Sizing Up Seismic Activity In Latin America

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It has been one week since an earthquake devastated Haiti. A 6.0 earthquake struck Guatemala Monday, and earthquakes have recently shaken Argentina and Venezuela as well. NPR science correspondent Richard Harris explains the seismic activity in Latin America.

REBECCA ROBERTS, host:

We know in theory that earthquakes happen a lot, daily in some places. Recently, a rash of earthquakes have struck along the Pacific coast of the Americas, including a 6.0 earthquake that struck Guatemala yesterday and a somewhat strong one in Argentina the day before. No deaths or damages were reported with those quakes, but with the earthquake that devastated Haiti last week some people are wondering: Is all the seismic activity normal?

If you have questions or worries about earthquakes, give us a call. We especially want to hear from you if you live on a fault line. Tell us your story. Our number here in Washington is 800-989-8255 800-989-8255. Our email address is talk@npr.org. And you can join the conversation at our Web site. Go to npr.org and click on TALK OF THE NATION.

With me now here in Studio 3A is NPR science correspondent Richard Harris. Welcome to TALK OF THE NATION.

RICHARD HARRIS: Thanks. Good to be here.

ROBERTS: So let's start with the is-it-normal question. Is the seismic activity normal?

HARRIS: Yes, I would think the answer to that is yes. I went to the USGS Web site, the geological survey's Web site, today. And I was just sort of perusing the list of earthquakes, and we've had six already today of magnitude five or above. There were 14 yesterday of magnitude five or above.

This is - you have to ask. Well, this seems like a lot of earthquakes. But over the course of a year, according to the USGS, there are 135 - well, 134 earthquakes between 6 and

6.9 magnitudes. So that's - I mean, we're talking even larger than that. If you're looking at the five range, it's like 1,300, which - a year - which is about four a day. So, you know, these - you know, the earthquake - earthquakes happen. Earth is a very dynamic planet and we sort of lose track of that but, actually, it does happen.

ROBERTS: Well, it's interesting looking at that USGS chart because the numbers get smaller in a hurry, you know? I mean...

HARRIS: Absolutely.

ROBERTS: ...the earthquakes in the fours are at 13,000, earthquakes in the fives 1,300, earthquakes in the sixes, 130. I mean, it's almost - you drop a zero each time.

HARRIS: Yes. That's true.

ROBERTS: Which also gets to the question of - the Richter scale is not a steady incremental scale, it's an exponential scale? Can you...

HARRIS: That's true. Yeah.

ROBERTS: ...just explain that a little bit?

HARRIS: Yeah. They - basically, each point on the magnitude scale, they don't say Richter anymore. That's sort of a little outmoded but...

ROBERTS: Oh, I'm sorry. I'm passe.

(Soundbite of laughter)

HARRIS: Oh, that's fine. But it's a - the scale still exists but it's not really used anymore. But at any rate, it's true that each step up gives you a whole - each number may seem like a small number but it actually represents a very large change. It is, as you say, an exponential scale. So, by the time you're talking about earthquakes of eight and above, which are cruelly massive earthquakes, they, on average, happen about once a year. Those are extremely rare. So...

ROBERTS: Which is 10 times stronger than a seven.

HARRIS: In terms of earth movement, yeah, yeah. That's true.

ROBERTS: But earth movement is only part of it, which is also&#65533;

HARRIS: That's true.

ROBERTS: We're getting into the week a little bit here.

HARRIS: But, you know, we also have...

ROBERTS: Fine for explaining, yeah.

HARRIS: ...energy that's released so that's not 10 times the energy. You actually get more energy released for each earthquake, which is why they're felt over much wider scales and so on. So, yeah, it's a - you can get a very large, dramatic difference between the smallest earthquakes you can feel and the biggest ones. They can make a, you know - even though the numbers on the magnitude scale are not that different, the way you feel them and they way they are felt globally can add up very rapidly.

ROBERTS: And is there an earthquake season? Are there times a year when they happen more often?

HARRIS: Not to my knowledge. I've never heard that said before.

ROBERTS: It's just - you know, following it, obviously, now in January because of the Haitian quake last week, you wonder, looking at annual numbers, whether those bunch around certain times a year. But if they did, it would be an easier thing to predict and earthquakes are notoriously impossible to predict.

HARRIS: That's true. Yeah. As far as I know, they are just sort of happening willy-nilly. And even, you know, one year to the other you can even get some fairly dramatic differences. For example, let me pull out a couple more numbers here. For example, in - there were relatively few earthquakes of this size in, say, 2009 compared to 2007. I mean, you do get year-to-year variety, but again, it - just because these things happen kind of unpredictably.

Let's step back for a second and think about where earthquakes come from. You have the earth's plates, these tectonic plates, shifting past one another. And what happens is they don't move smoothly sort of over long periods of time. They rotate and they move past one another but they stick together. There's like friction that holds them still. So, basically, you have these two plates that are jammed together and eventually the stress builds up enough and bing. They release that stress all at once and that's an earthquake.

So you have this kind of, you know, in the long term you know that = where the stresses are building up and how big an earthquake might be in a particular place. That's been fairly well established. But guessing when that rock is going to break, when that slip is going to happen, is beyond the realm of science right now.

ROBERTS: Let's take a call from Jose in Port Charlotte, Florida. Jose, welcome to TALK OF THE NATION.

JOSE (Caller): Yes. Hi. I just wanted to ask question. When an earthquake happens, like a big one, say, like, the one Haiti or elsewhere, are they related, because usually when one earthquake happens then you get, like, other earthquakes in other regions. Even when the tsunami hit in the other part of the world, in Asia, in Indonesia, actually, there seemed to have been like other earthquakes. Even if they have been underwater

or in the form of tsunamis or something like that. Are they all related? Does one tectonic plate affect one in another part of the world? And I'll take that answer offline, off the air.

ROBERTS: Thanks, Jose.

HARRIS: The answer to that generally is if it's close by, the aftershocks of course are closely related to earthquakes and - the original earthquake. Seismologists also say that over lengths of, you know, 600 or 1,000 miles, you might have a relation between an earthquake and other earthquakes. But across the globe, the general answer is no, that apparently that's not the case. And although there are some scientists who are still teasing out that question and saying there is some possibility that a large earthquake one place can cause it elsewhere, because an earthquake greater than magnitude six is going to send its seismic waves all around the planet.

And so those - that earthquake will jiggle the entire earth in one place or another. Some scientists say, well, the jiggling from that is much smaller than the effect of the tides that are caused by the moon, so you know, sort of handshaking, a hand-waiving argument. It's like, well, if it's even weaker than what the moon's tides are doing, then it seems highly unlikely that the earthquake will do it. However, it's a really interesting question. Scientists are digging into it. There are some intriguing suggestions that this might be the case.

But as general rule, you know, once you realize - I mean, what we in the media do is once there's an earthquake like this, all of the sudden people are paying attention to all the earthquakes around the world. And so these earthquakes, we never report five to six magnitude earthquakes unless there's some dramatic reason to do it. But all of a sudden, we're paying attention. The earthquake happens, somebody gets, you know, shaken up a little bit in Venezuela and we put something on the air. So it's sort of a...

ROBERTS: Well, it also makes you wonder if the opposite might also be true for different places along the same fault, that a quake one place might relieve the pressure somewhere else on the fault and actually make it less likely to have an earthquake there.

HARRIS: That is exactly right. You get both building up of pressure in some places and you get relieving pressure in others. So it's quite a skill to try to sort out how that stress changes after an earthquake. And scientists have been doing that right now for the Haiti quake. I've seen actually a map that shows where stress is building up and where stress has diminished, but it still - again, that's much more of a local phenomenon than a phenomenon across large areas of land.

ROBERTS: Now, we heard with the Haiti quake that it was a relatively shallow quake - what does that mean?

HARRIS: What that means is the seismic waves don't have to travel so far in order to do damage. And it was not only shallow, but it was very close to Port-au-Prince, so the quake was about, centered about - it started about six miles underground and it was only about 10 miles from Port-au-Prince, so you end up in a circumstance where that incredible amount of energy that's being released doesn't just have a chance to dissipate very much before it hits Port-au-Prince, and that's one reason we saw so much devastation there.

ROBERTS: Let's take a call from Ted(ph) in Portland, Oregon. Ted, welcome to TALK OF THE NATION.

TED (Caller): Hi. I'd appreciate comment on the Cascadia Falls(ph) of the coast of West Coast, from Vancouver, British Columbia and down to Northern California. It goes every three to 500 years at magnitude nine. And the last time was January 26 of 1700, which we know - although that was long before white people invaded this part of the world - we know that because of Japanese newspapers. There was a tsunami that hit Japan afterwards.

And so we're in the zone on that and we've been told that a magnitude nine quake would shake Portland for eight minutes. We have put a hundred masonry buildings here, all of which would be expected to come down, and today's Oregonian, our newspaper, says, are we ready? Probably not. And I'll take any comment offline. Thank you.

ROBERTS: Thanks, Ted.

HARRIS: Yeah. That does describe a well-known phenomenon, which is also true in Haiti as well, which is that the longer there has been stress building up on a fault, the greater the potential is for a very large earthquake. And for example, in Haiti, this earthquake - this fault zone hadn't ruptured for a couple of hundred years, and so it - so scientists had actually projected before this earthquake occurred that an earthquake of magnitude up to 7.2 could, in fact, occur on this, and if that stress was relieved all at once, and we saw, well, most of it was.

There's another fault that runs just to the north of Haiti, off the ocean and it goes across the island of Hispaniola, which is the island that Haiti is on, and that hasn't ruptured for 800 years. And that could have a very substantial earthquake on it as well. And obviously this is a general phenomenon that the longer it's been between great earthquakes, the greater potential you have for another greater earthquake. It also means the uncertainty about, you know, if it's been 800 years, it could be another hundred years, or it could be another 200 years, or it could be, you know, 10 years. You don't really know.

So, yeah, those are very real seismic hazards and the safety people in the Northwest are right to focus on those and say this is a potential, we have to think about how, you know - have to ask ourselves, are the buildings built to withstand the greatest possible earthquake here? And if not, what can we do about it?

ROBERTS: You know, I lived in San Francisco for 10 years, and even though they obviously had a big quake there in '89, there was constant talk about, you know, are we due for another big one? And some of it was to just keep public awareness up and make sure you had, you know, water stowed somewhere safe and all of the things that you need to do when you live on a quake zone.

But also there was just the sort of notion of, we don't know. We don't know when it's going to happen. We don't have any particular, you know, skills in getting better at predicting when it's going to happen. And so we're going to try to sort of keep vigilant in the absence of anything better to do.

Why is earthquake technology - prediction technology - such a challenge?

HARRIS: Well, it's a challenge because you really don't know - this gets back to what I was saying earlier about the rock breaking. You just don't know when the stress is going to be big enough to make that rock slip in any one particular place. There are places actually in the San Andreas Fault that have talc like baby powder in the rock, which also can affect slipping; something that subtle can go on. So it makes it extremely difficult to predict it.

But what you saw when you were living in San Francisco was the knowledge that there is a potential for very large earthquakes. And in some ways, you can argue, it's actually more important to ask yourself are the buildings built to withstand the biggest earthquake we can expect than can we predict it's going to happen a week from Tuesday - because if the buildings are built strong enough, then it matters much less when the earthquake occurs. And so even though the timing prediction is not very good, the prediction of how strong an earthquake can be is actually arguably a more important question. And that is better answered by seismologists than the timing question, obviously, which is, by and large, a big question mark.

ROBERTS: We have an email from Tanya(ph) in Iowa, who says: I've always heard one of the biggest fault lines is in the Midwest. Can you tell me more? I live in Iowa and thankfully haven't experienced an earthquake. I'm really happy just avoiding tornadoes every spring.

And actually, Tanya, I think we have an answer for you from Scott(ph) in Paris, Tennessee. Scott, you know the Midwest fault line that our emailer is talking about?

SCOTT (Caller): Yes. It's the New Madrid.

ROBERTS: And the New Madrid fault. And do you live near there in Tennessee?

SCOTT: Yes. It's West Tennessee. I live right on the - well, it's the Tennessee-Kentucky border in Paris.

ROBERTS: And do you regularly feel tremors there?

SCOTT: Roughly once a year I'll feel a little bump if I'm sitting in the house. I was wondering when - well, I know you can't predict when, but we're due for a big one, I understand.

HARRIS: New Madrid is an unusual circumstance because it is not on one of these plate boundaries I was talking about between the tectonic plates. And so it's a much murkier situation to understand. But there was a really big earthquake there. They - I've never figured out whether this is apocryphal or not, but they claim that it rang church bells in Boston. And the Mississippi River supposedly ran backwards for a period of time.

ROBERTS: Ran backward, right. I've heard that legend too.

HARRIS: Yeah. So - some of that's true, some of it may not be true. The church bells, I think, may be apocryphal. I think the river changing direction briefly might actually have some facts behind it. But that is much harder to understand because that is not a nice clean fault like the San Andreas Fault, which is between the Pacific plate and the North American plate, where you can really study how the strangest building up there. This is a fault zone that is a result of forces that are much more diffuse. And so I think it makes it much, much more difficult to predict when an earthquake would occur there.

ROBERTS: We are talking about seismic prediction and earthquake activity with NPR's Richard Harris. You are listening to TALK OF THE NATION from NPR News.

Let's take a call from Jan(ph) in Holland, Michigan. Jan, welcome to TALK OF THE NATION.

JAN (Caller): Thanks. You know, Florida had just had that cold spell for a week when the Haiti earthquake happened. Do you think any contraction of the earth from that has anything to do with it?

HARRIS: Interesting question. I think that - I can just sort of, by first principles, say that the cold penetrating your skin and your house probably did not go very far into the ground, maybe a foot or two. And considering that this earthquake originated about six miles below the surface, I think that cold spell seems to be a highly unlikely cause of it.

ROBERTS: Let's hear from Karen(ph) in Sonoma, California. Karen, welcome to TALK OF THE NATION.

KAREN (Caller): Hi. Thank you. I live 200 miles south of Humboldt County and there was an earthquake several weeks ago, and there was a video that was captured of the tiny earthquake hit. And five seconds before the earthquake hits, a dog got up and ran out of the room, and then the video shows everything shaking. I'm wondering what kind of science or research has been done with animals in regards to prediction. And I'll take my answer off the air.

HARRIS: That's a great question. And I must say that it's been so many years since I looked into that that I can't really reconstruct off the top of my head. But certainly there have been enough stories and studies of animal behavior that people have been very intrigued about what kind of clues these animals might be picking up. I believe the Chinese tried for a while to use animals as earthquake predictors. And supposedly it worked really well for one earthquake and then failed miserably for other earthquakes, even more deadly earthquakes.

So it's intriguing, but I think that sort of turning that into science is a real tough challenge.

ROBERTS: NPR's science correspondent Richard Harris, thank you so much for joining us.

HARRIS: My pleasure.

ROBERTS: We have been talking about the seismic activity in - around the world, in the context of the quake in Haiti. A reminder to stay here with NPR News for continuing coverage of the devastation from that earthquake as rescue efforts and aid efforts continue in that country. We will certainly be talking about it more here on TALK OF THE NATION throughout the week.

We will talk tomorrow about how the rescue effort has been going outside Port-au-Prince, the towns that are a little bit beyond the capital, where we have heard that search and rescue teams have taken up to a week to actually reach those towns. That's tomorrow here on TALK OF THE NATION.

This is TALK OF THE NATION from NPR News. I'm Rebecca Roberts in Washington.