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Using glaciers to identify, monitor, and predict volcanic activity

Michael Martin¹, Iestyn Barr¹, Benjamin Edwards², Elias Symeonakis¹, and Matteo Spagnolo³

¹Manchester Metropolitan University, Department of Natural Sciences, Geography, United Kingdom of Great Britain and Northern Ireland (michael.d.martin2@stu.mmu.ac.uk)

²Department of Earth Sciences, Dickinson College, United States

³Department of Geography and Environment, University of Aberdeen, United Kingdom

Many (about 250) volcanoes worldwide are occupied by glaciers. This can be problematic for volcano monitoring because glacier ice potentially masks evidence of volcanic activity. Both the deadliest and most costly volcanic eruptions of the last 100 years involved volcano-glacier interactions. The 1985 eruption of Nevado del Ruiz killed 23000 people, and the 2010 eruption of Eyjafjallajökull led to the closure of many European airports. Therefore, improving methods for monitoring glacier-clad volcanoes is of clear societal benefit. Amongst several methods, satellite based remote sensing techniques are perhaps most promising, since they frequently have a relatively high temporal and spatial resolution, and are mostly freely available. They can help to identify the effects of volcanic activity on glaciers, including ice fracturing, ice surface subsidence and glacier acceleration potentially due to subglacial melt or subglacial dome growth. This study aims to link pre-, syn- and post-eruption glacier behavior to the type and timing of volcanic activity, and to develop a satellite based predictive tool for monitoring future eruptions. Despite several studies that link volcanic activity and changing glacier behavior, the potential of using the latter to predict the former has yet to be systematically tested. Our approach is to use satellite imagery to observe how glaciers responded to past volcanic events, and to build a training database of examples for automated detection and forecasting.