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A Questionnaire Survey for the Earthquake in Suruga Bay on August 11, 2009

Toshiki Shimbaru[1*]

[1]Japan Meteorological Agency

A questionnaire survey in earthquake-affected areas is important to figure out the relationship between seismic damage and intensity. It has widely been used for many earthquakes since its algorithm was developed by OHTA(1979). After the earthquake in Suruga Bay on August 11, 20 09, the Japan Meteorological Agency (JMA) conducted a questionnaire survey.

OHTA(1979) showed the algorithm to calculate seismic intensity from a sheet of questionnaire. He also showed the method to convert this seismic intensity to a JMA seismic intensity by using empirical relationship. In addition to this original one, two more algorithms have been suggested. One is the revised algorithm proposed by OHTA(1998) that reflects the calibration in the higher range of seismic intensity, and the other is the simplified algorithm proposed by KOYAMA(1998) in which the number of questions are reduced for the acceleration of survey.

In this survey, 1,100 questionnaires were distributed in the area around 22 seismic stations where the intensity 5 upper or larger were observed. 708 responses were obtained as of January 2010, and 221 responses from the area close to the stations (within 300m) were used to calculate questionnaire-based intensity. Mean values of questionnaire-based intensity calculated for the above-mentioned three kinds of algorithms were compared with the value of JMA instrumental seismic intensity observed at each station.

As a result, the mean value of questionnaire-based intensity was positively correlated with JMA instrumental seismic intensity. However, the former value was lower than the latter about one in JMA seismic intensity scale. And the results of three algorithms resembled each other. Focusing on the responses to individual questions in the area of intensity 5upper and 6 lower, the ratio of respondent who answered that there had been strong shaking or heavy damage in the areas of intensity 6 lower was more than that of intensity 5 upper in terms of the movement of heavy furniture, the damage to the building, the damage to the window, the damage to the roof tile, and fear to the shake. For instance, the ratio of respondent who answered that the damage in roof tiles had been observed reached to 18% in the areas of intensity 6 lower, and it was three times more than that of intensity 5 upper. On the other hand, there was little difference of the response between intensity 5 upper and intensity 6 lower about the toppling of small object and the duration of strong shaking respondents felt.

The correlation between questionnaire-based intensity and instrumental seismic intensity shown in this research provides a possibility that we would be able to estimate the seismic intensity from the questionnaire in the areas where seismic stations are not installed. There is a systematic difference between the questionnaire-based intensity and the seismic intensity as shown in this survey, and it varies in other cases, but its reason is not studied. Consistency of the results among the three algorithms indicates that we would be able to use the simplified algorithm instead of original algorithm or revised algorithm for the acceleration of survey. In addition, analysis of individual

questions would provide the important knowledge of relationship between damage by strong motions and seismic intensities. JMA intends to conduct the questionnaire survey in the areas around seismic stations of high seismic intensity and in seriously damaged areas in order to accumulate the data which show the relationship between damage and JMA seismic intensity.

Keywords: questionnaire survey, seismic intensity, Suruga Bay