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# How to Prepare for the Inevitable

## An Interview with Eric Calais

*By Kristel Chanard*

**What role can scientists play in the earthquake risk reduction? Eric Calais discusses the paramount importance of establishing a dialogue between scientists, public authorities and humanitarian help in risky areas. One of the major challenges remains the difficulty of converting scientific knowledge into effective and safe public action.**

***Books & Ideas*** **What did your research show prior to the 2010 Haiti earthquake ?**

**Eric Calais** : My involvement in Haiti started in 1989. I was a PhD student at the time and I was doing field work essentially in Northern Haiti and in Northern Hispaniola in general. We were tracking an active fault zone that we had mapped offshore and we wanted to see what was the expression of that fault, of that tectonic plate boundary on land in Haiti. It took some time before I was able to go back after that. I started my own research project in Haiti, a pretty large research project in the whole of the North-Eastern Caribbean in 2003 back when I was a Professor at Purdue University in the US. We had fundings from the NSF (National Science Foundation) to develop a program where we installed GPS instruments with which we tracked the motions of tectonic plates with the precision of a few millimeters. By repeating these measurements over time, we can tell which faults are active, how fast they are building the elastic energy that will be released in future earthquakes, how dangerous they are, what their earthquake potential is. Two years before the 2010 earthquake in Haiti, in 2008, a postdoctoral student of mine and I published a paper on the quantification of the

earthquake potential of the fault that we know straddles the southern part of Haiti. We wrote in that paper that given our measurements of strained accumulation rates, of how fast the fault is loaded by the motions of tectonic plates and given additional information that we had on past earthquakes in this region, the fault was capable of an earthquake with a 7.2 magnitude if all the energy stored in the crust over the past 250 years – essentially since the last big earthquake in the region – was released today in one single event. This was the status of knowledge two years before the earthquake. Therefore, the faults were known, the strained accumulation was known and the earthquake potential was quite well described.

***Books & Ideas*: Could you describe and comment on the extent of the disaster while scientists knew the threat?**

**Eric Calais:** When the earthquake happened, like many seismologists, I received this email alert from the USGS (United States Geological Survey) saying that there had just been an earthquake in Haiti, the first estimate was of a magnitude 7.3. I looked at the depth of the earthquake, magnitude, location, and I thought immediately that it was going to be a major disaster, if you know the country, the quality of the construction – very poor--, the amount of preparedness efforts that had been going on as far as earthquakes are concerned – extremely low. There was no doubt that it was going to be a major disaster and we all saw it unfold essentially on TV in the hours and days after the event. It is quite shocking that the 2010 Haiti earthquake had the same magnitude, the same source (the process deep in the earth, 20-km depth, and the surface) that led to that earthquake as an earthquake that occurred in 1989 in Northern California, the so-called Loma Prieta earthquake that caused billions of damage but killed about 10 people in an area which was also extremely urbanized, in the south of the city of San Francisco. Therefore, you have these two extremes, and it is of course trivial to understand why the level of devastation was what it was in Haiti.

It is very difficult to find ways to change things. Before the earthquake, we had actually tried with some of my colleagues from Haiti. I had been working there for a number of years for the Haiti Bureau of Mines and Energy that handles the seismic network and all the national agencies in Haiti. It has been great working with them, but even them had very little impact on the way preparedness is done, if any preparedness is done for that matter. Therefore, it was a frustration to me, back in 2007-2008 when we had our first results, to realize how difficult it was to convey our message to people who matter, the decision-makers at the government level in Haiti, and even more importantly, the international community in Haiti. We got to the scene of the earthquake as seismologists ten days after the event. The level of devastation was actually less than what I had thought from what I had seen on TV. They only show you the catastrophic building collapses. To my surprise, there actually were many things standing up. It is also because Port-au-Prince was not the epicentral area of the earthquake. The epicenter was 40 kilometers to the west, where the devastation was greater but the density of buildings was lower. To conclude: a huge devastation and a frustration from

my part that we had not been able to convert our message as scientists to changing something. What that something was at the time, I had very little idea.

***Books & Ideas:*** **After the earthquake, you served as a science advisor for the United Nations. What was the impact of scientific information on the post-seismic humanitarian response?**

**Eric Calais:** Right after the earthquake, my team was in the field to do science. I did not go to the field because I became a science advisor to the UN. It quickly became apparent as we were making our measurements, trying to figure out what was the source of the earthquake, what had happened, that the people in charge had very little idea about what physically had happened and what could happen in the future. A good example of this is the call I received from the Haiti Minister of the Interior who asked me "We are right now in the middle of a crisis meeting with the government and the international community and we have heard that aftershocks will last for three days. Is this true?" Of course, the answer is no, it's not true, but I only had a few seconds to explain why, so I could not really explain why. A question like that may sound extremely silly for a seismologist but is extremely important in this particular context…They had very few people that could answer them. There was a critical lack of expertise in Haiti, on the process of the earthquake and the aftermath of the earthquake, of what to expect. I was there with some colleagues, I had been in Haiti many times before, people knew me so they started approaching me, asking me questions like this one. At this point I realised that there was a way to insert some science in the different levels, in this post-earthquake time frame. First of all, in the short term, what you call the humanitarian period, the response period where people have to make fast decisions such as "where are we going to settle camps?", "where are we going to host the UN headquarters?" "should we consider moving the capital city to a different location altogether ?", "should we bring boats to the bay of Port-au-Prince in the harbour and have all the humanitarian help being stationed on those boats so they are not exposed to aftershocks ?", "what is the likelihood of the next aftershock being bigger ?". Of course, as scientists, we don't always have answers to these questions, especially this last one: "Could there be a bigger one tomorrow? », and « how imminent is the next bigger one?". But we can explain what we know, what the uncertainties of what we know are and we can at least orientate decisions in directions that make sense from a scientific standpoint. That is what is important in the few months after the event. Then, there is the recovery and the reconstruction periods. The recovery would last a few years, and I suppose we are still in the reconstruction period, and we will be for a long time. During these two periods, there are questions that appear where science can have an impact. One of the questions that matter is "We have seen that some neighbourhoods were very badly affected and others were not. Why is that and what does it mean?" When that question is asked, you can put your foot in the door and say "this is my science moment right there, I can explain that there is variability, ability of the soil to amplify seismic waves depending on where we are in a city". Therefore, if you map the soil and if you do the proper seismic experiments, you can forecast where the highest probability of damage will be in the future, and that becomes an element of decision in urban planning if you want to use it that way. We wanted to start a big seismic microzonation program that became a stepping stone for advocating for earthquake risk reduction in Haiti. It was to me the best

example of what science was able to provide within two years of the earthquake, also because this program was performed by Haitian institutions with the help of international partners.

***Books & Ideas:*** **What actions are needed in the next decade to reduce earthquake losses? What role may scientists play in all this?**

**Eric Calais:** To reduce earthquake losses, there are different timescales we need to think about. Of course, we would like to act now and have an impact in the short term, we want to do more microzonation projects and use that information for urban planning and better design of buildings to be earthquake-resistant, and so on. The problem is there are very difficult barriers between the level of information that scientists and engineers have and the actual application of what we know, in terms of urban planning and new constructions. Haiti is a country of many problems, besides the earthquake problems, and it is a country with an ambiguous governing system. We want to push things, to have an impact in the short term, but at the same time we need to think that what is really going to make a difference is not so much what me for example, as an outsider, can do, but what a Haitian expertise can do on this topic. To me, the key thing that has to happen is to help the Haitian government and institutions to build a critical expertise in the area of earthquake risk reduction in seismology all the way to geotechnical engineering and structural engineering for the design of earthquake-resistant structures. The situation has changed since, but at the time of the earthquake, there was only one seismologist in Haiti, and he was not really a seismologist. He was and still is an excellent geologist who decided to be an advocate for earthquake risk reduction. His name is Claude Prépetit, he is very well known in Haiti. But one person, however efficient, who could talk with some level of scientific authority, will find it very difficult to have an impact. In the past few years, we have trained young Haitian scientists in the general topic of earthquake science. Of course, not all of them are going back to Haiti, but some are. The work we have to do now is to continue training them and working with them in Haiti to provide them with the framework in which they can continue working in their own country. Salaries are very low in Haiti, you have to have additional jobs on the side, therefore you can't really do research; therefore you can't really be impactful in your domain of expertise, which is ironical. We are working now on helping the young Haitian researchers who are returning back to their country to stay there in an environment where they can do research. So that in the end, in a few years, there will be in Haiti a critical mass of scientists who can deal with these issues, who can be the advocates for seismic risk reduction. There will always be collaboration with other groups from other countries, but they need to develop their own expertise, their own force, their own ability to advocate for risk reduction and that will be what makes the difference.

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