A possible source model of the 1512 Eisho tsunami described in an ancient document

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Interplate earthquakes repeatedly occur in the subduction zones such as the Nankai trough. We must learn the past earthquakes to anticipate disasters caused by the future earthquakes. Investigations by using ancient documents and geological ways are necessary for the earthquakes and tsunamis older than 100 years because the instrumental observations are limited within a period of the latest 100 years.
“SHINCHO-KI” is an ancient document that records damages caused by the 1512 Eisho earthquake, the 1605 Keicho earthquake, the 1707 Hoei earthquake and the 1854 Ansei-Nankai earthquake at Shihikui region in Tokushima, where is located along the coast of the southeastern part of Shikoku, facing to the Nankai trough. According to SHINCHO-KI, 3700 people were dead at Shishikui by the tsunami during the 1512 Eisho earthquake. However, no evidence was found for the occurrence of 1512 Eisho earthquake except for SHINCHO-KI, while the other earthquakes were recorded in many ancient documents in the southwestern Japan. Therefore, the 1512 Eisho tsunami might be a local tsunami. In this study, we suggest a possible source mechanism of the 1512 Eisho tsunami. For example, the tsunami associated with the 1998 Papua New Guiana earthquake was enhanced by a submarine mass movement. That resulted in the large tsunami up to 15 meter which was locally apparent in the Sissano lagoon.
We carefully read a bathymetric chart and found a scarp with height of about 400 m and width of about 6000 m at a position about 24 km offshore in the southeastern direction from Shishikui. We also carried out a survey by using a deep-towed sub-bottom profiler (SBP) on ROV NSS during the R/V Hakuho-maru KH-16-5 cruise. The result shows detailed structures possibly caused by a recent landslide. The vertical displacement of the strata was measured to be about 50 m. By considering these results, we constructed a model of submarine mass movement and calculated the initial sea surface displacement by a method of Watts et al. (2005). We investigated several cases by changing movement distances from 800 to 3000 m because it is unknown for one event. For the numerical tsunami simulations, we solved the nonlinear shallow water equations by a finite differential method with a nested grid algorithm which allows the spatial resolution of the study region to be easily increased. The topographic data in Shishikui was made from the present data. But we removed the artificial structures such as wave breakers and altered costal lines by referring to old map images. The numerical summations indicated that the flow depths during the 1512 Eisho tsunami described in SHINCHO-KI could be simulated by the causes using a range from 1400 to 2400 m of movement distance of the submarine mass movement. The maximum tsunami heights of 6 –9 m were calculated at Shishikui in these cases, while it was 3 m at the maximum along the Kii Peninsula located at the opposite side of the Kii Channel.

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