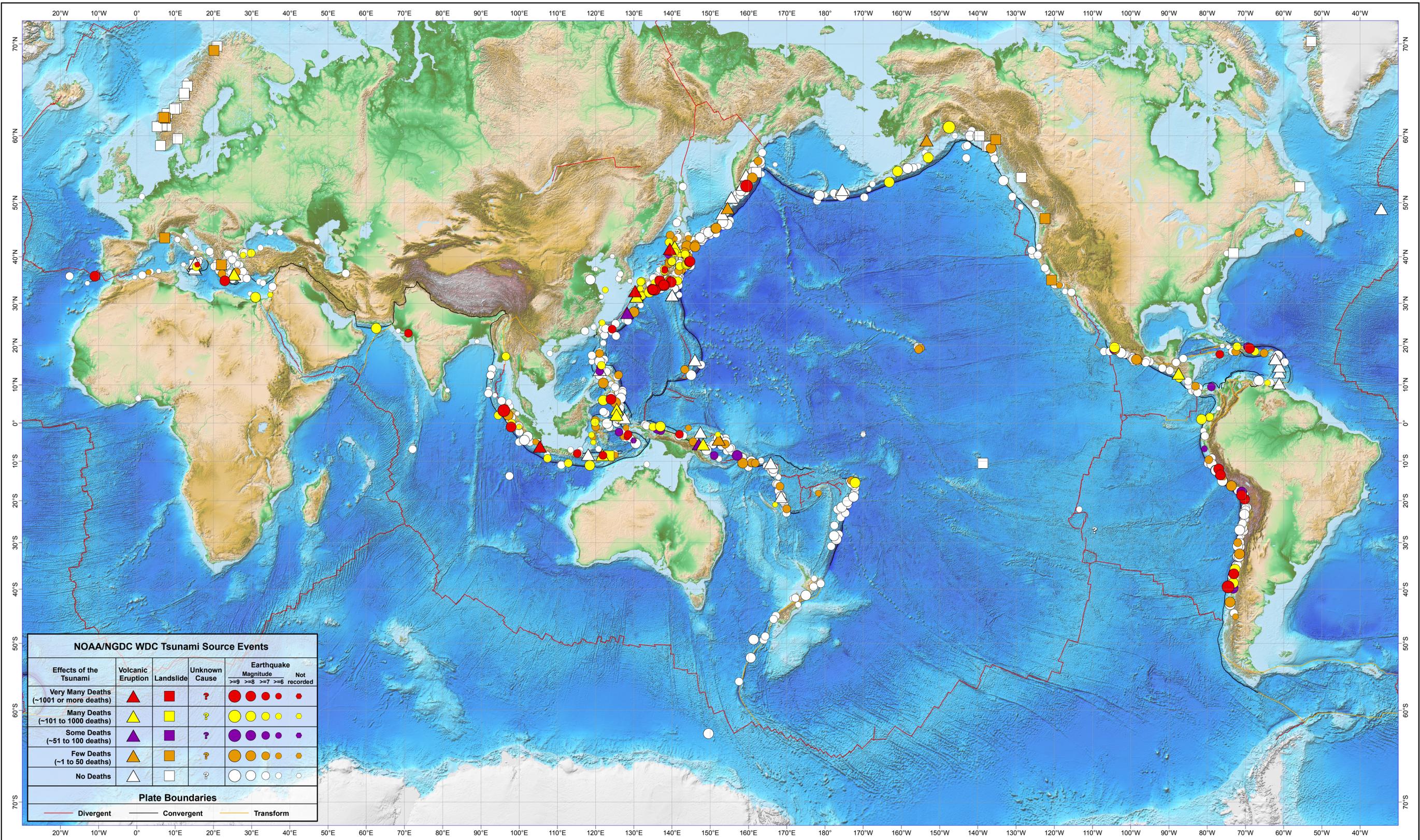


Tsunami Sources 1650 B.C. to A.D. 2010 from Earthquake, Volcano, Landslide, and Other Causes



NOAA/NGDC WDC Tsunami Source Events					
Effects of the Tsunami	Volcanic Eruption	Landslide	Unknown Cause	Earthquake Magnitude	
				>=9	>=8 >=7 >=6 recorded
Very Many Deaths (~1001 or more deaths)	▲	■	?	●	●
Many Deaths (~101 to 1000 deaths)	▲	■	?	●	●
Some Deaths (~51 to 100 deaths)	▲	■	?	●	●
Few Deaths (~1 to 50 deaths)	▲	■	?	●	●
No Deaths	▲	■	?	●	●

Plate Boundaries		
—	—	—
Divergent	Convergent	Transform

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

Date	Year	Mon	Day	Source Location	Estimated Dead or Missing
365	7	21		Crete, Greece	5,700
867	8	2		Niigata, Japan	2,600
1341	10	31		Aomori Prefecture, Japan	2,600
1498	9	20		Eruwharua Sea, Japan	31,000
1570	2	8		Central Peru	2,300
1586	1	18		Ise Bay, Japan	8,000
1605	2	3		Nankaido, Japan	5,000
1611	12	2		Sanku, 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		Bosw. Prefecture, Japan	5,233
1707	10	28		Eruwharua Sea, Japan	2,000
1707	10	28		Nankaido, Japan	30,000
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**	4,300
1854	12	24		Nankaido, Japan	3,000
1868	8	13		Northwest Chile*	25,000
1883	8	27		Karatake, Indonesia**	36,000
1896	6	15		Sanku, Japan	31,122
1899	9	29		Banda Sea, Indonesia	2,460
1923	9	1		Sagami Bay, Japan	2,144
1933	3	2		Sanku, Japan	3,022
1976	8	16		Maro Gulf, Philippines	4,456
1992	12	12		Flora Sea, Indonesia	2500
1998	7	17		Papua New Guinea	2,183
2004	12	26		Banda Aceh, Indonesia	227,898

*May include earthquake casualties
**Tsunami generated by volcanic eruption

NOAA's National Geophysical Data Center (NGDC) and co-located World Data Center (WDC) for Geophysics and Marine Geology 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 1650 B.C. to A.D. 2010. The tsunami definitions are from the Tsunami Glossary 2008 published by UNESCO.

Of the 2,000 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 71% Pacific Ocean, 15% Mediterranean Sea, 7% 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 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 casualties and considerable property damage result from these tsunamis (Table 1). Between 1975 and 2010 there were 37 local or regional tsunamis that resulted in deaths and property damage (Table 2); 25 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 three 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 casualties and destruction on distant shores. In the last 200 years, there

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

Date	Year	Mon	Day	Source Location	Estimated Dead or Missing		Distant locations that reported casualties
					Local	Distant	
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)
1896	6	15		Sanku, Japan	4,000	4,000	Japan, East coast of China
1899	1	15		Papua New Guinea	0	Hundreds	Caroline Islands
1901	8	9		Loyalty Islands, New Caledonia	1	2	Several
1923	2	3		Kanokoshi, Russia	2	1	USA (Hawaii)
1945	11	27		Makran coast, Pakistan	300	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	178,827	52,071	Bangladesh, India, Kenya, Maldives, Myanmar, Seychelles, Somalia, South Africa, Sri Lanka, Tanzania, Yemen

*May include earthquake casualties

NOAA / National Geophysical Data Center
World Data Center for Geophysics and Marine Geology
325 Broadway
Boulder, CO 80305-3328 USA
Tel: 1-303-497-6084, Fax: 1-303-497-6513
Email: paula.dunbar@noaa.gov
URL: http://www.ngdc.noaa.gov/hazard/

The International Tsunami Information Center
A UNESCO/IOC - NOAA Partnership
737 Bishop St., Ste. 2200
Honolulu, Hawaii 96813 USA
Tel: 1-808-532-6422, Fax: 1-808-532-5576
Email: I.kong@unesco.org, laura.kong@noaa.gov
URL: http://www.tsunamiwave.info

have been at least 27 damaging teletsunamis and 12 caused fatalities 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/index.htm#data>)
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/global.html>)

Table 2
Regional and local tsunamis causing deaths since 1975

Date	Year	Mon	Day	Source Location	Estimated Dead or Missing
1975	10	31		Philippine Trench	2
1975	11	20		Hawaii, USA	4,456
1976	8	16		Maro Bay, Philippines	189
1977	6	15		Southern Indonesia	4,539
1979	7	18		Letiwa Island, Indonesia**	6
1979	9	12		Iran, Java, Indonesia	100
1979	10	16		French Polynesia**	6
1979	12	12		Namco, Colombia	1000
1981	8	1		Samoa Islands	3
1983	5	26		Norhoku, Japan	100
1986	8	10		Solomon Islands	1
1991	4	22		Luzon, Costa Rica	2,500
1992	9	2		Off coast Nicaragua	170
1992	12	12		Flora Sea, Indonesia	2,500
1993	7	17		Sea of Japan	230
1994	6	2		Java, Indonesia	250
1994	8	14		Halmahera, Indonesia	1
1994	11	4		Skagway Alaska, USA**	1
1994	11	14		Philippine Islands	798
1995	5	14		Tener, Indonesia	11
1995	10	9		Manzanillo, Mexico	1
1996	1	1		Sulawesi, Indonesia	9
1996	2	17		Iran, Java, Indonesia	110
1996	7	21		Northern Peru	12
1996	7	17		Philippine Islands	2,183
1999	8	17		Uzmi Bay, Turkey	150
1999	11	26		Vanuatu Islands	10
2001	6	23		Southern Peru	26
2004	12	26		Banda Aceh, Indonesia	227,898
2005	3	28		Somalia, Indonesia	10
2006	3	14		Seram Island, Indonesia	4
2006	11	7		Java, Indonesia	664
2007	4	1		Solomon Islands	12
2007	23			Southern Chile	10
2009	8	29		Sumatra Islands	181
2010	1	12		Haiti	7
2010	2	27		Southern Chile	124

*May include earthquake casualties
**Tsunami generated by landslide