Inverse analysis of tsunami deposits using non-steady flow model

*Hajime Naruse[1], Tomoya Abe[2]

1. Department of Geology and Mineralogy, Graduate School of Science, Kyoto University, 2. Geological Survey of Japan, AIST

Tsunami deposits provide important clues to understand ancient tsunami events. Here we propose a new inverse model of tsunami deposit emplacement. The model is an improved version of FITTNUSS that is the inversion model proposed by the authors. The model considers both transport of non-uniform suspended load and entrainment of basal sediments, and the flow deceleration process is newly incorporated in this model. This inversion model requires the spatial distribution of deposit thickness and the pattern of grain-size distribution of the tsunami deposit along 1D shoreline-normal transect as input data. It produces as output run-up flow velocity, inundation depth and concentration of suspended sediment. To solve for advection of non-uniform suspended load, a transformed coordinate system is adopted, which increase computational efficiency. Tests of inversion using artificial data successfully allow reconstruction of the original input values, suggesting the effectiveness of our optimization method. We apply our new inversion model to the 2011 Tohoku-Oki Tsunami deposit on Sendai Plain, Japan. The thickness and grain-size distribution of the tsunami deposit was measured along a 4 km long transect normal to the coastline. The result of our inversion fits well with the observations from aerial videos and field surveys. We conclude that this method is suitable for the analysis of ancient tsunami deposits, and that it has the advantage of requiring the minimum information about the condition of the emplacing paleotsunami for reconstruction.

Keywords: tsunami, tsunami deposit, inverse analysis

