Multi-temporal satellite photogrammetry for the quantification of lava flow volumes

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Résumé

The retrospective mapping and quantification of lava flows is an important prerequisite for reconstructing volcanic activity (e.g. effusion rates) and for assessing lava flow hazard. While recent years have seen numerous applications of space-borne bistatic X-band SAR interferometry there are still relatively few studies to assess the potential value of increasingly available very-high resolution optical stereo-pairs and triplets (e.g. Pléiades, WorldView). To fill this gap we conducted a case study on the quantification of lava flow volumes resulting from eruptions of the Piton de La Fournaisse between 2010 and 2016 including a LiDaR DSM (2010) and two Pléiades triplets (2015, 2016). The data was processed using an in-house processing chain (DSM-OPT) which is is built on top of the MicMac library and enables end-to-end automation of the photogrammetric processing on high-performance computing infrastructure. We report the accuracies of the obtained surface models and the uncertainties of the lava flow volumes in comparison to ground-based measurements. Our results demonstrate the feasibility of using spaceborne photogrammetry for measuring lava volumes with an error of less than 10% and, consequently, the potential use of this technique for operational volcano monitoring.

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