Enhancing understandings of geomorphological processes using multi-temporal 3D print models

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Two-dimensional (2D) representations of land surface including photographs and maps are often used for promoting understandings of geomorphological processes. It is commonly known that representations of geomorphological processes based on such 2D information has a certain effect on enhancing the understandings and spatial thinking by people, but the use of 2D information may also have a limitation in its understandability for recipients particularly if their skills and knowledge of land surface are not well established. To provide more intuitive appeals to recipients' senses, we examine methods of presenting geomorphological processes using three-dimensional (3D) information. Using topographic measurement methods including unmanned aerial system-based structure-from-motion photogrammetry (UAS-SfM) and terrestrial laser scanning (TLS), we can readily capture the change of natural environment at high-definition. Furthermore, these methods enable not only 2D representations such as photographs and maps but also 3D representations such as high-density point cloud, 3D mesh, and 3D print models. In this study, we use 3D print models based on UAS- and TLS-derived topographic data to examine the effectivity of 3D information in promoting people's understandings of geomorphological processes. We carried out a public exhibition at a local museum and conducted interviews with visitors. First, we showed the visitors aerial photographs of sea cliffs in two different periods and asked them to describe changed areas. After that, we showed them two 3D print models and asked to describe the changed portions. The visitors were unable to specify the changes in the sea cliffs from the 2D aerial photographs, but they correctly pointed out many changed portions with the 3D print models. They also realized the amount of erosion and the rate of erosion with the 3D print models. The multi-temporal 3D print models are therefore effective in contributing to people's intuitive understanding of geomorphological processes.

Keywords: 3D print models, geomorphological process, erosion, outreach, high-definition topographic data

