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Rapid mapping using low-cost structure-from-motion photogrammetry expedites the lahar modeling process

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Structure-from-motion (SfM) is a branch of photogrammetry that triangulates points in digital photos to produce a 3D model. When applied to topographical modeling, SfM presents a powerful tool for rapid terrain mapping. At little to no cost and on a timescale of hours, a metric-resolution digital terrain model (DTM) can be produced; the resultant DTM can be used for many types of hazard scenario modeling and is here applied to lahars and floods.

This study demonstrates the robustness of the SfM method through two case studies. First, an SfM DTM of Boscastle, UK, is compared against LiDAR and SRTM DTMs in a flood simulation model. Resolution is found to be more robust than for satellite based DTMs, and though less precise than the most detailed LiDAR survey, still perfectly adequate for the purposes of modeling flows. Next, the same method is applied to a region of Ecuador lacking the regionally comprehensive LiDAR survey available in the UK. Compared against the only other topographical data available, (SRTM, ASTER, 1956 topographical map), the SfM DTM is shown to have a higher resolution and is a preferable alternative for modeling lahars.

The advantages of this study for emergency management are to provide a cheap and rapid metric-resolution alternative to low resolution or costly topography data sets. In regions such as Ecuador where scientific resources are scarce, SfM assists in providing a thorough, but otherwise unattainable, understanding of potential disaster scenarios that is accessible to local authorities to be used in the disaster prevention and mitigation processes.