

A scheme for effective selection of survey sites in paleotsunami research, Hachinohe case, Aomori Prefecture, Japan

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Keywords: tsunami modeling, sediment source differentiation, coring site selection.

Abstract

It is generally accepted the choice of the survey sites will determine the quality of the samples that will be obtained. In tsunami geology, the sampling technique and site choosing criteria are decisive and can set the presence or not of evidence of previous events. In some cases, these elements can define the occurrence of deposits that could seem lithologically related to tsunami events but genetically be linked to other hydrodynamic phenomena as storm surges.

In order to obtain reliable evidence of paleotsunami deposits in Hachinohe, we implemented a survey scheme that permitted us to choose the best possible survey points and in consequence to get the best possible geological record. First, we conducted preliminary numerical modeling to estimate the inundation areas produced by projected scenarios of both storm surges and tsunami waves that occurred in the past or may happen in the future, ensued by sediment transport modeling, following the routine proposed by Watanabe et al. (2018). The calculation result allowed us to recognize the areas that could be inundated by the tsunami waves but not by storm surges, even with the most extreme typhoon in this region. In the studied section of the Kamikita Plain the five-meters-high uplifted marine terrace morphology mainly controls the inundation capability for both, and in consequence, constricts the sediment transportation capacity of the storm surges to the surroundings of the shoreline and allows the tsunami waves with sediments to go further inland. Secondly, we used Ground Penetration Radar (GPR) to visualize the underground configuration of the terrace, irregular paleosurfaces shallowing gently landward, to find local depressions that guaranteed the maximum sediment preservation. Lastly, on the identified spots and using a Handy Geoslicer we extracted several sediment cores, finding intercalation of peaty mud sheets and several event deposits, with occasional tephra layers.

The conducted scheme shows high usefulness to increase the efficiency of surveys oriented to obtain paleotsunami deposits since it permits to get the best sediment conservation sites and to reduce uncertainty, costs and facilitates to rule out deposits related to different coastal hydrodynamic processes.