

Using Stereo-photogrammetry to Understand the Topography, Composition, and Evolution of Lava Flows from Effusive Eruption of Quizapu Volcano

¹R. Moon, ²E. Lev

¹*Columbia University*, ²*Lamont-Doherty Earth Observatory of Columbia University*

Located at the southern end of the Descabezado Grande-Cerro Azul eruptive system in central Chile, Quizapu Volcano's first recorded eruption occurred in 1846. The large (~5 km³) effusive eruption formed multiple lava flows, including two major (~9 km long) flows west of the currently existing crater. The two western flows have distinct topographies and chemical compositions. The southern flow is wider and more gradually sloped with a silica content of 67-68 wt%, while the northern flow is more rugged and irregularly shaped with a silica content of 62-63 wt%. Flow morphology and structure are closely connected with lava composition, temperature, viscosity and volumetric flux. However, existing (e.g., Google Earth, GeoMapApp) topographic data for the Quizapu flows does not provide sufficient spatial resolution to characterize flow morphology. To address this gap, a large set of aerial photographs was collected through 12 flights of an unmanned aerial vehicle (UAV). These flights covered areas of both the north flow and south flow at varying distances along the length of the flows. Utilizing stereo-photogrammetry and the Structure-from-Motion method, the overhead images were used to construct high resolution digital elevation models (DEMs) of the surveyed areas. Analysis of the DEMs showed distinct differences in flow morphology and structure between the northern flow and southern flow. Pressure ridges on the northern flow have an average wavelength of 70m and an average height of 6.3m, while pressure ridges on the southern flow have an average wavelength of 43m and an average height of 2.4m. The wavelength and height of the pressure ridges also varied in response to the local width of the lava flow. On the northern flow, where the levee to levee distance is 342 meters, the levee height above the adjacent exterior is an average of 41m high with a pressure ridge wavelength of 61m and height of 5.7m. At the northern flow's narrowest point, where the levee to levee distance decreases to 220 meters, the levee height above the adjacent exterior rises to 93m high, the pressure ridge wavelength increases to 107m and the height to 9.9m. The results demonstrate the capabilities of stereo-photogrammetry to produce high resolution DEMs which can be used to effectively analyze lava flow morphology.