

Tsunami Sources 1410 B.C. to A.D. 2011 from Earthquakes, Volcanoes, Landslides, and Other Causes

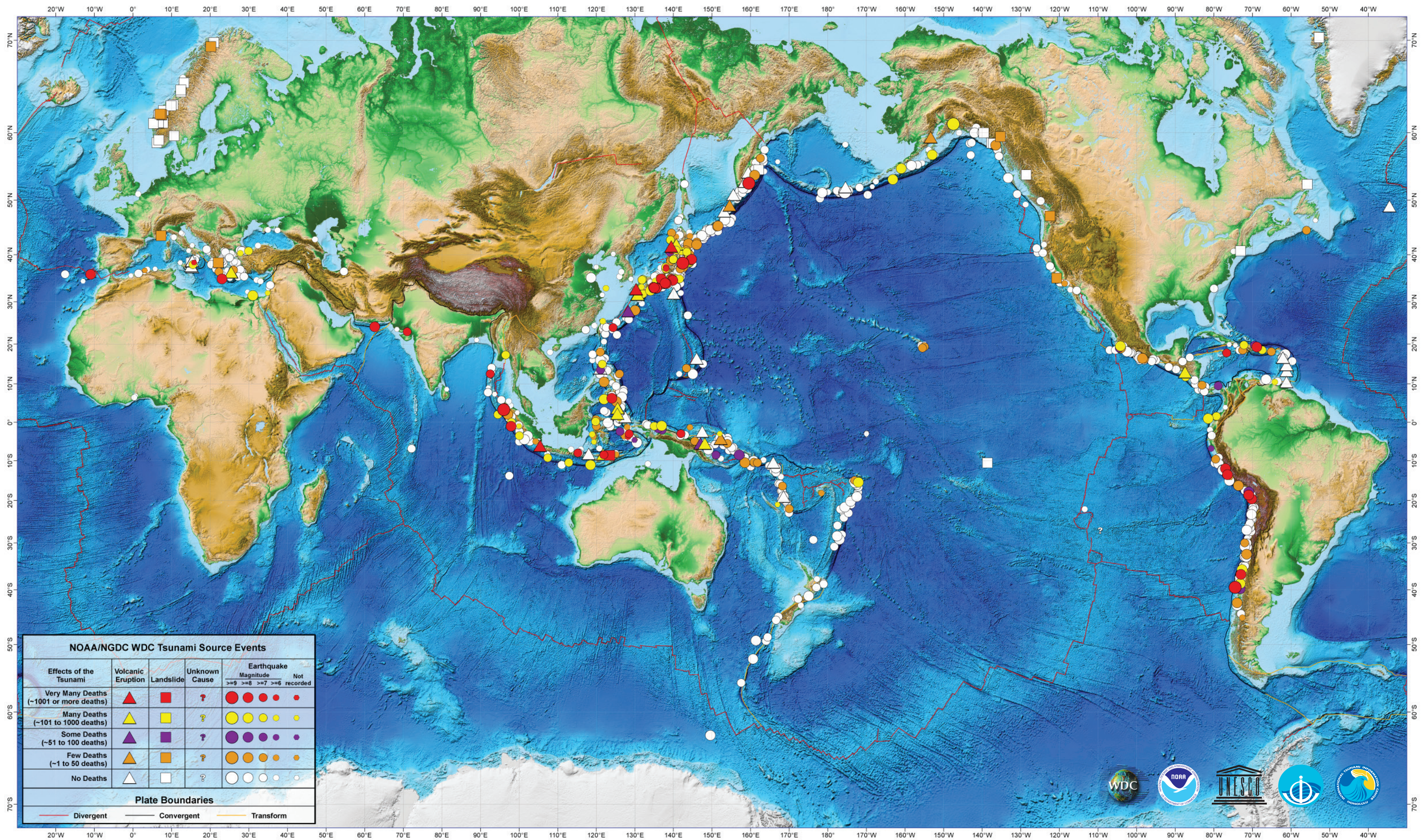


Table 1 Regional and local tsunamis causing 2,000 or more deaths

Date				Source Location	Estimated Dead or Missing
Year	Mon	Day			
365	7	21		Crete, Greece	5,700
887	8	2		Niigata, Japan	2,000
1341	10	31		Aomori Prefecture, Japan	2,600
1498	9	20		Enshunada Sea, Japan	31,000
1570	2	8		Central Chile	2,000
1586	1	18		Ise Bay, Japan	*8,000
1605	2	3		Nankaido, Japan	5,000
1611	12	2		Sanriku, Japan	5,000
1674	2	17		Banda Sea, Indonesia	2,243
1687	10	20		Southern Peru	*5,000
1692	6	7		Port Royal, Jamaica	2,000
1703	12	30		Boso Peninsula, Japan	*5,233
1707	10	28		Enshunada Sea, Japan	2,000
1707	10	28		Nankaido, Japan	*5,000
1746	10	29		Central Peru	4,800
1751	5	20		Northwest Honshu, Japan	2,100
1755	11	1		Lisbon, Portugal	*60,000
1771	4	24		Ryukyu Islands, Japan	13,486
1792	5	21		Kyushu Island, Japan**	5,443
1854	12	24		Nankaido, Japan	*3,000
1868	8	13		Northern Chile*	25,000
1883	8	27		Krakatau, Indonesia**	36,000
1896	6	15		Sanriku, Japan	*27,122
1899	9	29		Banda Sea, Indonesia	*2,460
1923	9	1		Sagami Bay, Japan	2,144
1933	3	2		Sanriku, Japan	3,022
1945	11	27		Makran Coast, Pakistan	*4,000
1952	11	4		Kamchatka, Russia	4,000
1976	8	16		Moro Gulf, Philippines	4,376
1998	7	17		Papua New Guinea	2,205
2004	12	26		Banda Aceh, Indonesia	*227,898
2011	3	11		Tohoku, Japan	*20,896
Total					530,728

*May include earthquake deaths

**Tsunami generated by volcanic eruption

Table 3 Tsunamis causing deaths greater than 1000 km from the source location

Date	Estimated Dead or Missing						
	Year	Mon	Day	Source Location	Local and Regional	Distant	Distant locations that reported casualties
1837	11	7		Southern Chile	0	16	USA (Hawaii)
1868	8	13		Northern Chile**	*25,000	7	New Zealand, Samoa, Southern Chile
1877	5	10		Northern Chile	Hundreds	Thousands	Fiji, Japan, Peru, USA (Hawaii)
1883	8	27		Krakatau, Indonesia	36,000	2	Sri Lanka
1899	1	15		Papua New Guinea	0	Hundreds	Caroline Islands, Solomon Islands
1901	8	9		Loyalty Islands, New Caledonia	0	Several	Santa Cruz Islands
1923	2	3		Kamchatka, Russia	2	1	USA (Hawaii)
1945	11	27		Makran coast, Pakistan	*4,000	Some	India
1946	4	1		Unimak Island, Alaska, USA	5	159	USA (California, Hawaii)
1960	5	22		Central Chile	1,000	223	Japan, Philippines, USA (California, Hawaii)
1964	3	28		Prince William Sound, Alaska, USA	106	18	USA (California, Oregon)
2004	12	26		Banda Aceh, Indonesia***	*175,827	52,071	Bangladesh, India, Kenya, Maldives, Myanmar, Seychelles, Somalia, South Africa, Sri Lanka, Tanzania, Yemen
2011	3	1		Tohoku, Japan	*20,894	2	Indonesia, USA (CA)

*May include earthquake deaths

**Local and regional deaths in Chile and Peru

***Local and regional deaths in Indonesia, Malaysia, and Thailand

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Table 2 Regional and local tsunamis causing deaths since 1975

Date				Source Location	Estimated Dead or Missing
Year	Mon	Day			
1975	10	31		Philippine Trench	1
1975	11	29		Hawaii, USA	2
1976	8	16		Moro Bay, Philippines	4,376
1977	8	19		Sumbawa, Indonesia	189
1979	7	18		Lebata Island, Indonesia**	1,465
1979	9	12		Irian Jaya, Indonesia	100
1979	10	16		French Riveria**	9
1979	12	12		Narino, Colombia	*600
1981	9	1		Samoa Islands	2
1983	5	26		Noshiro, Japan	100
1988	8	10		Solomon Islands	1
1991	4	22		Limon, Costa Rica	2
1992	9	2		Off coast Nicaragua	170
1992	12	12		Flores Sea, Indonesia	1,169
1993	7	12		Sea of Japan	208
1994	6	2		Java, Indonesia	250
1994	10	8		Halmahera, Indonesia	1
1994	11	4		Skagway Alaska, USA**	1
1994	11	14		Philippine Islands	*81
1995	5	14		Timor, Indonesia	11
1995	10	9		Manzanillo, Mexico	1
1996	1	1		Sulawesi, Indonesia	9
1996	2	17		Irian Jaya, Indonesia	110
1996	2	21		Northern Peru	12
1998	7	17		Papua New Guinea	2,205
1999	8	17		Izmit Bay, Turkey	155
1999	11	26		Vanuatu Islands	5
2001	6	23		Southern Peru	26
2004	12	26		Banda Aceh, Indonesia	*227,898
2005	3	28		Sumatra, Indonesia	10
2006	3	14		Seram Island, Indonesia	4
2006	7	17		Java, Indonesia	804
2007	4	1		Solomon Islands	*52
2007	4	21		Southern Chile	10
2009	9	29		Samoa Islands	191
2010	1	12		Haiti	7
2010	2	27		Southern Chile	156
2010	10	25		Mentawai, Indonesia	431
2011	3	11		Tohoku, Japan	*20,896
Total					261,720

*May include earthquake deaths

**Tsunami generated by landslide

NOAA's National Geophysical Data Center (NGDC) and co-located World Data Center (WDC) for Geophysics and the International Tsunami Information Center (ITIC), a UNESCO/IOC-NOAA partnership, have collaborated to produce a map showing tsunami sources. The information comes from the NGDC Historical Tsunami Database that includes information on tsunami source events throughout the world that range in date from 1410 B.C. to A.D. 2011. The tsunami definitions are from the Tsunami Glossary 2008 published by UNESCO.

Of the 2,100 events in the NGDC Historical Tsunami Database, over 1,100 confirmed tsunami source events are displayed on the map. The global distribution of these tsunami sources is 70% Pacific Ocean, 15% Mediterranean Sea, 8% Caribbean Sea and Atlantic Ocean, 6% Indian Ocean, and 1% Black Sea. Most of these tsunamis were generated by earthquakes (83%) or earthquakes that caused landslides (6%). The remaining events were caused by volcanic eruptions (6%), landslides (3%), and unknown sources (2%).

Tsunamis are also classified by how far away the effects of the waves were observed. For example, the effects of a local tsunami are confined to coasts within about 100 km (62 miles) or less than 1 hour tsunami travel time from its source. A tsunami capable of destruction within 1,000 km (621 miles) or 1-3 hours travel time from its source is considered a regional tsunami. Most destructive tsunamis can be classified as local or regional. It follows that many tsunami-related deaths and considerable property damage result from these tsunamis (Table 1). In fact, 90% of all tsunami deaths in the historic record occurred in the local or regional area within the first 3 hours of the event. Between 1975 and 2011 there were 39 local or regional tsunamis that resulted in deaths and property damage (Table 2); 26 of these were in the Pacific and its adjacent seas.

A distant or teletsunami is a tsunami originating from a far away source, generally more than 1,000 km (621 miles) or more than 3 hours tsunami travel time away. They usually start as a local tsunami that causes extensive destruction near the source; the waves then continue to travel across the entire ocean basin with sufficient energy to cause additional deaths and destruction on distant shores. In the last 200 years, there have been at least 31 damaging teletsunamis and 13 caused deaths more than 1,000 km (621 miles) from the source (Table 3).

The events in the NGDC Historical Tsunami Database were gathered from the NOAA Tsunami Warning Centers, NOAA National Data Buoy Center, NOAA National Ocean Service, UNESCO/IOC-NOAA International Tsunami Information Center, NOAA Pacific Marine Environmental Laboratory, U.S. Geological Survey, national and government databases and reports, tsunami catalogs, post-event reconnaissance reports, journal articles, newspapers, internet sources, email, and other written documents. This compilation does not include sources inferred from the study of tsunami deposits. Tsunami deposits are the physical evidence left behind when a tsunami impacts a shoreline or affects submarine sediments. For a complete listing of references used in compiling the database, please visit: <http://www.ngdc.noaa.gov/hazard/>

The data in the NGDC Historical Tsunami Database are continually being updated and reviewed for accuracy. Please contact NGDC (paula.dunbar@noaa.gov) or ITIC (l.kong@unesco.org, laura.kong@noaa.gov) with any changes, additions, or comments.

References:

Intergovernmental Oceanographic Commission (IOC). 2008. Tsunami Glossary, 2008. Paris, United Nations Educational, Scientific, and Cultural Organization (UNESCO). IOC Technical Series, 85. (English)

Plate boundaries from the Plates Project, University of Texas, Institute for Geophysics, Austin, TX (<http://www.ig.utexas.edu/research/projects/plates/data.htm>).

Topography/Bathymetry from Amante, C. and B. W. Eakins. 2008. ETOPO1 1 Arc-Minute Global Relief Model: Procedures, Data Sources and Analysis. National Geophysical Data Center, NESDIS, NOAA, U.S. Department of Commerce, Boulder, CO (<http://www.ngdc.noaa.gov/mgg/global/>).