

## Collaboration beyond the difference between science and government

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Government and public take actions with decisions and judgments based on scientific knowledge. Science community widens and deepens human knowledge with continual research efforts. Therefore, any scientific conclusion, which is once regarded as true, can be denied by later researches. This is the origin of disagreement between science, which has essential uncertainties, and government and society, which require definite decisions. They need to acknowledge such differences that exist between science and government to improve the society.

In the volcano eruption prediction in Japan, the relationship between science community and government-public functions well. The reason is "reasonable distance" between them. Japan Meteorological Agency (JMA) is responsible for issuing volcano information for evacuations. The information is justified in the discussion of the Coordinating Committee for the Prediction of Volcanic Eruption (CCPVE), where both scientists, geologists to geophysicists, and government personnel participate. Scientists often devoted themselves to the disaster reduction plan in local society near volcanoes, also contributing establishment of reasonable-distance between scientists and local government-public.

The Headquarters of Earthquake Research Promotion (HERP) is responsible for making use of the scientific knowledge of earthquakes in disaster reduction. In contrast to the volcano eruption prediction, it is rather difficult to keep reasonable distance between scientists and government-public for the following reason. The community of earthquake science is much bigger than that of volcano eruption prediction. Government personnel are changed in two years. Most of earthquake scientists live in Mega cities, and many prefectures have no earthquake scientists to ask for advices.

Volcanic Alert Levels were established following the requirement by the public. The level is designed so that each level corresponds to a definite evaluation action of the residents. Although, this is more than that volcano science can provide, the level functions so far with a conservative operations. For example, in the 2011 eruption of Kirishima nobody was insured or killed in spite of no precursors are observed. The alert level was kept level 2 after the small eruption of the previous year.

HERP issues long-term probability of earthquake occurrence in Japan, which was a strong requirement of the public after the 1995 Kobe earthquake. Characteristic earthquake model is used for the evaluation, because this the only usable model for the calculation of long-term probability of earthquake. To meet the responsibility for the public the government have to evaluate earthquake probability for all of major active faults and plate boundaries in Japan territory, in spite of large uncertainty. In the evaluation the off-Tohoku area are divided into several regions, each of which was assigned its own characteristic earthquake. Interaction of asperities, which represents the region division, was not taken into account. The off the coast of Tohoku earthquake is really a result of such interaction. After the earthquake the "Off-the-coast-of-Tohoku-type" earthquake are introduced in the evaluation process, but still based on the characteristic earthquake hypothesis. The disaster reduction plan based on the long-term evaluation depends on the polity of the Cabinet Office or local governments.

The above examples are the results of interaction among social demands, governmental policy and state-of-the art of scientific knowledge. Though we have to admit that they are more than the present achievement of volcano and earthquake science, it is inevitable to issue some information for practical disaster reduction. We need to make continual efforts to improve the disaster reduction measure through effective communication between governmental personnel, public and scientists.