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What caused a large number of fatalities in the Tohoku earthquake?

M. Ando (1), M. Ishida (2), Y. Nishikawa (3), C. Mizuki (4), and Y. Hayashi (5)

(1) Institute of Earth Sciences, Academia Sinica, Taipei, Taiwan (ando@earth.sinica.edu.tw, 886-2-2783-9871), (2) Japan Agency Marine-Earth Science Technology, Yokohama, Japan (ishida@jamstec.go.jp), (3) Department of Life Science, National Taiwan University, Taipei, Taiwan (yuka.med@gmail.com), (4) Graduate School of Sciences, Hokkaido University, Sappro, Japan (cmizuki@wwwgeo.ees.hokudai.ac.jp), (5) Faculty of Safety Sciences, Kansai University, Takatsuki, Japan (yhayashi@kansai-u.ac.jp)

The Mw9.0 earthquake caused 20,000 deaths and missing persons in northeastern Japan. 115 years prior to this event, there were three historical tsunamis that struck the [U+3000] region, one of which is a "tsunami earthquake" resulted with a death toll of 22,000. Since then, numerous breakwaters were constructed along the entire northeastern coasts and tsunami evacuation drills were carried out and hazard maps were distributed to local residents on numerous communities. However, despite the constructions and preparedness efforts, the March 11 Tohoku earthquake caused numerous fatalities. The strong shaking lasted three minutes or longer, thus all residents recognized that this is the strongest and longest earthquake that they had been ever experienced in their lives. The tsunami inundated an enormous area at about 560km2 over 35 cities along the coast of northeast Japan. To find out the reasons behind the high number of fatalities due to the March 11 tsunami, we interviewed 150 tsunami survivors at public evacuation shelters in 7 cities mainly in Iwate prefecture in mid-April and early June 2011. Interviews were done for about 30min or longer focused on their evacuation behaviors and those that they had observed. On the basis of the interviews, we found that residents' decisions not to evacuate immediately were partly due to or influenced by earthquake science results. Below are some of the factors that affected residents' decisions.

1. Earthquake hazard assessments turned out to be incorrect. Expected earthquake magnitudes and resultant hazards in northeastern Japan assessed and publicized by the government were significantly smaller than the actual Tohoku earthquake. 2. Many residents did not receive accurate tsunami warnings. The first tsunami warning were too small compared with the actual tsunami heights. 3. The previous frequent warnings with overestimated tsunami height influenced the behavior of the residents. 4. Many local residents above 55 years old experienced the 1960 Chile tsunami, which was significantly smaller than that of the 11 March tsunami. This sense of "knowing" put their lives at high risk. 5. Some local residents believed that with the presence of a breakwater, only slight flooding would occur. 6. Many people did not understand why tsunami is created under the sea. Therefore, relation of earthquake and tsunami is not quite linked to many people.

These interviews made it clear that many deaths resulted because current technology and earthquake science underestimated tsunami heights, warning systems failed, and breakwaters were not strong or high enough. However, even if these problems occur in future earthquakes, better knowledge regarding earthquakes and tsunami hazards could save more lives. In an elementary school when children have fresh brain, it is necessary for them to learn the basic mechanism of tsunami generation.