Earthquake expert who advised the Haiti government in 2010: 'Why were clear early warning signs missed?'

September 9 2021, by Luigi Di Sarno

The Enriquillo–Plantain Garden Fault Zone runs along the southern side of the island of Hispaniola. Credit: Wikipedia/NasaWorldWind

It was about 8:30 a.m., local time, on August 14, 2021, when I felt the room starting to shake. I was lying in my bed on the top (21st) floor of a

hotel in the Dominican Republic, to the eastern side of Haiti. The picture frames were swinging and I could see that the flat screen TV in front of the bed was also rocking from side to side.

It took me a few seconds to realize that the tremors the building was experiencing were caused by an earthquake—and I am a structural earthquake engineer, with nearly two decades of experience in academic teaching and research, plus professional consultancies for international firms and governmental agencies. But I suppose that goes to show what a shock a situation like that is to the human mind. It can be hard to believe it's happening, and can take a moment to process.

It was Saturday and, being the first day of a bank holiday weekend, I thought that I could take some extra rest to relax. I was in Santo Domingo discussing the aging bridges and vulnerability of historical buildings in the Ciudad Colonial UNESCO's World Heritage Site. It had been a hectic week of meetings about structural engineering and earthquake risk mitigation.

When I first noticed the movement of the picture frames, I initially thought it was caused by a strong wind passing through the joints of the large sea-view windows. This had happened to me in the past, from high wind speeds caused by tropical storms. But this was not the case on that Saturday morning.

My instinctive reaction was to jump from the bed. By standing on the floor, I started to experience a sense of swaying. I was now sure that an earthquake had struck. To quickly double-check this, I filled a glass which was on my desk with water, and observed the liquid sloshing: clear evidence of the building shaking.

I decided to leave my room when I started to feel the floor vibrating. Approaching the corridor, I could not see any warning signs or

evacuation routes, and I was surprised that all the lights were on and that the glass lift was fully functioning. Generally, when an earthquake happens, the power goes off. Following basic rules of earthquake engineering, I stopped close to a large column in the corridor and waited a few minutes until the shaking stopped.

I now had two options: either use the lift or walk down the stairs. I knew that the lift generally takes a few seconds to bring you to the lobby, from the 21st floor. I imagined it could take a few minutes to reach the ground floor using the stairs. So I thought the faster, the better and decided to risk a trip down in the lift. This was also based on the assumption that you never experience two large magnitude events or quakes that are very close to each other. There is an extremely low probability that a large magnitude main-shock is followed by aftershocks of the same magnitude.

When I arrived in the lobby, I checked the internet on my mobile to find out if there was any news about earthquakes in the region. I was amazed to read from the United States Geological Survey (USGS) that a 7.2 magnitude earthquake had occurred. It was localized in the south-west of Haiti, near the city of Les Cayes, about 200km (125 miles) from where I was staying.

Yet in the hotel reception, everything seemed normal. Tourists were checking in and out without a care in the world. I asked the receptionist if she had felt the strong earthquake, using my basic Spanish: "*terremoto*" (earthquake). She responded calmly: "*Oh, terremoto … no … más probable era pequeño*" (Oh, earthquake … no … most probably it was a small one). Initially, I felt a bit stupid, as it seemed that people in the Dominican Republic were well attuned to earthquake risks, deciding by simply personal perceptions whether an earthquake is "pequeño" or not.

But I soon realized that I was not being stupid at all. People in that hotel

could have been at risk. It brought home to me just how much work needs to be done, worldwide, on risk assessment and awareness.

Then, using a white paper napkin, I did some simple calculations. Considering the height of the building (which did not exhibit visible cracks) and the level of ground shaking that I derived from the online maps by USGS, I determined—roughly—the horizontal movement of the building floor (also termed "lateral displacement") that I had experienced 30 minutes earlier. In this case, the displacement was in the order of 12-14cms (or two hand palms). I was worried that the building could be severely damaged with cracks, compromising its stability so I requested a lower room and was transferred to the 13th floor. Being about 30 meters below the 21st floor was much more reassuring and certainly less scary for the night.

Haiti suffers again

The earthquake occurred in the Enriquillo Plantain Garden Fault Zone, located in the south-west of Haiti. The island of Hispaniola, which comprises two nations (the French-speaking Haiti and the Spanish-speaking Dominican Republic) is a very active seismic region of the Greater Antilles arc on the Caribbean plate, with several active faults. A fault is the resulting fracture in the Earth's outer layers, or crust, after an earthquake.

What struck that day was a 7.2 magnitude earthquake. That corresponds to strong seismic events with a large loss of lives. By August 25, the official death toll had reached 2,300, with 12,000 people injured and at least 137,000 buildings severely damaged or collapsed. The energy released during this earthquake roughly corresponded to 36 Hiroshima atomic bombs exploding simultaneously.

Surveys carried out by UNICEF also found that 94 out of the 255

schools in the western part of Haiti were severely damaged or fully collapsed.

The earthquake I had felt in my hotel room was rather "shallow" in that it originated at less than 10km from below the Earth's surface. The depth of an earthquake is very important for its effects on the built environment: the shallower the origin of the shaking, the more devastating the effects are. Seismic energy propagates through waves in the soil and tends to attenuate (or reduce) with the distance from the source (also termed hypocentre or focus).

Seismic wave propagation and attenuation are a complex geophysical phenomenon which depend significantly on the properties of the faults, the soil type, the presence of water and the depth of the "focus." To visualize the seismic wave propagation and attenuation, you might think of the circles in water when a stone thrown in a pond.

Knowledge of the fundamentals of seismology is essential to understand the complexity of Hispaniola and more generally for most Caribbean islands, which are exposed to "multi-natural hazards," such as earthquakes, hurricanes, floods and landslides. In the last ten years, I have been involved in numerous projects, funded by national and international institutions, including the Ministry of Health and Public Works in Haiti, the European Union, the World Bank, the PanAmerican Health Organization (PAHO) and the World Health Organization (WHO). My role has been in risk assessment and disaster mitigation in the Caribbean region.

My research interest has been stimulated by the complexity of natural risks in this part of the world, a place that most people know only for beautiful beaches and crystal clear seas. My work in the Caribbean has focused primarily on enhancing the resilience of existing structures and infrastructure and promoting the enforcement and adaption of building

codes.

I have provided advice for the implementation of early warning systems at critical facilities, such as hospitals. The approach that my colleagues and I at PAHO/WHO have illustrated and discussed with several Caribbean institutions is to ensure the resilience of hospitals, at least those that are at high risk (for example, large vulnerable buildings close to seismic faults or built on unstable soils). I work to try and make the buildings in earthquake zones safer and I try to help those zones be more prepared when an earthquake hits.

Many large cities in Hispaniola are heavily exposed to seismic risk because of their proximity to seismic sources, high vulnerability of existing infrastructure and the large concentration of population, as well as poor quality soils. Soil instability, exacerbated by strong ground motions and heavy rains during tropical storms, has induced hundreds of landslides. As a consequence, thousands of buildings are washed out by mud flow every year. This was the case on August 14 as the earthquake followed on from tropical storm Grace.

This devastating earthquake highlighted, once again, the high vulnerability of buildings and infrastructure on Haiti, which is the poorest country in the Latin American and Caribbean region and among one of the poorest nations in the world. Hospital facilities have been under extensive stress since the disaster. They have lost much of their functionality and most injured people were initially transported to Miami. Temporary tents were also installed in hospital outdoor parking areas and in the streets to deal with less serious cases. But such activities were jeopardized by heavy rains and storm surges following the wake of storm Grace.

Warning signs missed

What happened on August 14 was all too familiar to me. I surveyed Haiti in February 2012 in the wake of another 7.0 magnitude (2010) earthquake when I was sent by PAHO for post-disaster recovery. That earthquake caused more than 200,000 casualties as it occurred in a far more densely populated area.

During site visits, the joint PAHO and World Bank team, of which I was a member, met with several representatives of Ministry of Health and Ministry of Public Works, and we advised the enforcement of simple and robust seismic design criteria for new constructions, especially for hospital buildings. A few of the recommendations were successfully implemented in practice. Sadly, others were not.

The truth is there have been very few improvements between the 2010 and the 2021 earthquakes. For example, it is now possible to access data on the strong motions recorded by the seismic network which was installed in some private residences in different locations in Haiti. These data can be easily and freely accessed online.

Nevertheless, this network has not been efficiently used for early warning alerts. A quick examination of the data revealed to me that at least two strong motions (with magnitude 4.0 or above) were recorded *before* August 14 along the Enriquillo Plantain Garden Fault. So the warning signs were there, but nobody—it seems—was looking out for them.

But it is not only about the deployment of technology, it is about its efficient use for risk mitigation. People could have been saved by a simple message on their mobile phones which are widely used in Haiti, even in rural communities. Yet, the government issued no such warnings to its residents. The question must be asked: what exactly did Haiti's National Civil Defence do to warn the people it is charged to protect?

Sadly, many vital issues in earthquake mitigation and assessment are just not on the agenda of any of the Caribbean islands—but Haiti, in particular, has been badly served due to political turmoil and a combination of other environmental and economic factors.

Personally, I have never seen in all my career the combination of so many hazards in a single place at the same time.

The devastation of the earthquake was combined with heavy rain from tropical storms. The affected communities are poor and already under threat from COVID-19. And finally there are the political tensions—which led to the assassination of the former President of Haiti in early July. All these issues together means that it is almost impossible to manage the situation.

For example, international support for the deployment of relief supplies, along with the delivery of aid from neighboring Caribbean countries and many other nations have been hindered by COVID-19 restrictions. All these "non-technical" aspects require further investigations to evaluate their effects on the recovery.

But the 2021 Haiti earthquake has starkly demonstrated how weak communities are in low-income countries and has shown that governance of disaster management is still far from being successfully implemented in several countries worldwide, as advocated by the UN. Activities sponsored by the PAHO/WHO, World Bank and other international agencies in response to the devastating 2010 earthquake have not been very successful.

Even one month after the devastating event of August 14, there are still numerous unsolved challenges on the ground for those who are providing humanitarian aid and disaster relief. I know this because I am in regular contact with colleagues and friends who are there right now. Colleagues

like Shalini Jagnarine, regional consultant for PAHO and WHO, Barbados. She told me: "Traveling within Haiti is extremely difficult. The United Nations do not permit us to go alone by car because of the ongoing security situation. There are only two helicopters, with a long waiting list for their use. This is really delaying our relief operations."

Philippe Lauture, manager and structural engineer of a construction company, in Haiti's capital'laterthe loca Port-au-Prince, told me how thousands of residential buildings, schools, churches and hospitals have been severely affected and he has witnessed several collapses caused by landslides due to torrential rain. "We need to seriously rethink our way of planning and constructing to avoid future devastating effects," he said.

Stable local governance is a vital component for effective disaster preparedness and in building community resilience. The United Nations Office for Disaster Risk Reduction summed it up perfectly when it said: "We will not eradicate poverty if we do not reduce disasters." So the challenge is on all of us.

Provided by The Conversation

Citation: Earthquake expert who advised the Haiti government in 2010: 'Why were clear early warning signs missed?' (2021, September 9) retrieved 11 May 2024 from https://phys.org/news/2021-09-earthquake-expert-haiti-early.html