

## Terrestrial laser scanning of a tsunami-affected valley in Aneyoshi, northeastern Japan

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The devastating tsunami wave induced by the Tohoku-Oki megathrust earthquake caused erosion of side-slopes in valleys along a ria-type coast. The tsunami-wave erosion, including the removal and modification of vegetation, soil, regolith and even bedrock, is observed at inland areas of a valley facing the coast. One of the most typical cases is the valley of Aneyoshi, where the highest runup of tsunami wave, 38.9 m, was recorded. We investigated detailed morphology of its eroded valley-side slopes using a terrestrial laser scanner (TLS), together with airborne laser scanner (ALS) data. Topcon GLS-1500 was used as the scanner, and the geographic coordinates of the position of laser scanning were defined using a 2-band GNSS capable of carrier phase correction. Point cloud data obtained from multiple scanning positions of the TLS were compiled using the relative positions and/or geographical coordinates of targets for scanning. Morphological analyses, such as slope computation and cross profile extraction from the topographic data, suggest that the asymmetric valley shapes, as well as small topographic features such as near-vertical segments of slopes located at the tsunami-inundated height, are correlated to the large tsunami-wave attacks, which could have occurred multiple times in the late Holocene period. Also, the width of the valley suddenly increases toward the ocean at an incised meander bend, and a knickpoint is observed at the maximum tsunami-runup point, c. 100-m upstream of the bend. The increase in the valley width could be correlated with the change in the direction of tsunami wave invasion, whereas the position of the knickpoint, nearly at the run-up height of the tsunami, may be affected by the repeated tsunami-wave erosion and/or post-tsunami fluvial erosion.

Keywords: tsunami, erosion, bedrock, terrestrial laser scanning, valley-side slope