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Virtual Transient Electromagnetics at Stromboli Volcano, Italy

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Volcanic activity is one of the main natural hazards and may cause damage to life and infrastructure. Therefore, investigation and monitoring of volcanic activity is crucial in mitigating volcanic risk. Since transport processes in the conduit have a major impact on eruption dynamics, understanding conduit processes is of great interest. Unfortunately, direct measurements of these processes are difficult and one has to rely on remote sensing techniques while observing them.
Due to the high conductivity contrasts between hot magma or hydrothermal systems and the relatively cold and mostly dry host rock, electromagnetic methods are suitable to detect hydrothermal systems or processes within the conduit of an active volcano. The transient electromagnetic method (TEM) is capable of investigating conductivity structures of up to several hundred meters depth. Therefore, this method should be well suited to explore hydrothermal systems and processes within a volcanic conduit.
For exploring the usability of TEM in volcanic environments, we use three-dimensional forward modeling, so-called virtual experiments, on a digital elevation model of Stromboli volcano, Italy. The main purpose is to characterize the nature of electromagnetic fields in complex topographic settings and the vicinity of a magmatic conduit causing a highly conductive anomaly. Consequently, conclusions on the usability of TEM in volcanic environments can be drawn.
Motivated by the computational results, in June 2019 we conducted a field experiment at Stromboli Volcano, Italy, to investigate the feasibility of TEM under field conditions.
The results of the virtual experiments as well as the conductivity distribution resulting from the TEM field data will be presented.

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