Real Time Loss Estimates after Earthquakes

A Resilient Future: Science and Technology for Disaster Risk Reduction

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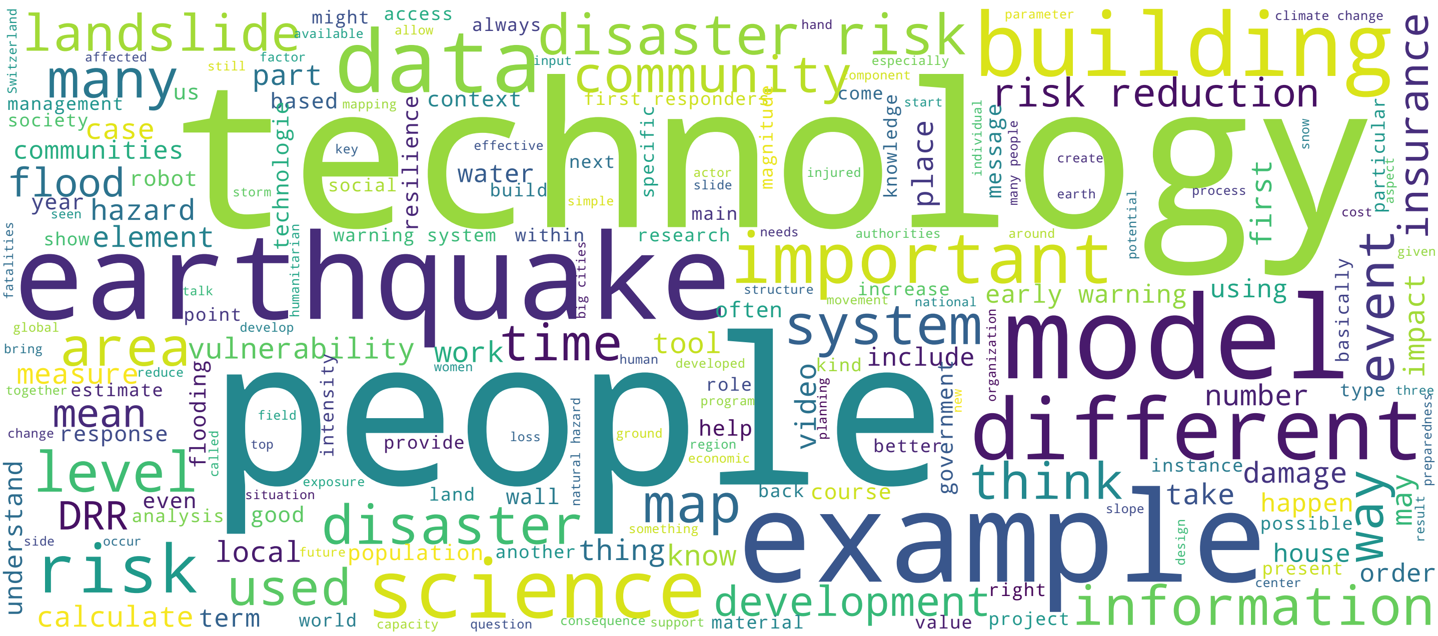

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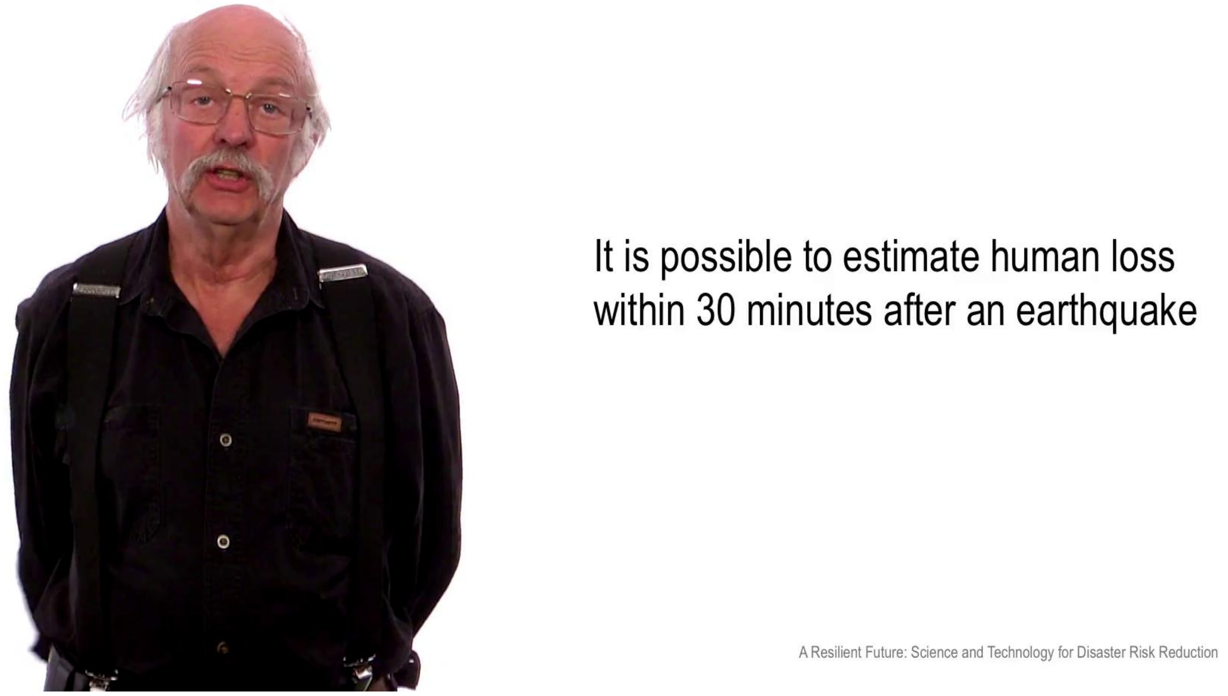
Video

Real time loss estimates after earthquakes



I am Max Wyss, I started my career in Switzerland In Zürich, I got a diploma from the Federal Institute of Technology and later became a seismologist. Now I'm retired and I would like to give back a little bit of my expert knowledge to society. The way I do this is by estimating losses immediately after earthquakes. What does immediately mean? It means in 30 minutes I make an estimate of how many people are dead, how many people are injured. And that is transmitted to first responders who then can get fast onto the scene.

Notes

Summary

0m 04s

Generating loss estimates in real time


(1)

Very first thing that happens is, the earthquake itself. Houses collapse, people are hurt, endangered, but in the world, nobody knows anything about this.

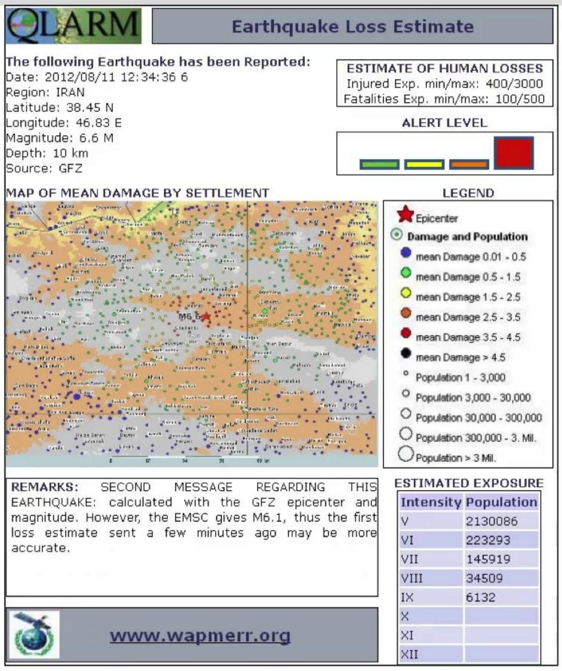
Notes

Summary

0m 51s

Generating loss estimates in real time

(2)



If you wish to receive alerts, sign up at www.icesfoundation.org

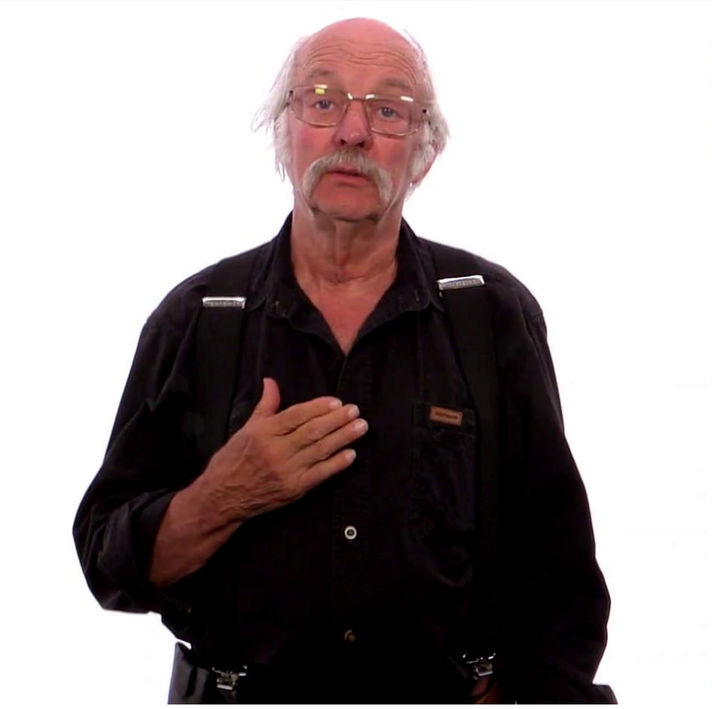
Now I get a message by SMS, I have telephones here, two, so in case one is failing then the other is still reporting, and I calculate how many dead, how many injured, approximately, that's my estimate. And I transmit this to anyone who wants to receive this message. The important thing of course is that first responders look at my message, what is my message? Look at this slide now. On the left top is the input, epicenter, depth, magnitude, I need to know that to calculate what's on the top right. The number of fatalities, the number of injured as I think it is and in the middle we have a map of mean damage for every settlement in my dataset.

Notes

Summary

1m 03s

Estimating damage to buildings



The damage to houses is important, because it's buildings that collapse that kill people, the earthquake itself does not.

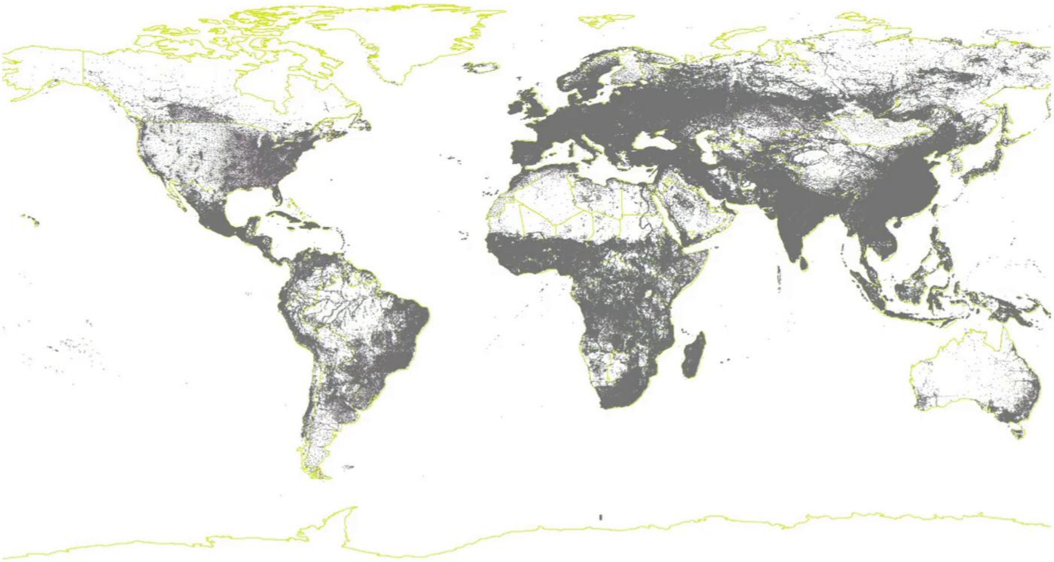
Notes

Summary

2m 00s

Required data

Nearly 2 million settlements with name, coordinates, population, models for buildings



(4) QLARM population database (ICES, 2014)

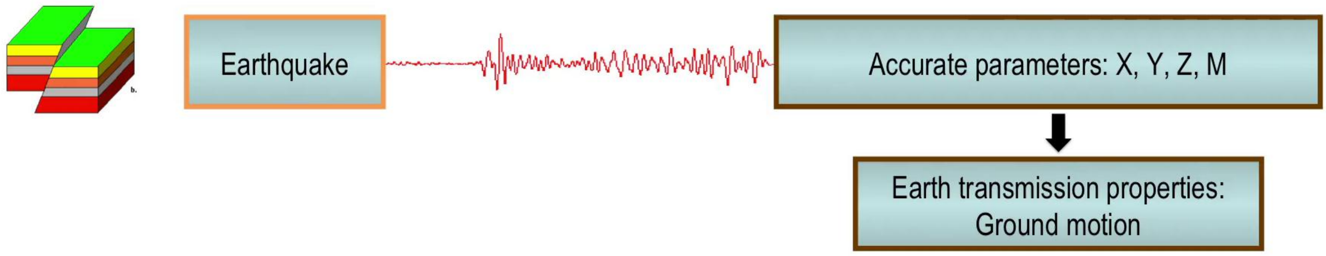
In order to make this calculation, we have to have information for the whole world. This slide simply shows a black dot for every settlement that we have in the dataset, and these are nearly two million settlements. What do we know for settlement? Coordinates, name, number of people and a model for the buildings present in the settlement.

Notes

Summary

2m 08s

The full process



(5)

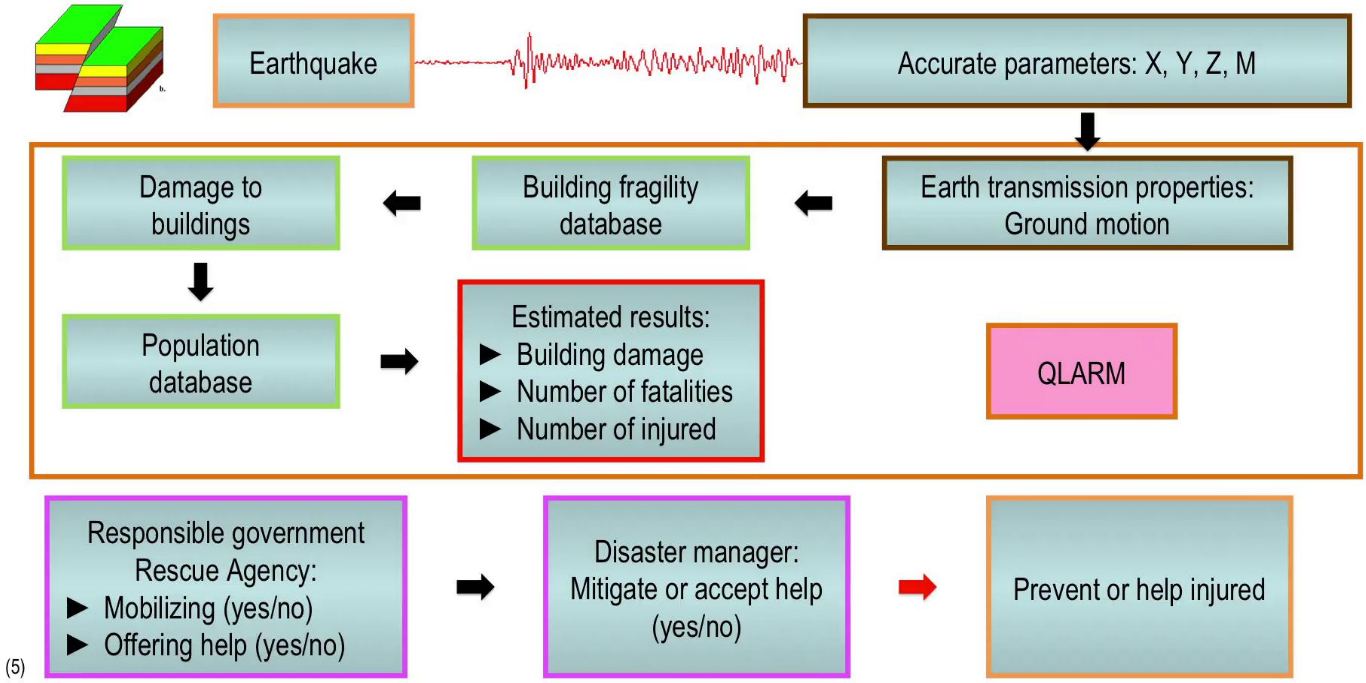
Now I want to tell you quickly what actually happens. First you see an earthquake happens, waves are travelling through the earth, and they have to arrive at stations. That takes a few minutes, once they arrive, international locations like, the US geological survey or the center in Germany in Potsdam, calculates the episode, and this is X and Y is latitude, longitude, Z is depth, M is magnitude. Now we have a first model of the earthquake itself, a simple model, just a point source X and Y. Next now I get that information, next I have to consider the transmission of seismic waves through the earth. Sometimes in some places the transmission is good, in other places less good and if I know that I can build that in my program, it's programmed and I can choose different attenuation, one calls this, transmission properties. From this I calculate the impact on the buildings and that is the most important thing because the impact on the buildings is what make damage to the buildings if the building collapses it kills people, its not the earthquake itself.

Notes

Summary

2m 34s

The full process



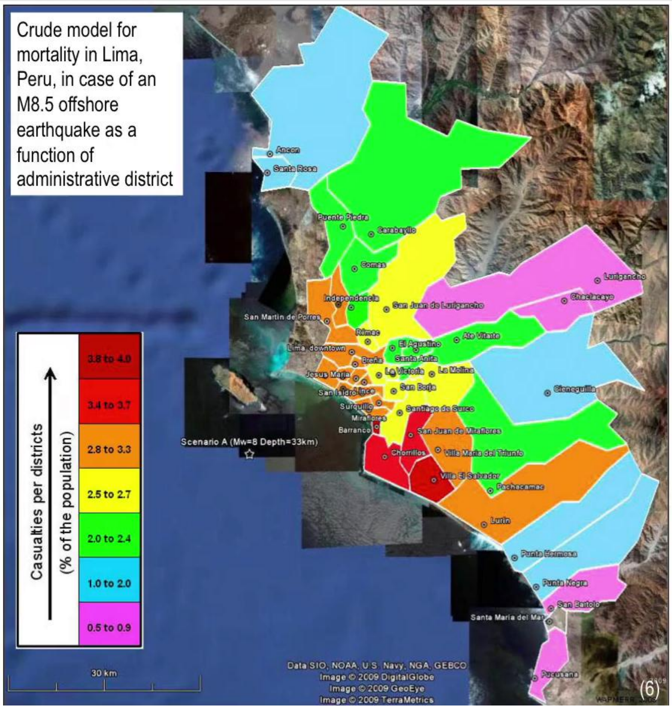
So I have to know how many people so the next thing is, the impact on the people and I calculate the probablity how many are dead, how many injured and so then, our result are, building damage and fatalities and injured. That's the QLARM job and I framed it here so that you see clearly what the QLARM job is. At the very top is the input I get, now I framed the part that I do, and at the bottom you see the response. It is out of my hands, I then hope that the first responders and the government, the authorities in the countries affected make the right decision to the ultimate aim at the bottom right, you see, helping the people who have been impacted by this earthquake.

Notes

Summary

3m 57s

An example of a mortality scenario



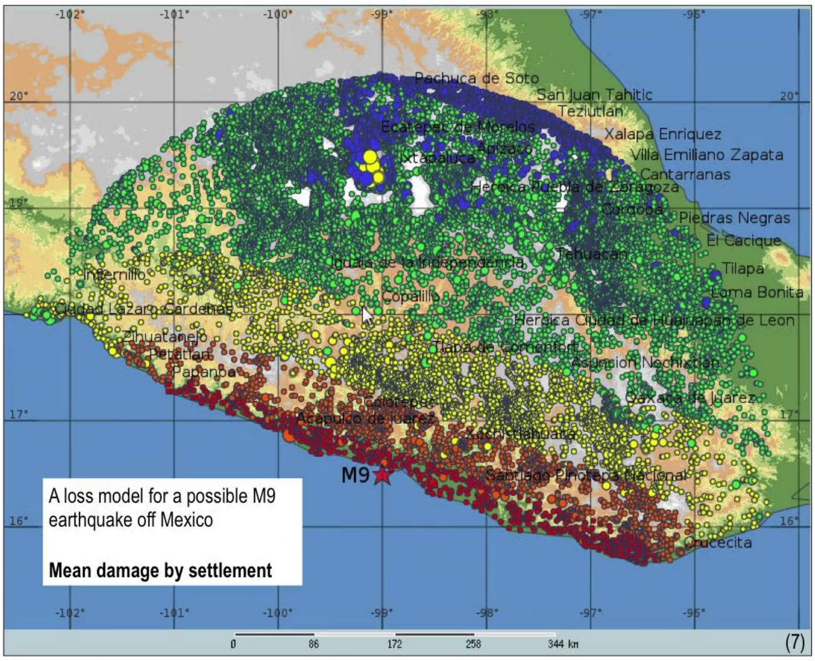
So here we have a model of a big city, big cities are always the top concern for some people because of course, big cities are where most people live, big cities are where the greatest casualties occur. And it's also a point where one can go to and say, "that is the worst case in this earthquake," and this is just an example to show you. This case Lima, Peru, it is close to an earthquake belt so we make a model for a magnitude 8.5 and what do we calculate? We calculate the mortality, in each district of the city. What is a district? It's a predefined area of administration. So actually it's not geology, you would like to have predefined volume of bad soil or good soil or different building properties, the villa district is different from the industrial district, which is different from downtown a mixture of buildings, but we don't have that information, that's what we would like, so here I just showed you, how is the mortality to be expected in different administrative districts.

Notes

Summary

4m 49s

An example of a loss model



In Mexico, we know, everybody knows that there is a trench offshore the western coast of Mexico, that produces large earthquakes. Historically there has been a really large earthquake about 500 kilometers in rupture length. So I model an earthquake that you see here in, as a rupture of 500 kilometers and give it a magnitude of approximately nine, magnitude nine is a pretty much at the upper level, the maximum that we can expect. And here is a map of mean damage, red of course terrible situation, blue is minor. Now I think the value of a map like this is, that we have an idea of what should first responders, what should medical people, hospitals expect to happen, what should they be ready for?

Notes

Summary

6m 05s

Improving real time loss estimates

- Location and type of schools
- Location and type of health facilities
- Location and type of critical facilities
- Location and number of seasonal tourists
- Open Street Map crowdsourcing: location, type and number of buildings
- Tandem InSAR satellites: Building heights to within ± 3 m
- Adding values of dwellings, office and industrial buildings for $ loss estimates
- Add soil conditions for estimating amplification
- Refining housing properties (especially regional variations)
- Updating world population
- Calculating losses due to tsunami (large separate project, but exists)
- Calculating losses due to flooding
- Calculating losses due to forest fires

It is also clear that we don't have enough information to do the best job we could do we could do a much better job if we had more information. And especially we would like to calculate losses in hospitals so that the first responders are not transporting all the injured to the wrong hospital, we would like to calculate the damage in schools, because the children are the most precious part of society. And so we think that, we need better data, and we need support from the population in getting that, and if we do then we have very good estimates of future losses of earthquakes that are likely to happen. And we would like the population and the governments to pay attention, and improve their building structures, in those places where we expect great damaging earthquakes in the future.

Notes

Summary

7m 13s

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Notes

Summary

8m 16s