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SedCas_Volcano: a novel approach to modelling decadal evolution of lahar hazard in response to episodic volcanic eruptions

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Lahars are a common and potentially long-lived hazard in river basins affected by explosive volcanic eruptions. They result from the hydrological disturbance of surrounding landscapes, driven by the destruction of vegetation and deposition of pyroclastic material. These modifications typically result in heightened rainfall runoff responses, via reduced interception and infiltration, leading to increased water and sediment flux, manifesting as lahars. With time, landscapes recover via removal of sediment, establishment and stabilisation of channels, and the redevelopment of vegetation. This recovery subsequently reduces the runoff response to rainfall and in turn limits the potential magnitude and frequency of lahars. Numerical modelling is an important approach for assessing the hazard posed by lahars. Most modelling approaches related to lahars consider the remobilisation susceptibility of pyroclastic deposits under particular conditions, or the runout/inundation potential of individual or probabilistic ensembles of flows. To date, very limited research has sought to address the longer-term (years to decade) evolution of lahar activity in affected catchments as they respond to and recover from disturbance. Here we present and discuss SedCas_Volcano, a simple model designed to simulate the longer-term evolution of lahar incidence in a catchment on the island of Montserrat that has been repeatedly disturbed by episodic volcanic activity since 1995. Using this simple and computationally inexpensive numerical framework, we account for variability in sediment supply, vegetation cover, and rainfall. Here we will discuss the merits of this model and identify possible next steps for continued model development.