

Communicating uncertainty of geoscience for the disaster risk reduction -Geoscience, the ambiguous, and ourselves-

*Satoko Oki¹

1. Faculty of Environment and information Studies

In Japan, a large earthquake causing casualties occurs once every few years. The 2016 Kumamoto Earthquake, the 2018 Northern Osaka Earthquake, and the 2018 Eastern Ibaraki Earthquake occurred one after another, even after the 2011 Tohoku Earthquake caused more than 18,000 deaths and missing. In addition, damage from storms and floods, such as heavy rains and storm surges caused by rising sea levels, is also increasing these years. You can't tell where they point when you hear "disaster area" in Japan.

In such situation, geosciences are expected from the society for disaster risk reduction, and geosciences have also tried to meet this expectation. For example, seismology has been making efforts to publish the National Seismic Hazard Maps announced by the government every year since the 1995 Kobe Earthquake. Regarding meteorology or volcanology, they are committing to the introduction and operation of warning levels as well as the improvement of prediction accuracy.

Here I would like to report the results of a survey on how this information from geoscience is perceived by the public, taking the National Seismic Hazard Map as an example.

Since we have earthquake risk everywhere in Japan, it is not enough to make the hazard map of individual scenario earthquake. We therefore calculate the probability of a certain place to be affected by a ground motion of seismic intensity 6 or more within the next 30 years, then color it from yellow to brown on Japan map to overview the earthquake occurrence risk.

We investigated how the public perceives this map (Nagamatsu et.al., 2017) by comparing two groups in areas with low probabilities. Those people in one group are shown this map and the other not shown. The results showed that people seeing the map had lower risk perception. Earthquakes will occur everywhere in Japan, and in fact, some of damaging earthquakes have occurred at the low probability area. It is an ironic result that the map prepared by the government to encourage earthquake countermeasures reduce the public awareness of disaster prevention at least to those who live in areas with low probabilities.

When geoscience gives out useful information to society, it is always accompanied by uncertainty. To express this uncertainty, we introduce probability, but it does not seem to be a good communication to the public. How should we communicate uncertainty? I would like to introduce an activity called "disaster prevention novel" which is being conducted at a junior high school.

The "disaster prevention novel" was introduced into the Shimizu Junior High School in Kochi prefecture. It is the only junior high school in this city of Tosashimizu, which is facing the Pacific Ocean and told to face devastating tsunamis in the forthcoming Nankai-trough Earthquake. The "disaster prevention narratives" are written by the students provided the detailed date and time of the Nankai-trough Earthquake occurrence in about a month by the school teachers. The main characters are themselves, living in their

actual neighborhood. Other characters are real people too. One important requirement is that the stories end with hope.

Let us review this "disaster prevention novel" in terms of communicating the uncertainty of an earthquake. The present earthquake science cannot accurately predict when an earthquake occurs. And, if "When" cannot be designated, the accompanied damage anticipation can also be ambiguous. For example, the degree of fire disaster depends on the time of the earthquake. The uncertainty of earthquake occurrence leads to the uncertainty of damage anticipation.

In the activity of "disaster prevention novel", the school designates the date and time of earthquake occurrence. Nobody thinks this is a true earthquake prediction. It is one of the educational considerations that one can think about his/her own evacuation behavior with the detailed occurrence time. In the novels, the way tsunamis inundate the town is depicted in different ways by students. Some students describe fires, and others write about landslides. The 90 students anticipate and express the damage in 90 ways. This expresses uncertainty and ambiguity of the forthcoming Nankai-trough Earthquake. In the following year, students wrote the "disaster prevention novel" in different seasons, different times, and different weather settings. This led students, parents, and locals to come up with various assumptions. The unavoidable uncertainties from geosciences can be expressed in this way without introducing probabilities.

In the presentation, I would like to refer to a possible improved communication of geosciences.

Keywords: communication, uncertainty, earthquake, disaster