Fault and Tsunami Deposit Investigations in Eastern and Northern Taiwan

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Fault and tsunami deposits are the important indicators for near-surface geophysics investigation within the critical zone. Paleo-tsunami event investigation along the eastern coast of Taiwan to assess the potential risk for future tsunami hazards could be important. The occurrence of “Malaulau” tsunami event (Abe, 1938) which may struck the entire eastern coast of Taiwan according to the folklore of the Ami tribe maybe tightly link to 1771 Great Yaeyama tsunami event occurred along the Ryukyu trench. Recent studies has also made considerable progress in east coast area of Taiwan (Ota, 2013; Ando et al., 2013; Lallemand et al., 2015). Surveys on the distribution of tsunami sediments become important to confirm the timing, run-up, and inundation area associate with paleo-tsunami events. For imaging existing or suspected fault becomes another challenging research goal for hazard assessment and prevention through near-surface geophysical studies.

We employed the shallow Ground Penetrating Radar (GPR) studies to detect fault and tsunami deposits from radar responses. The GPR survey; hand-auger drilling to collect samples and UAV/drone survey were carried out at Chenggong, ChangBin, DanMan, BaXianDong, TaiDong County area and LuDao; LandYu offshore islands during August-September of 2015 and 2016. The investigation of Jing Shan fault at Zhongjiao Beach, Shazhu bay were also carried out during 2017 and 2018. The convenient non-invasive and non-destructive radar sensing surveys is used to track the distribution and lateral extend of tsunami sediment layers and fault. Drilling utilized hand-auger with direct inspection of near-surface deposits and detailed log were noted in the field. UAV records provide the information on topography and area features.

The GPR frequencies used are mainly rely on 50, 100, 200 and 250 MHz with occasion of using 500 MHz and 1 GHz for ultra-shallow penetration depth say within 2 meter. GPR surveyed at middle terrace (asl. 18 m) in Cheng Gong town was extensively carried out. We could detect the undulation of boundary between soil and mud layers with strong variation in elevation changes up to 20 cm at the depth of 50 cm. Such fine-scale deposition feature with concentration of fragments created distinct diffraction pattern could be recorded and detected by careful radar profiling.

Near-surface effects becomes an important factor for detecting the targets. From multi-scale high resolution GPR survey, the target size ranges from few centimeter to several meters can be detected. Migrated images from multi-frequencies data, careful GPR data processing workflow and experiences become the key for a successful investigation.

Keywords: tsunami deposits, fault, hazard mitigation, Ground Penetrating Radar