Motivation

Hydrological systems within volcanoes are complex. Hydrothermal fluids moving within the volcanic edifice facilitate alteration, creating zones of mechanical weakness that can lead to sector collapse or lateral generation. In addition, the interaction of surface or groundwater with the magmatic system can trigger plastic strains which may produce large-scale magmatic eruptions. Despite the vital role of groundwater in volcanic hazards, little is known about subaerial volcanism hydrology. Efforts to develop groundwater models are hindered by a lack of data on water table elevation and poor constraints on water budget. Topographic flux generally suffers from decreasing resolution with increasing depth, thus limiting our ability to resolve deep structure. At Mount St. Helens, the removal of 450m of elevation during the 1980 eruption provides a unique window into the deeper plumbing of an active strato-volcano.

Method & Data Processing

Time-domain electromagnetic (TEM) is a non-contact geophysical technique capable of imaging resistivity structure on scales intermediate between DC resistivity and magneto tellurics (5-500m). As an indicative technique, it is well-suited to volcanic settings where high contrast structures often hinder current injection and/or potential measurements.

In practice, the TEM method consists of transmitting current through a large loop kept with a few 10’s of 100’s of square meters and then measuring the self-capacitance. The current turns on induces an emf in the earth which off-sets decreases and is neutralized. In subsurface conductors, only conductive regions which remain producing secondary magnetic fields that are measured as a result located in the center of the transmitter loop. It is the time delay that is recorded to form a secondary emf that contains information about the subsurface resistivity.

Measured data are averaged and converted to an apparent resistivity from the Mount Rainier cutaway future role of post-Osceola extwve high conductivity of this layer suggests the presence of clays within a thick brecciated member of the summit cone future Osceola collapse. The geometry of this system is first order given that the change in plane 3000m m in elevation during the 1980 eruption provides a unique window into the deeper plumbing of an active stratovolcano. The geometry of this system is first order given that the change in plane 3000m m in elevation during the 1980 eruption provides a unique window into the deeper plumbing of an active stratovolcano.