Geophysical Research Abstracts
Vol. 20, EGU2018-11000, 2018
EGU General Assembly 2018

Emulation of the relationship between hazard intensity and volcanic processes

Stuart Mead, Mark Bebbington, and Jonathan Procter
Massey University, New Zealand (s.mead@massey.ac.nz)

The impact of hazardous volcanic processes such as pyroclastic flows, tephra fall and lava flow varies with the style, intensity, magnitude and location of the eruption in addition to environmental conditions (e.g. wind, snow). The large, multidimensional input space created by this variability makes potential damage from volcanic hazards hard to predict using traditional statistical, deterministic or combined modelling approaches. A recent technique for quantifying the impact of volcanic hazards, emulation, maps the functional relationship between the inputs and outputs of modelled volcanic phenomena. This approach reduces the computational cost of numerical modelling in multidimensional input spaces, leveraging a limited number of simulations to quantify volcanic hazard, including uncertainty, at unsimulated inputs. Additionally, when combined with modern mapping and information technologies, emulation has the potential to provide end-users with an accessible, complete picture of volcanic hazards and their potential impacts. To approximate the relationship between model inputs and outputs, emulation requires the specification of covariance functions and their hyperparameters. Covariance functions define the correlation structure between inputs and outputs with weighting controlled by hyperparameters, free parameters in the covariance function. The choice of covariance functions and hyperparameters are of great importance for robust hazard estimates.
This study presents observations and results from a multi-hazard assessment of select volcanic hazards (tephra fall, pyroclastic density currents and lava flows) at Mt. Taranaki, New Zealand. Numerical modelling is used in conjunction with emulation to produce an estimate of the hazard intensity, including uncertainty, at any input configuration. The effect of different covariance functions and hyperparameter fitting strategies on hazard estimates is analysed, and new techniques to deliver hazard information direct to stakeholders are proposed.