Literature review and numerical modeling for updating physical identification criteria of tsunami and storm deposit

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Once tsunami or storm deposits can be identified, (1) inundation area of tsunami or storm wave/surge in the prehistoric age, and (2) recurrence interval of tsunami or storm can be estimated. However, the both sedimentological characteristics are very similar because the both type of deposits are formed by coastal waves from the sea (e.g., Bourgeois et al., 2006). For appropriate risk assessment at coastal region, tsunami and storm deposits are needed to be reasonably identified.

The studies for identifying tsunami and storm deposit has been conducted mainly based on geological approach. However, field examination is insufficient to clarify the relationship between distribution trend of deposit and topography or input wave condition. To reveal the relationship, the examination using numerical calculation based on ideal topography condition is valid as in Cheng and Weiss, (2013). The objective of this study is to update identification criteria of tsunami and storm deposit based on our numerical modeling and literature review.

We firstly conducted the simulation of sand sediment transport by tsunami and storm waves on ideal topography condition to reveal general distribution trend of onshore sandy tsunami and storm deposit and the parameters that contribute to the distribution characteristic of the both deposits. As a result, we revealed the parameters which mostly contribute to the distribution of sandy tsunami and storm deposits and inundation limits of tsunami or storm wave. The parameters which mostly contribute to inundation distance of storm wave were land slope and initial water level rise. In contrast, the parameters which mostly contribute to inundation distance of tsunami were land slope and input wave condition. The parameters which mostly contribute to distribution distance of sandy storm deposit was land slope and initial water level rise. While, the parameters that mostly contribute to distribution distance of tsunami deposit were topography condition and input wave condition. Indeed, some studies identified sandy tsunami deposit based on the fact that the distribution limit of sandy tsunami deposit is small compared to sandy storm deposits. For using the same method to identify sandy tsunami deposit, knowing what factors affect to the inundation of tsunami and storm wave or distribution of sandy deposit would be very effective. As a result of our simulation, we also revealed that volume of storm deposit become very small compared to tsunami deposit when a size of storm surge was strong or there is source of sand sediments near the coastline. Thus, confirming deposit volume over land is effective for discriminating tsunami deposit from storm deposit.

We secondary conducted literature review according to identification of onshore sandy tsunami and storm deposits, then the identification criteria of sandy tsunami and storm deposits was updated with the result of our numerical simulation on ideal topography condition. Using the updated criteria proposed in this study, identification of tsunami and storm deposits can reasonably be conducted, although further development of numerical models are also required. Once the tsunami or storm deposits are appropriately identified, size or recurrence interval of extreme waves can be examined, which will be useful for future risk assessment at coastal area in the world.

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Keywords: tsunami deposit, storm deposit, sediment transport simulation

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