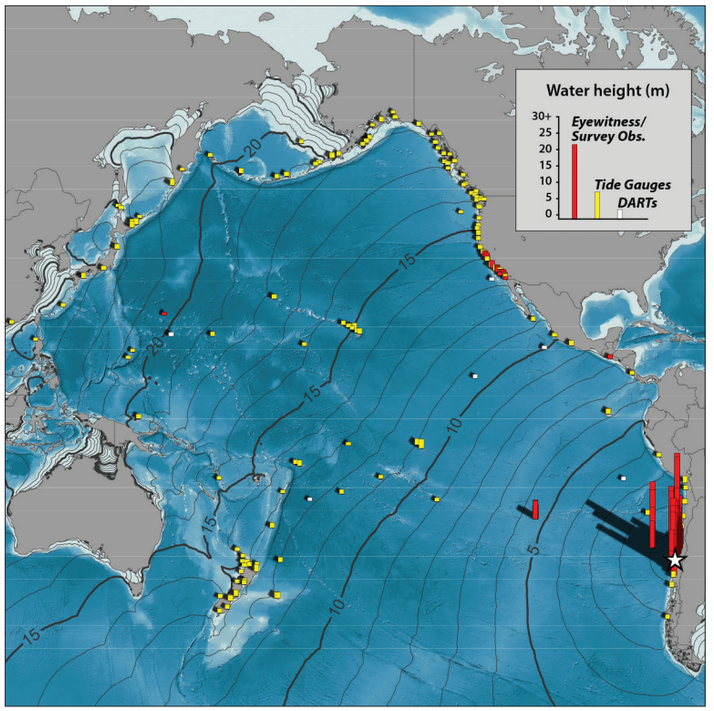
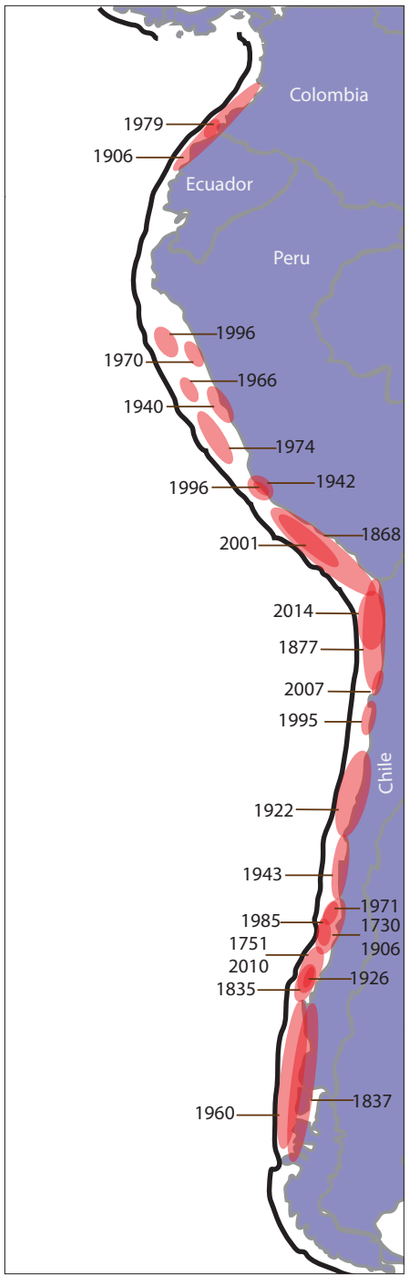


February 27, 2010 tsunami water heights from eyewitness accounts, field surveys, tide gauges, and DARTs; and estimated tsunami travel times plotted at 1-hour intervals (black lines) using the earthquake epicenter (star) as a point source. The maximum runup was 29 meters at Constitución, Chile. (Credit: J. Varner, NGDC)



The Peru-Chile subduction zone is the second most dangerous tsunami source zone in the Pacific, with 15% of the Pacific's deadly tsunami over history. Tsunami sediment studies suggest recurrence intervals of several hundred years or more. (Credit: ITIC-IOC)

2010 February 27, Mw 8.8 South-Central Chile

On February 27, 2010 a great Mw 8.8 earthquake occurred off the coast of Chile about 100 kilometers north of Concepción. The earthquake resulted from thrust faulting on the interface between the Nazca and South American plates. The epicenter (36.122°S, 72.898°W) was located in the center of the Concepción – Constitución area (35°S – 37°S) in south-central Chile, identified as a mature seismic gap. The earthquake ground shaking and resulting tsunami caused 512 deaths, 46 missing and presumed deaths, and USD $30 billion damage in Chile. According to continuing investigations, the majority of the fatalities are attributed to the earthquake; while the tsunami accounts for at least 156 victims concentrated in the coastal regions of Maule and Biobio, Robinson Crusoe Island of the Juan Fernandez Archipelago, and Mocha Island.

The PTWC issued warnings for Chile and Peru 12 minutes after the earthquake. The tsunami arrived within 30 minutes at many locations in Chile, therefore, official evacuations and warnings by local authorities were not available at many places prior to the arrival of the tsunami. Fortunately, most coastal residents in Chile were aware of the tsunami risk and evacuated to high ground as a result of ancestral tsunami knowledge, regular evacuation drills, and education programs. In interviews after the event, many older residents remembered the 1960 tsunami and had passed on their lessons learned to family and friends over the years. Additionally, large regional tsunamigenic earthquakes beforehand in southern Peru in 2001 (Mw 8.4) and 2007 (Mw 8.0), and in Chile in 2007 (Mw 6.2, Mw 7.7) had greatly raised awareness of the dangers of local tsunamis.

The single largest loss of life from either ground shaking or inundation was in Constitución, where numerous people died who were staying overnight on the Oreggo Island at the mouth of the Maule River or at the adjacent low-lying coastal campgrounds. The island was accessible only by boat, had no high ground, and was an informal campground fully occupied on the weekend of February 27. The island was completely submerged by the tsunami with a 10 meter flow depth. Dozens of campers, who were mostly Chilean visitors enjoying the late summer weekend and anticipating

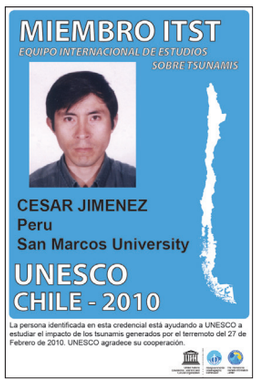
Many coastal towns were destroyed, leaving wooden debris everywhere. In Llolleo, Chile, runups of 3 to 4 meters. (Credit: H. Fritz, Georgia Tech Univ.)

Fishing boat was carried inland several kilometers near Coliumo, southern Chile. Brown vegetation that died from sea water immersion delineates maximum tsunami runup. ITST-Chile post-earthquake and tsunami surveys by engineers documented structural impacts. (Credit: G. Chock, I. Robertson)

scheduled fireworks over the island, were washed away by the tsunami. The tsunami was observed throughout the Pacific basin and caused $3.5 million damage to California boat harbors, but all tsunami-related deaths were confined to the local area.

Following the event, International Tsunami Survey Teams (ITST-Chile) measured runups and flow depths, documented the effects of the tsunami, and interviewed eyewitnesses. Altogether, there were more than 25 teams and 70 scientists that conducted surveys between mid-March and May 2010. The survey area was extensive, covering 800 kilometers of coast, as well as nearby Robinson Crusoe and Mocha Islands, and Juan Fernandez and Easter Islands in the Pacific. The maximum runup of 29 meters was measured at Constitución along a steep coastal bluff. To the north of Constitución, the runup distribution exhibited a decaying trend with runup heights typically between 5 and 10 meters exceeded only by a 14 meter runup on a coastal bluff within 70 meters of the shoreline at Caleta de Mostazal 35 kilometers south of San Antonio.

In 2014, four large earthquakes again struck Chile, the largest an Mw 8.2 earthquake off Iquique in northern Chile. The PTWC issued warning advice on April 1, 2014 at 23:55 UTC and Chile's SNAM followed with Watch and then Warning at 23:56 UTC and 23:59 UTC, respectively. Two to four meters runups struck 10-30 minutes after the earthquake in Pisagua, Iquique, Patache, and Chipana arriving at high tide adding to the flooding; with no loss of life. The 2014 earthquakes were located along the same fault segment as the 1995 Mw 8.0, 2007 Mw 7.7, and 1877 M 8.3 earthquakes.



The 2010 ITST-Chile was a coordinated effort organized by UNESCO, IOC, ITIC, USGS, and local scientists, at the request of the Government of Chile to assist them in immediately assessing the tsunami and its impact. Upon arrival, each team met with UNESCO Santiago staff, which briefed them on the current situation and provided them with an official ID badge and Letter of Support. The 2011 ITST-Japan provided similar credentials, and was closely coordinated to complement the Japan National Survey Teams and ensure safety around the Fukushima Nuclear Plant crisis. (Credit: ITIC)