Representation of three-dimensional cave structure using point cloud data by terrestrial and airborne laser scanning

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Effective conservation of underground cultural heritage is often required for the sustainable development of the local area. Although the awareness of underground cultural heritage is often limited among local people and society due partially to its invisibility, it would be necessary to promote the awareness of the heritage by various approaches including primary education and outreach activities. Non-destructive visualization of the shape and structure of underground cultural heritage is one of the fundamental approaches for its further recognition by local people. For this purpose, we propose to utilize a combined point cloud data by both airborne and terrestrial laser scanning (ALS/TLS). The study site is Taya Cave, a registered cultural heritage in Yokohama City, Kanagawa Prefecture in central Japan. While land surface point cloud data was taken by ALS, point cloud data of the inner area of the cave was obtained by TLS, for which georeferencing was applied by control points with GNSS-derived geographical coordinates. 3D point cloud data and associated mesh data were utilized for the visualization of the cave environment. A stability analysis was also performed using the 3D data, although detailed structural parametrization requires further data collection regarding the geological structures. Communications among researchers, residents, and local governments are recommended for the effective and sustainable protection of the cave, and the visualized 3D dataset will be utilized for evaluating the value of the underground cultural heritage in the local society.

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