

Quantification of surface erosion and hiker use of mountain trails: A case study at Mt. Yotei, Hokkaido

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The use of mountain trails by hikers often causes soil surface erosion of trails. Assessing such erosion and the amount of use by hikers is essential for the sustainable management of trails in mountain areas and for the future contributions to the health and life enrichment of people. At the study sites of trails at Mt. Yotei in Hokkaido, Japan, we explore the effective methods of three-dimensional measurements of trail surface using different sensors of terrestrial and mobile lidar (light detection and ranging), including Trimble TX5 (terrestrial lidar) and Apple iPhone (mobile lidar), to quantify the amount of erosion on the trail surface. It appears that the lidar measurement by iPhone is likely more efficient than that by TX5, although the morphology of small features like low-height steps and tree roots are represented better in the point cloud obtained by TX5. We also use human flow (person trip) data on the hiking trails to show the spatially- and temporary-variable use of the trails based on the number of hikers and their connectivity. We perform big data analysis using the database of activity tracks taken by personal trackers with GNSS (global navigation satellite system) and assess the frequency of the trail use that relates to the soil surface erosion. This case study will also show the potential of low-cost lidar measurement for further applications to other mountainous areas.

Keywords: lidar, human flow, trail surface