Seismic intensity distribution and validation of the source location and the magnitude of the 1914 Sakurajima earthquake

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The 1914 Sakurajima earthquake (M 7.1) occurred about eight hours after the eruption of Sakurajima. The seismic intensity distribution in Kagoshima city is estimated from the damaged data of houses and stone block walls (Imamura, 1920). The intensity data used in Imamura (1920) is originally defined in his study and cannot be directly compared to the present seismic intensity scale in Japan defined by the Japan Meteorological Agency (JMA) in 1996. Takemura and Toraya (2015) proposed a conversion procedure from damage data of houses to the present seismic intensity scale for the 1944 Tonankai earthquake.

The seismic intensity distribution in Kyushu Island has also compiled by Imamura (1920) and its isoseismal maps were drawn by Imamura (1920) and Omori (1922). The intensity data can be compared to the present seismic intensity in JMA scale, because the present seismic intensity scale was revised several times from that used for the isoseimal map for the Kyushu Island in Imamura (1920).

In this study, we convert from the damage data of houses in Kagoshima city (Imamura, 1920) to the present seismic intensity in the JMA scale. We also review the seismic intensity distribution in Kyushu Island. Then we verify the source location and magnitude using an attenuation relation of seismic intensity for Japan presented by Morikawa et al. (2010).

Imamura (1920) presents the total number of households but does not present the total number of houses. The sum of the completely destroyed, half destroyed, and partially damaged houses are larger than the number of household in a town, Shiomi-cho. We adopt two assumptions for the total number of houses. One is that the total number of houses in each town is equal to that of householders in it. The other is that the ratio of total number of houses to that of householders in each town is equal to the ratio in Shiomi-cho. The true value may be between those inferred from the two assumptions. The distribution of the present seismic intensity scale adopting the former assumption shows that the maximum intensity is 6 Upper, and that adopting the later assumption is that the maximum intensity is 6 Lower. The maximum difference between the intensities at a same place adopting the two assumptions is one grade.

We also plot the seismic intensities in Kyushu Island to review the isoseismal maps of Imamura (1920) and Omori (1922). The isoseismal contours of both papers are inconsistent to the intensity data at several observation points. It is difficult to draw the isoseismal contours being consistent with the seismic intensity data.

We verify the source location and magnitude of the 1914 earthquake. The source fault of the 1914 Sakurajima earthquake has not been investigated in previous studies. Kagoshima Prefecture assumes a source fault for the same type of an earthquake as the 1914 Sakurajima earthquake to predict the strong ground motions for disaster prevention. The seismic intensities predicted by the attenuation relation with Mw 7.1 are much higher than the observed ones in Kagoshima city. When the magnitude is fixed at Mw

7.1, the source fault location should be moved at least 50 km further from the assumed fault. If the source fault location is fixed, the magnitude should be 5.6. The comparison of the predicted seismic intensity to the observed ones in Kyushu Island shows that Mw 7.1 is too large.

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