

# The 14 August 2021 Haiti Earthquake (Mw7.2): Coseismic and postseismic processes and implications on future hazard

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On 14 August 2021, an Mw 7.2 earthquake struck the Tiburon Peninsula of the Republic of Haiti, killing more than 2,000 people. Enriquillo-Plantain Garden fault (hereafter called Enriquillo fault) runs through the peninsula, forming the boundary of the Gonave microplate to the north and the Caribbean plate to the south. The August 2021 earthquake occurred along the Enriquillo fault, just as same as the earthquake that struck Haiti in 2010. The epicenter of the 2021 quake was located approximately 75 km west of the 2010 epicenter.

Some studies have suggested that the earthquake in 2010 did not rupture the Enriquillo fault but another blind fault (Calais et al., 2010; Hashimoto et al., 2011), because 1) geomorphological features suggest the Enriquillo fault to be nearly vertical, and 2) the coseismic deformation pattern contradicted the present landscape where lowland uplifted and highland subsided. The August 2021 earthquake, the second well-captured earthquake along the Enriquillo fault, should provide additional vital clues as to the fault structure and hence the seismic hazard of Haiti.

From the ALOS-2 SAR interferometry analysis and fault modeling, I found that, similar to the 2010 quake, the deformation due to the August 2021 quake was more prominent on the northern side of the Enriquillo fault and that a transpressional rupture (left-lateral strike-slip and reverse slip on a northward-dipping fault plane) could explain the pattern. The moment tensor solutions of the two quakes determined by USGS also showed consistency. Such similarities of the two quakes suggest that the two quakes ruptured segments of a sizeable north-dipping fault. This fault could be the Enriquillo fault or another fault that runs side-by-side with the Enriquillo fault. In either case, there remains an unruptured segment of 60 km between the 2010 and 2021 rupture segments.

Further analysis on the ALOS-2 postseismic interferograms revealed that the gap part of the fault experienced a slip of a few centimeters in several months, although the temporal evolution of the slip cannot be known from the ALOS-2 data because of the scarcity of acquisitions. Considering the dimension, amplitude, and seismicity in the observation period, the slip was most likely aseismic. Intriguingly, a seismic swarm (largest M5.6) occurred in late January 2022 on the northern side of the fault trace, implying a possibility that the aseismic slip triggered the swarm. It is unclear at the moment whether the aseismic slip indicates a lack of potential for future unstable slip.

The set of results obtained in this study strongly suggests the presence of a major north-dipping transpressional fault beneath the Tiburon Peninsula of Haiti, on which two major earthquakes and aseismic slip occurred. The probability of having an M7 earthquake in the gap segment is difficult to evaluate, but its possible future occurrence should be taken into account for the sake of disaster mitigation.

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