

One of the strongest earthquakes in New Zealand in the past 200 years

On November 13, 2016 New Zealand's South Island was struck by one of the strongest earthquakes the country has observed in the past 200 years.

According to both the U.S. Geological Survey and New Zealand's Seismological Observatory GNS Science, the earthquake had a magnitude of 7.8 which makes it to one of the five strongest recorded earthquakes in New Zealand.

Recorded at Norwegian seismic stations

Shortly after the earthquake happened, NORSAR's seismic stations in Norway and at the Troll base in Antarctica recorded strong signals of the event (see Figure).

The main shock was followed by a significant number of aftershocks with magnitudes up to 6 on the Richter scale.

Heavily stricken region

The earthquake's hypocenter (rupture starting point) was located approximately 95 km north of Christchurch, which, with a population of 375,000 is the largest city on New Zealand's South Island. This region was heavily stricken by several earthquakes in the period 2010-2012. The focal depth for this new earthquake was provided at 15 km (GNS) to 23 km (USGS).

- This is probably one of the reasons why the extent of damages and losses are comparably low. Other, probably more pivotal reasons for the low numbers of casualties were the affected region's low population number, as well as the low vulnerability of the prevalent building stock, says Dominik Lang, Head of Department Earthquake Hazard and Risk.

According to GNS Science, the earthquake's epicenter was located 15 km north-east of the small city of Culverden in Hurunui District, a 8660 sq.km. large area with only 12,700 inhabitants. The existing building stock mostly consists of one-story timber frame buildings with light-weight roof systems.

Explains the tsunami warning

Even though the epicenter was located onshore with a significant distance to the eastern shore of the island, a tsunami warning for all of New Zealand's coasts was initially released and kept active for several hours after the quake. According to New Zealand scientists, the tsunami warning was released since the earthquake's fault plane projected offshore and the predominantly strike-slip source mechanism involved thrust motion.

- This may lead to an uplift or drop of the sea floor and thereby generating tsunami waves, says Lang.

Complex pattern of quakes

Like other large earthquakes in New Zealand, this quake appears to have involved jumping from one fault rupture to another in a complex pattern. This compound style of rupture was a feature of the magnitude 7.1 Darfield quake of 2010 where up to eight neighboring faults ruptured almost simultaneously.

The recent November 13, 2016 event was triggered by the Marlborough fault system, a sub system of the Alpine fault which runs for about 600 km up the spine of the South Island, and being one of the world's major geological features. The Alpine fault is the onland boundary of the Pacific and Australian Plates.

Shallow quakes more dangerous

In the period 2010-2012 Christchurch City and the surrounding region was hit by several major earthquakes. On February 22, 2011, 185 people were killed during a shallow quake of magnitude 6.3 located close to city.

- Since New Zealand is being located along a tectonic border of the Australian Plate to the west and the Pacific Plate to the east, almost all parts of New Zealand are susceptible to experience severe earthquake activity. Records of historical seismicity since the mid of the 19th century show 19 events with magnitudes greater than 7, with the largest ever recorded earthquake in New Zealand being the M 8.2 Wairarapa earthquake on January 23, 1855, explains Lang.

Picture text

The figure shows observations on NORSAR's seismic stations at the Troll base in Antarctica and in Hedmark, southern Norway.