



Patterns in Seismicity at Mt St Helens and Mt Unzen

Oliver Lamb, Silvio De Angelis, and Yan Lavallee

Dept. Earth, Ocean and Environmental Sciences, University of Liverpool, Liverpool, United Kingdom
(olamb245@gmail.com)

Cyclic behaviour on a range of timescales is a well-documented feature of many dome-forming volcanoes. Previous work on Soufrière Hills volcano (Montserrat) and Volcán de Colima (Mexico) revealed broad-scale similarities in behaviour implying the potential to develop general physical models of sub-surface processes [1]. Using volcano-seismic data from Mt St Helens (USA) and Mt Unzen (Japan) this study explores parallels in long-term behaviour of seismicity at two dome-forming systems. Within the last twenty years both systems underwent extended dome-forming episodes accompanied by large Vulcanian explosions or dome collapses. This study uses a suite of quantitative and analytical techniques which can highlight differences or similarities in volcano seismic behaviour, and compare the behaviour to changes in activity during the eruptive episodes.

Seismic events were automatically detected and characterized on a single short-period seismometer station located 1.5km from the 2004-2008 vent at Mt St Helens. A total of 714 826 individual events were identified from continuous recording of seismic data from 22 October 2004 to 28 February 2006 (average 60.2 events per hour) using a short-term/long-term average algorithm. An equivalent count will be produced from seismometer recordings over the later stages of the 1991-1995 eruption at MT Unzen. The event count time-series from Mt St Helens is then analysed using Multi-taper Method and the Short-Term Fourier Transform to explore temporal variations in activity. Preliminary analysis of seismicity from Mt St Helens suggests cyclic behaviour of subannual timescale, similar to that described at Volcán de Colima and Soufrière Hills volcano [1]. Frequency Index and waveform correlation tools will be implemented to analyse changes in the frequency content of the seismicity and to explore their relations to different phases of activity at the volcano. A single station approach is used to gain a fine-scale view of variations in seismic behaviour at both volcanoes with a focus on comparisons with changes in activity with the hope of gaining a greater understanding of sub-surface processes occurring within the volcanic systems. This approach and the techniques above were successfully implemented at Redoubt Volcano (USA) [2] which also concluded that these techniques may serve an important role in future real-time eruption monitoring efforts.

[1] Lamb O., Varley N., Mather T. et al., in prep Similar Cyclic Behaviour at two lava domes, Volcán de Colima (Mexico) and Soufrière Hills volcano (Montserrat), with implications for monitoring.

[2] Ketner, D. & Power, J., 2013. Characterization of seismic events during the 2009 eruption of Redoubt Volcano, Alaska. *Journal of Volcanology and Geothermal Research*, 259, pp.45–62