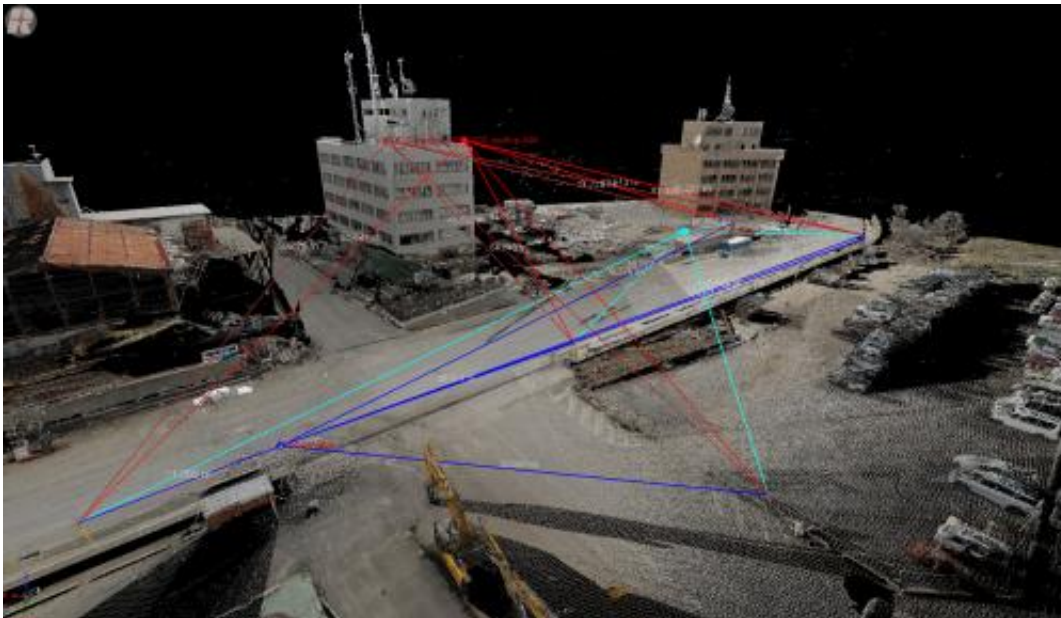


Mapping the tsunami to prepare for future events

March 6 2012, By Liz Klipp



Dr. Fritz used terrestrial laser scanners to map the height of the tsunami and learn more about the flow of the devastating currents.

(PhysOrg.com) -- The 2011 Tohoku tsunami was Japan's deadliest in more than 100 years. Despite an extraordinary level of preparedness by the Japanese, the tsunami caused more than 90 percent of the almost 20,000 fatalities last March.

Georgia Tech Associate Professor Hermann Fritz and his team are studying the impact of the [tsunami](#) on the Sanriku coast, which is

armored with tsunami mitigation measures, from control forests to sea walls and bay mouth breakwaters.

Using eyewitness video and terrestrial laser scanners from atop the highest buildings that surveyed the tsunami, Fritz has mapped the tsunami's height and flood zone to learn more about the flow of the devastating currents.

Fritz's measurements and observations could produce flooding forecasts that influence future evacuation plans and building designs, preventing loss of life and property damage in Japan and in other areas of the world susceptible to tsunamis.

“The ultimate goal is to save lives,” Fritz said. “In order to do so, we have to have a better understanding of what worked and didn't work. This is the first time we've been able to look at the structural infrastructure designed to protect coastal towns from tsunamis and examine why it didn't work. There's a lot to learn in terms of surviving tsunamis and protecting, evacuating and ultimately saving lives.”

Fritz led a reconnaissance team surveying the impact of the tsunami on a fishing town in Kesenuma Bay, where 1,500 people perished. The bay has been hit by historic tsunamis in 1896, 1933, 1960 and 2010—making it the most vulnerable in Japan to both near- and far-field tsunamis. The fact that the coastal structures and other mitigation measures were designed based on conservative, historic high-water marks rather than probable maximum tsunamis contributes to the area's susceptibility to natural disasters.

From two atop vertical evacuation buildings, owned by the Japanese coast guard and the government, where eyewitnesses gathered during the tsunami, Fritz and his team used lasers to scan the port and bay entrance, creating a three-dimensional, topographic model of the flood zone.

Using this data, they reconstructed eyewitness videos to determine the varying heights and flow velocities of the tsunami. They determined that the tsunami reached a maximum height of 9 meters, followed by outflow currents of 11 meters per second less than 10 minutes later, a speed which Fritz says is impossible to survive or navigate by vessels.

“What we can learn from the hydrograph is confirmation that the water goes out first, drawing down to more than negative 3m on the landward side of the trench, which can make vessels hit ground inside harbors,” Fritz said. “During the subsequent arrival of the main tsunami wave, the water rushing back in changed the water level by 40 feet, engulfing the entire city in 12 minutes.”

Understanding tsunami impacts will help prepare for future disasters—whether its designing buildings high enough to serve as vertical evacuation points or sea walls and breakwaters strong enough to control the flow of water.

Along with such [mitigation measures](#), Fritz says educating people about tsunamis is key.

“[Japan](#) was probably the best prepared for a tsunami,” Fritz said. “Indonesia, on the other hand, had no knowledge of tsunamis and it caught people by surprise in 2004. The outcomes of the tsunamis were very different—200,000 killed versus 20,000 killed. That shows educational awareness and preparedness and civil defense mechanisms can work to reduce the death toll. People need to be tsunami-aware.”

Fritz worked with researchers from the University of Southern California and Japanese researchers from the University of Tokyo, the Tokyo University of Marine Science and Technology, and the Port and Airport Research Institute, in coordination with the UNESCO-organized International Tsunami Survey Team and the [Tohoku](#) University in

Sendai.

Provided by Georgia Institute of Technology

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