Geophysical Research Abstracts
Vol. 19, EGU2017-10595, 2017
EGU General Assembly 2017

Experimental and numerical analysis of fluid flow in pipe - like conduits

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Volcanic activity is complex and it is a good example of multiscale phenomenon due to the sundry processes that occur at different scales while fluids ascend from the magmatic reservoirs to volcanic vents. Several processes occur at their own time scale and within a wide range of strengths. Each process contributes with its particular elastic response to the overall stress-strain field of the conduit dynamics. In this work, we present experimental and numerical analysis of fluid flowing through pipe-like conduits in order to understand the dynamic of the volcanic eruptions and its effects on the seismic signals. We focused on the elastic response of cylindrical conduits due to the flow of viscous Newtonian fluids (0.001 and 1 Pa s) passing through them. We compared signals obtained experimentally with those calculated by numerical modeling. The experimental signals are recorded with high dynamic range piezoelectric sensors located along the conduit where the fluid flows due to a sudden pressure drop. The numerical counterparts are calculated through a scheme that involves the continuity and motion equations for fluids, where the fluid couples with the surrounding solid; the excitation function simulates a pressure drop, in the range of the experimental values. In both, the excitation is considered an instantaneous pressure drop from maximum 3 bar to ambient pressure. The analysis of these observations included video recording of the process with a high speed camera. The dynamic behavior of experimental and numerical simulations present high similarity with field volcanic signals associated with pressurization processes. Our studies contributes to the understanding volcanic phenomenon and its effects on field base seismograms.