

## Relationships between heights and damage of the 1854 Ansei Nankai tsunami along west coast of Kochi prefecture, Japan

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Estimation of the historical tsunami heights is basically based on historical documents which record concrete marks of inundation heights and/or inundation limits. Some documents recorded only damage, for example, numbers of damaged buildings. In this case, it is no doubt about the tsunami inundation, but it is difficult to estimate the tsunami heights from only the damage records. Therefore, relationships between the tsunami heights and the damage are needed. The relationships are proposed as tsunami fragility (e.g. Koshimura et al., 2009, JDR), but it basically targets recent tsunamis. These relationships cannot be directly applied to the historical tsunamis, because resistance of buildings might be different between the present and the historical era. In this study, relationships between heights and damage ratio of the 1854 Ansei Nankai earthquake tsunami along west coast of Kochi prefecture, Japan, were obtained. A document “Kaei kinoe-tora doshi ojishin hikki recorded by Tatsusuke Tokunaga” documented in “Shinshu Nihon jishin shiryō 5 suppl. 5” was used. The document recorded numbers of buildings which were swept away, collapsed buildings, and slightly damage buildings. We calculated damage ratio (Hatori, 1964, BERI) as numbers of damaged buildings divided by those of total buildings for each hamlet. The numbers of the total buildings were used from “Kanpo gocho”. Tsunami heights have already been reported by previous studies (e.g. Tsuji et al., 1994, Historical Earthquake). Then, relationships between the damage ratio and the tsunami heights were obtained. The result shows that tsunami heights of 2 m corresponds to damage ratio of zero. The damage ratio drastically increases to more than 0.8, when the tsunami height exceeds 5 m.

Keywords: tsunami height, damage ratio, the 1854 Ansei Nankai earthquake tsunami, Kochi prefecture