Mathematical Coupling of Geological Data as an Approach to Volcanic Hazard Analysis; Harrat Rahat, Saudi Arabia

Melody G Runge[1], Mark Bebbington[2], Shane J Cronin[2], Jan M Lindsay[1], Mohammed R Moufti[3], Talal Mokhtar[3]

[1]University of Auckland, New Zealand, [2]Massey University, New Zealand, [3]King Abdulaziz University, Saudi Arabia

E-mail: mhum400@aucklanduni.ac.nz

The monogenetic volcanic field of Harrat Rahat in Saudi Arabia is a highly complex volcanic system with 1000+ volcanic cones or craters distributed over 20,000 km2 and with evidence of volcanic activity spanning from >10 Ma to eruptions in 641AD and 1256AD. This record, and a possible recent stalled eruption in 1999, drives a need to quantify the likelihood and magnitude of future eruptions. This has stimulated research about the controlling subsurface processes essential for estimating eruption frequency, magnitude, and style of distributed alkali-basaltic intraplate volcanism, as well as the probable location of a future event.

Observable data for this field include: vent locations, volumes and spatial distributions of past eruptive products, aeromagnetic and seismic interpretations of sub-surface structure, regional tectonic models, along with petrographic and geochemical analyses of some the erupted products.

To obtain spatio-temporal recurrence rate estimates for volcanic fields that exhibit both natural variability and highly complex dynamics, a method is presented which determines probable relationships between data sets. The ultimate goal is to determine which, if any, of the currently observable data and geophysical/geological models are related to the locations and timings of eruptive events.

Data sets are arranged as spatially (and if applicable, temporally) constrained layers and training and validation procedures used to determine the most probable relationships between data sets and consequently which geophysical properties best explain the surface expression of volcanism