

Pyroclastic Flow Induced Tsunami Captured by Borehole Strainmeter during Massive Dome Collapse at Soufriere Hills Volcano, Montserrat, West Indies: Observations and Theory

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Strainmeters at three Caribbean Andesite Lava Island Precision-Seismo-geodetic Observatory (CALIPSO) borehole sites recorded dilatation offset by 7-12 minutes from the seismic signals leading up to 12/13 July 2003 dome collapse eruption of Soufriere Hills Volcano, Montserrat, West Indies. Pyroclastic flows were observed entering the ocean at the Tar River Valley (TRV) delta at 18:00 local time (LT) 12 July. The eruption occurred 23:30 LT 12 July, with dome collapse consisting of 210×10^6 m³ (DRE). Dilatometers at three sites recorded complex, correlated long period oscillatory wave packets with periods ~250-500 s. The strongest oscillatory signal was at Trants, the site nearest to the TRV delta and the coastline. GEOWAVE was used to model wave initiation and propagation to test that pyroclastic flows and dome collapse into the ocean at the TRV delta stimulated tsunamis. These tsunamis are hypothesized to be signal the strainmeter is observing. The spectral power simulated ocean waves were compared to observed strain at Trants. Simulated wave heights correlate with observations and demonstrate strainmeter sensitivity to geophysical processes not envisioned in the design of the installation at SHV.