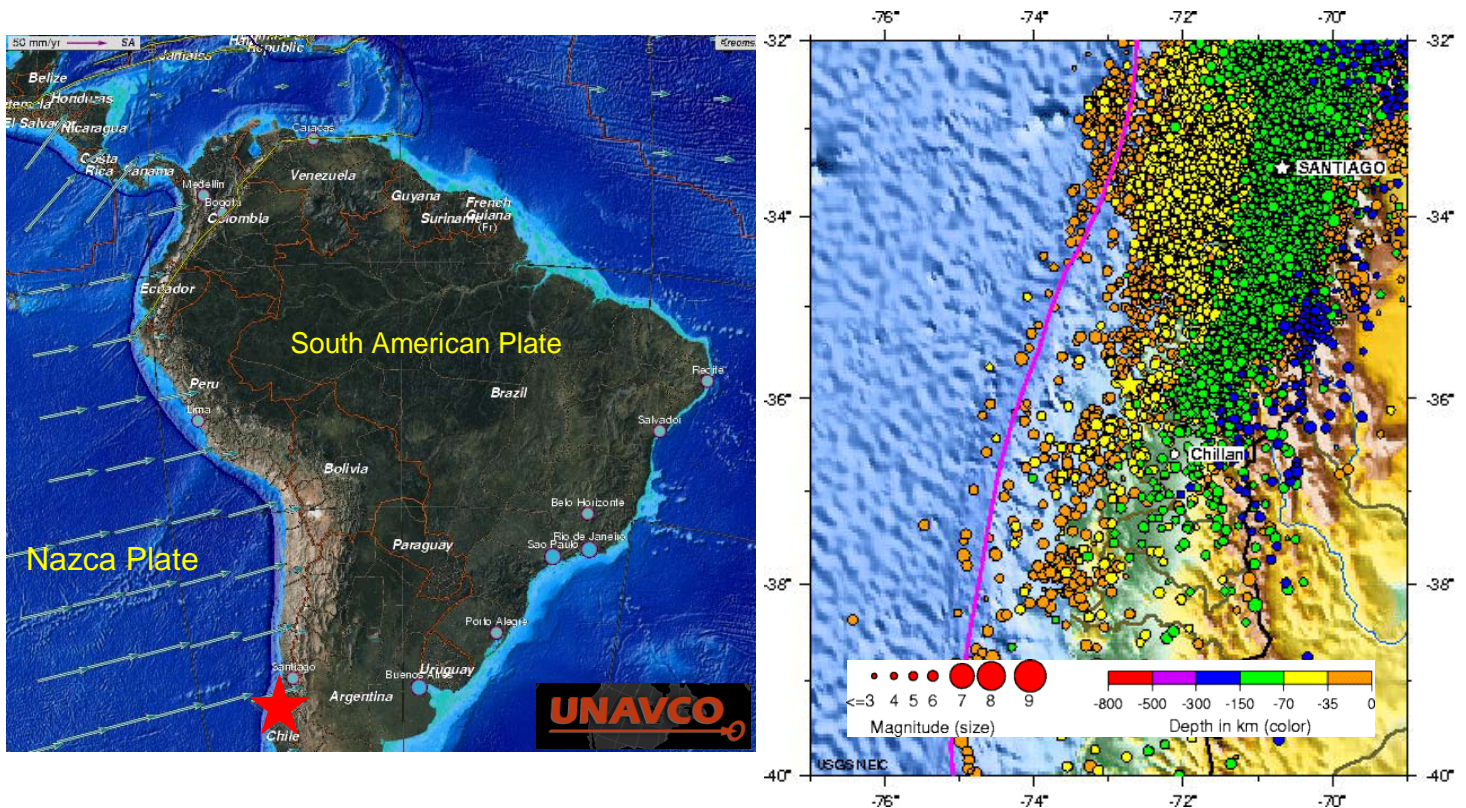
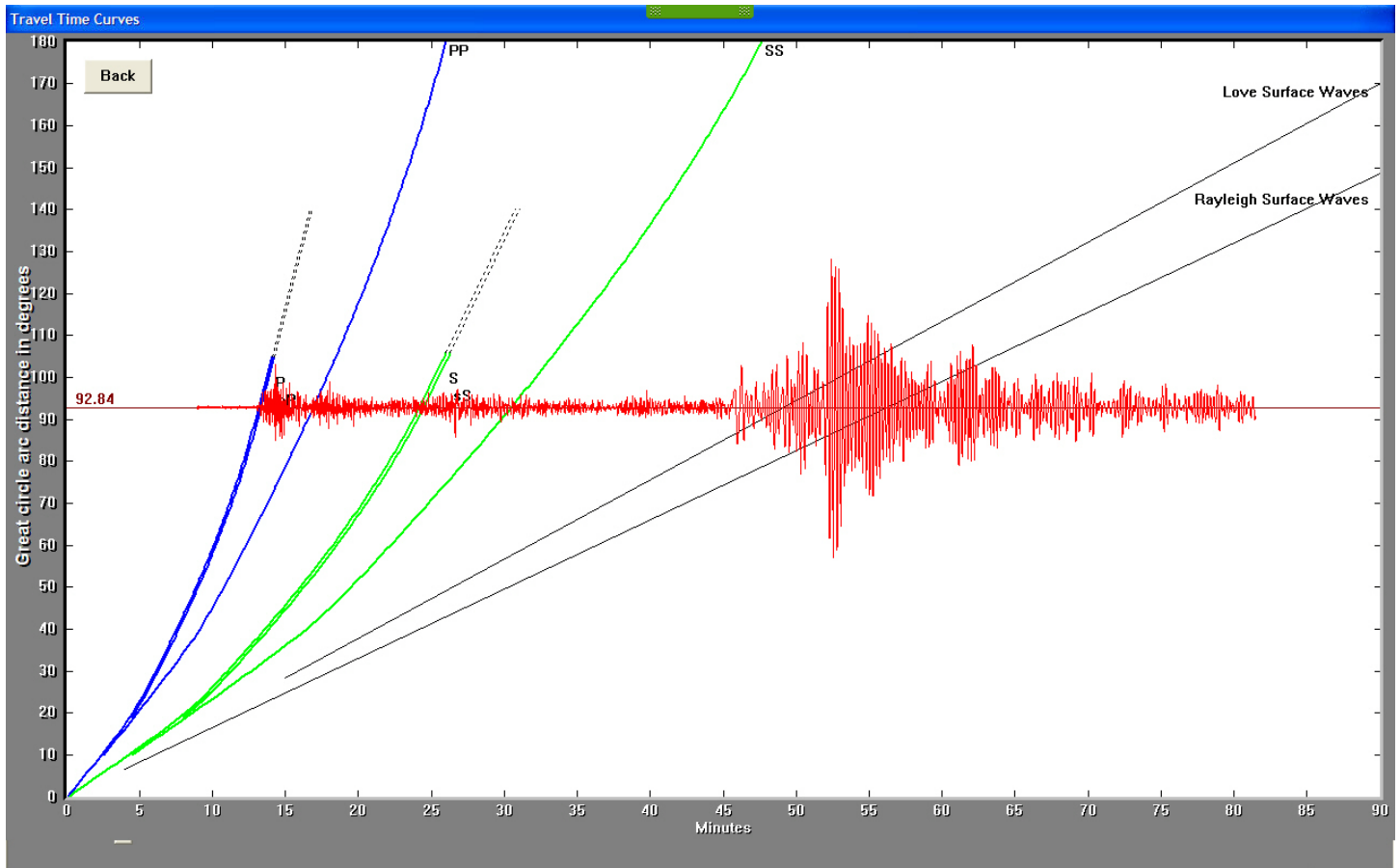


Magnitude 8.8 Great Earthquake Offshore Central Chile
Saturday, February 27, 2010 at 06:34:14 UTC
03:34:14 AM Local time in Chile
10:34:14 PM Pacific Standard Time
Epicenter: Latitude 35.846 °S, Longitude 72.719 °W
Depth: 35 kilometers.

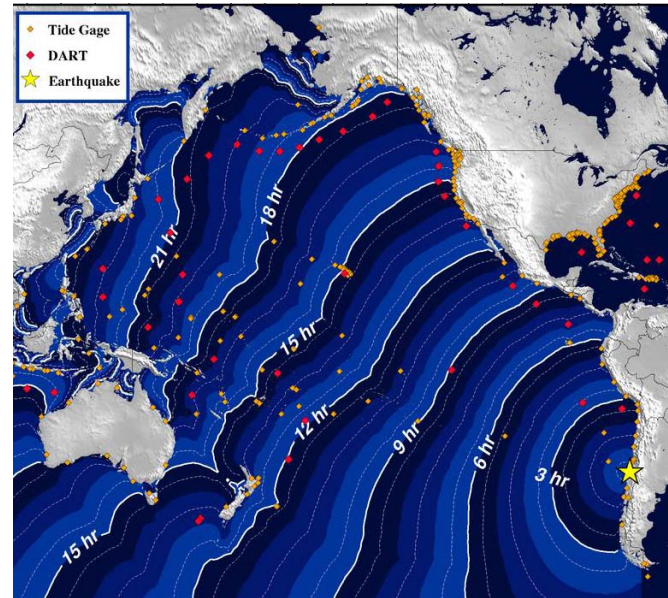
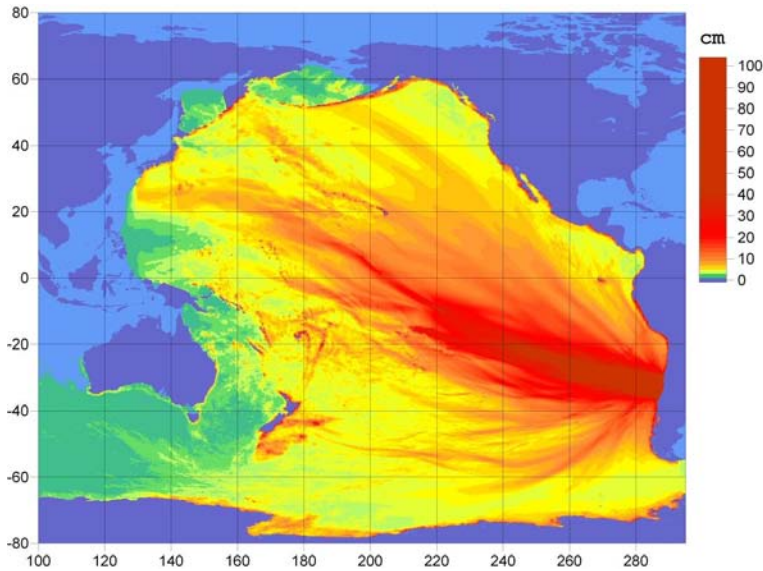
A great earthquake occurred near the coast of central Chile at 3:34 AM local time Saturday February 27. This earthquake occurred on the subduction zone plate boundary at the Peru – Chile Trench where the oceanic Nazca Plate subducts beneath the continental South American Plate. The red star on the left-hand map below shows the epicenter of the earthquake while the arrows show the direction of motion of the Nazca Plate toward the South American Plate. At the location of this earthquake, the two plates are converging at a rate of about 8 cm/yr. The map on the right shows historic earthquake activity near the epicenter (star) from 1990 to present. Earthquakes are shallow at the Peru - Chile Trench and increase to > 300 km depth (blue dots) towards the east as the Nazca Plate dives deeper beneath the South American Plate. The epicenter of this M8.8 great earthquake is just 115 km (70 miles) NNE from Concepcion, an area of ~900,000 inhabitants that experienced severe ground shaking and major damage. Nearly 5 million people live in the Santiago metropolitan area located 325 km (200 miles) NE of the epicenter. Electric power was interrupted and substantial damage has occurred in Santiago where the airport has been closed. At this time, 122 deaths have been reported and the number of dead and injured is likely to rise considerably as communications with the most heavily affected areas are restored. Large shallow earthquakes in subduction zones can produce tsunamis and a tsunami was indeed produced by this earthquake. Along the coast of Chile, wave heights up to 2.3 meters (7.7 ft) were recorded and a tsunami warning is in effect for the Hawaiian Islands.



The record of the M8.8 Chile earthquake on the University of Portland seismometer (UPOR) is illustrated below. Portland is about 10296 km (6400 miles, 92.76°) from the location of this earthquake. Following the earthquake, it took 13 minutes and 6 seconds (786 seconds) for the compressional P waves to travel a curved path through the mantle from Chile to Portland. PP waves are compressional waves that bounce off the Earth's surface halfway between the earthquake and the seismic station. PP energy arrived 16 minutes and 48 seconds (1008 seconds) after the earthquake. S and SS are shear waves that follow the same paths through the mantle as P and PP waves, respectively. The S waves arrived 24 minutes and 6 seconds (1446 seconds) after the earthquake while SS waves took 30 minutes and 21 seconds (1821 seconds) to travel from the earthquake to Portland. Surface wave energy required approximately 39 minutes and 14 seconds (2354 seconds) to travel the 10296 km (6400 miles) around the perimeter of the Earth from Chile to Portland, Oregon.



Large subduction zone earthquakes like the M 8.8 Chilean earthquake are perfect sources of tsunamis because these events can displace a large area of ocean floor by several meters. Such a large disturbance can produce extraordinary ocean waves so tsunamis can have wavelengths greater than 100 km and periods of tens of minutes. Because the wavelength is more than 20 times the 4 km average depth of the oceans, a tsunami travels as a “shallow water” wave than can propagate across an entire ocean basin with minimal loss of energy. In the open ocean, a tsunami travels at a speed of over 700 km/hr (~440 mph) and the wave moves the ocean water all the way to the sea floor. This “shallow water” behavior means that the velocity and projected wave heights of a tsunami can be calculated using a map of ocean depth. The map on the left below is from NOAA’s West Coast and Alaskan Tsunami Warning Center. This map shows the predicted amplitudes of the tsunami produced by the M8.8 Chilean earthquake.



The map on the right above shows travel times for the tsunami from the Chilean earthquake. The first waves are predicted to reach Hawaii at about 11:05 AM Hawaii time, about 14.5 hours after the earthquake occurred in Chile. Warning sirens were activated at 6:00 AM Hawaii time and preparations for the arrival of the tsunami in Hawaii are underway. A tsunami advisory (low level warning) has also been made for the west coast of the United States from California to Alaska. These waves are expected to arrive in southern California around noon local time with wave heights of approximately 2 to 3 feet.