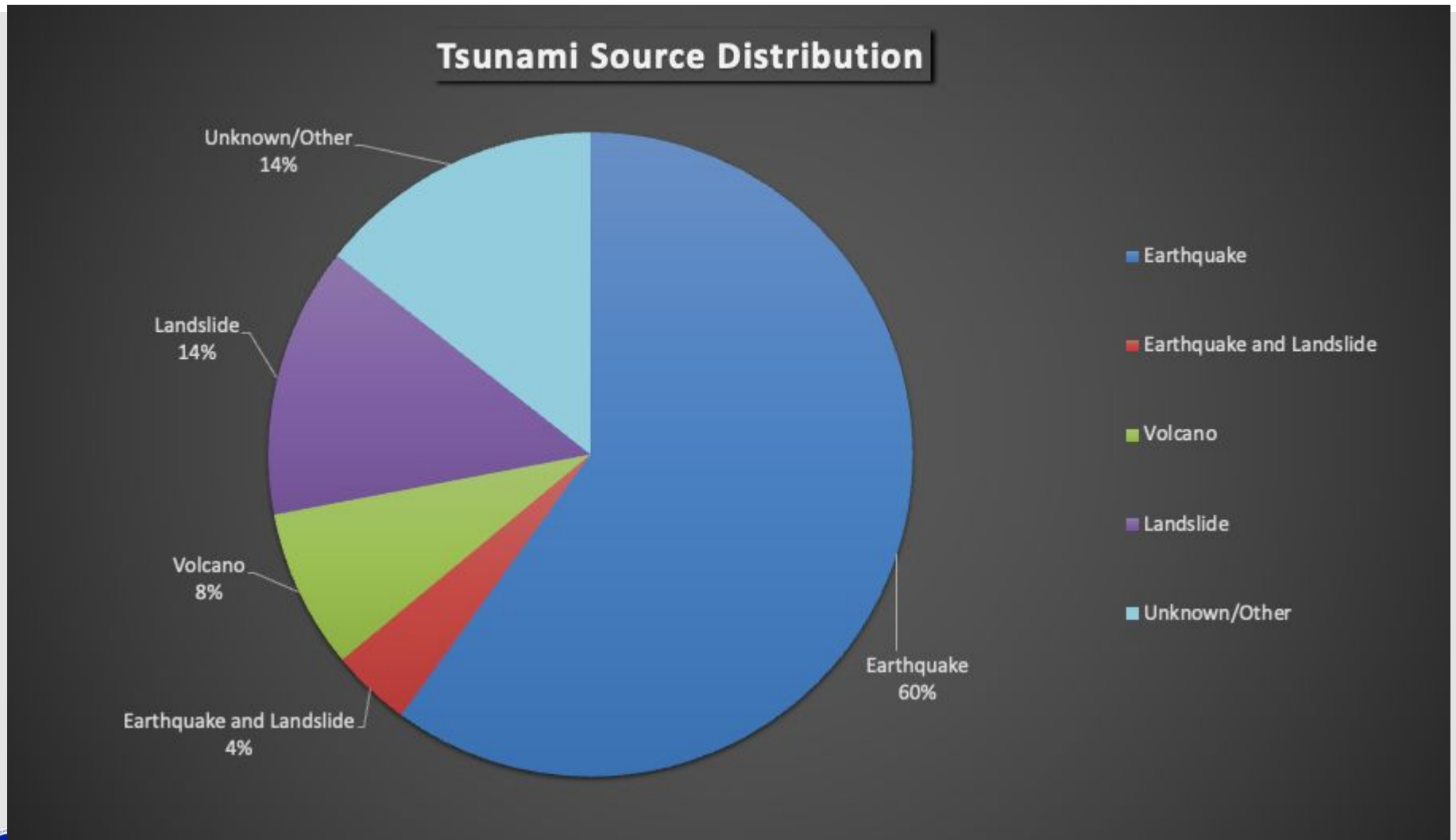
March 2022



Tsunami Source Event data since 2021



Tsunami Source Event data since 2021

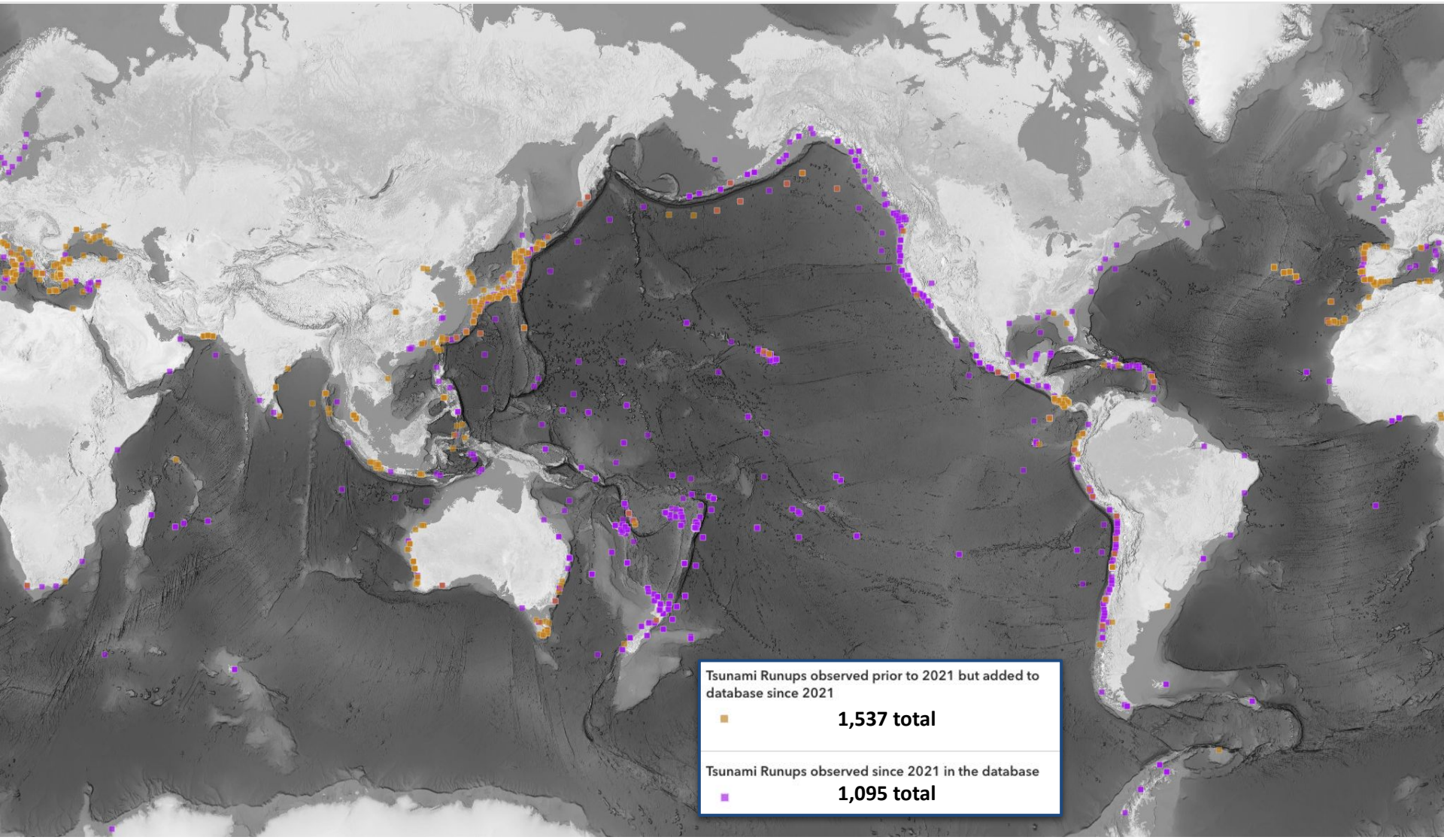


Tsunami Source Event data since 2021

Tsunami Events Added to NCEI Database Since 2021

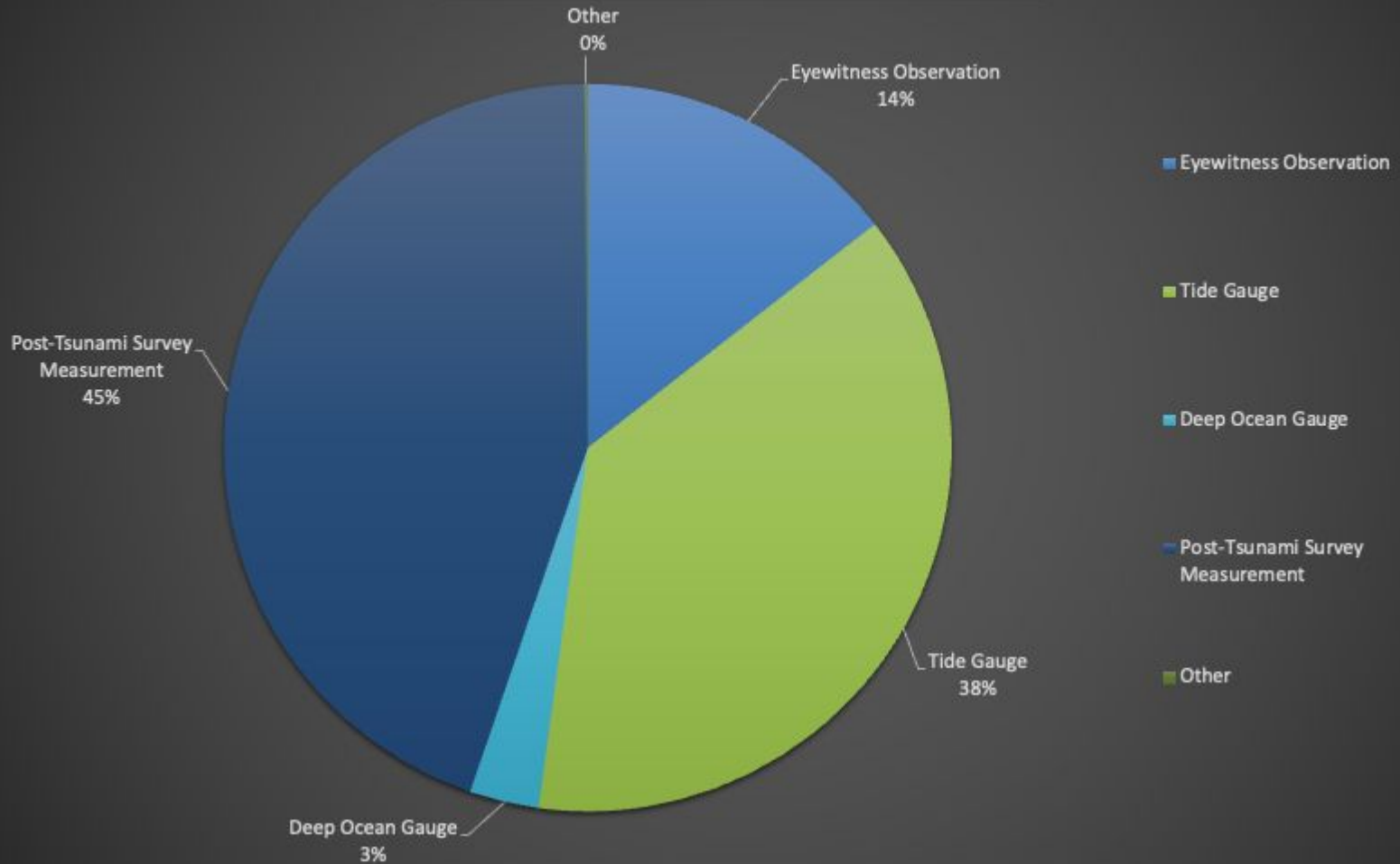


Tsunami Runup data since 2021



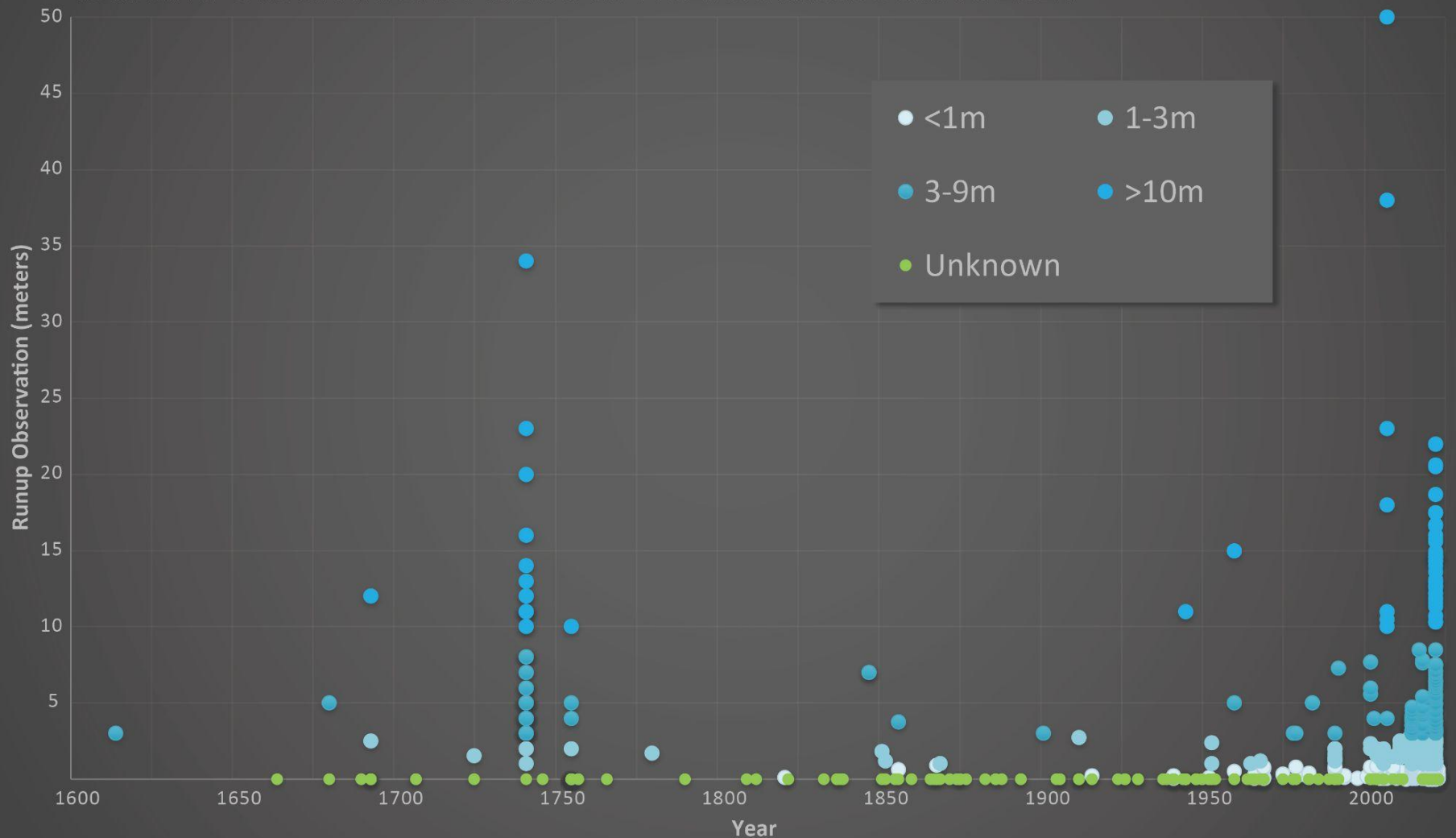
Tsunami Runup data since 2021

Observation Type Distribution



Tsunami Runup data since 2021

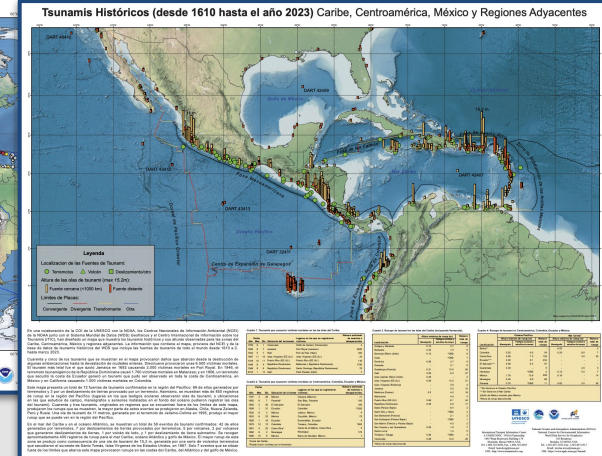
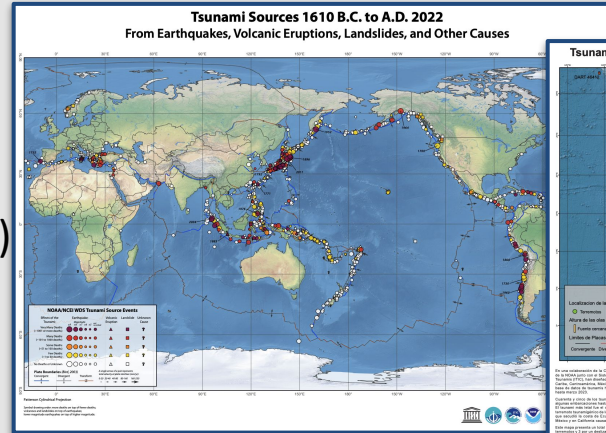
Tsunami Observations Added to NCEI Database since 2021



NCEI and ITIC Collaborative Projects

Global posters:

- Tsunamis (2022 & 2023)
- Significant earthquake (2022)
- Significant volcanic eruptions (2022)



Regional:

- Caribbean and adjacent regions (English & Spanish)
- Tonga Trench

Historical Tsunami Effects near the Tonga Trench (1837-2023)

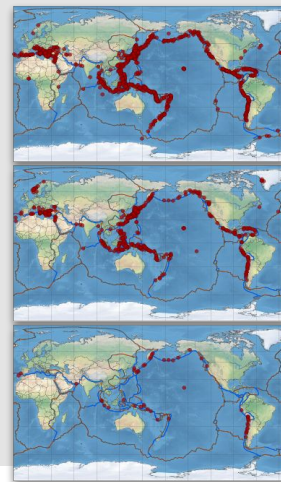
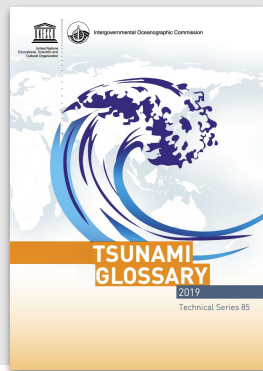
Confirmed Tsunami Source Locations affecting American Samoa, Samoa and Tonga

Year	Location	Depth (km)	Magnitude	Distance (km)	Wave Height (m)	Damage	Deaths
1837	Samoa	~10	~8.5	~100	~10	Severe	~100
1881	Samoa	~10	~8.5	~100	~10	Severe	~100
1917	Samoa	~10	~8.5	~100	~10	Severe	~100
1929	Tonga	~10	~8.5	~100	~10	Severe	~100
2009	Tonga	~10	~8.5	~100	~10	Severe	~100
2022	Tonga	~10	~8.5	~100	~10	Severe	~100

Historical Tsunami Observations near the Tonga Trench

Year	Location	Depth (km)	Magnitude	Distance (km)	Wave Height (m)	Damage	Deaths
1837	Samoa	~10	~8.5	~100	~10	Severe	~100
1881	Samoa	~10	~8.5	~100	~10	Severe	~100
1917	Samoa	~10	~8.5	~100	~10	Severe	~100
1929	Tonga	~10	~8.5	~100	~10	Severe	~100
2009	Tonga	~10	~8.5	~100	~10	Severe	~100
2022	Tonga	~10	~8.5	~100	~10	Severe	~100

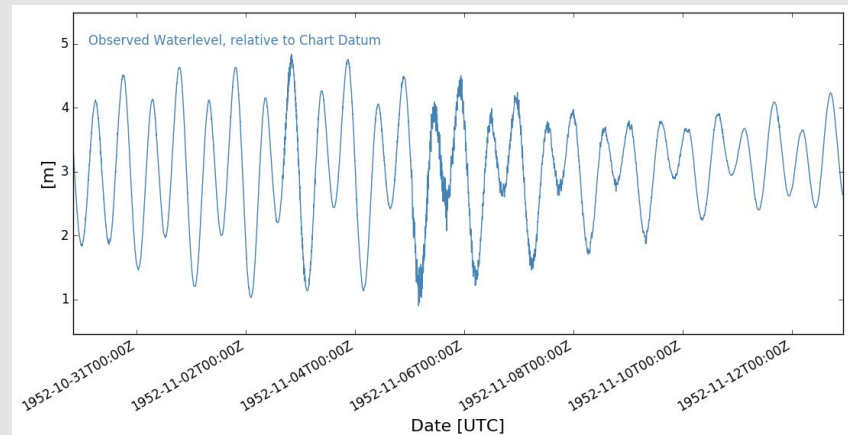
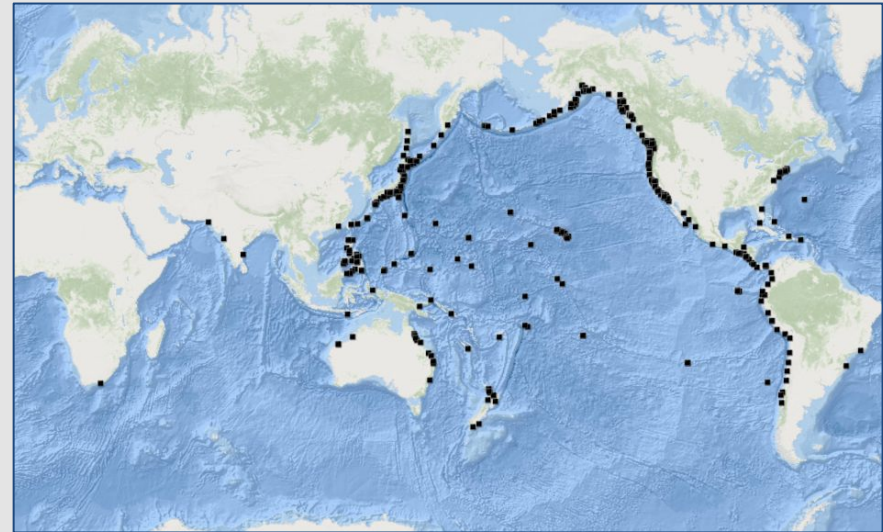
Assisted in updating UNESCO IOC Tsunami Glossary



Analog Data Records (Marigrams)

<https://www.ngdc.noaa.gov/hazel/view/hazards/tsunami/marigram-search>

- Over 3,400 historic paper records (between 1854 and 1994)
 - ~2650 images online
 - **More scans expected in 2024**
 - Recent request on smaller tsunami events
- Collected from U.S. and international stations
 - ~2500 U.S. and U.S. territories
 - ~980 international stations
- Digitized 47 marigram records over 9 significant historical tsunami events.





Summary

NCEI and the co-located World Data Service for Geophysics continues to:

- **Maintain and update a global historical tsunami event database**
- **Steward water level data for tsunami research**
- **Develop high-resolution DEMs to support a variety of programs**
- **Look for partners to work with on detailed information in their region to support these products**

Encourage ICG/PTWS Member States to submit tsunami data for archiving



Thank you!

**National Centers for Environmental Information (NCEI)
World Data Service for Geophysics**

<http://ngdc.noaa.gov>
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dem.info@noaa.gov

