ABSTRACT

TITLE:	An Analysis of GPS and Remote Sensing Data of Soufrire Hills Volcano, Montserrat, During the July 2003 Dome Collapse: Implications for Detection of Ash Plumes and Vertical Deformation
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ABSTRACT: A 210 Mm3 dome collapse of the Soufrire Hills Volcano (SHV) occurred on July 12th, 2003. Five continuous GPS receivers collected data at 30 sec intervals covering the massive dome collapse. GPS data were processed with GOA-II (v. 5) using high-rate (30 s) final, precise orbit, clock, and earth orientation parameter products, while treating the antennae as a kinematic buoy. During the peak dome collapse event while ash venting and significant plumes were most prominent, one GPS station, HERM, located 1.6 km northeast of the dome, recorded a maximum vertical displacement of 1.98 m from its mean elevation of 437m above sea level, with negligible horizontal movement. This estimate of vertical site displacement was an order of magnitude larger than those estimated at other sites on SHV. Both HERM and another station, SOUF, are in close proximity to the path of the pyroclastic flows resulting from the dome collapse; the SOUF site shows a maximum vertical displacement over the same time of only 0.43 m. Full resolution GOES satellite imagery from the event were examined and correlated with the timing of apparent vertical displacement from HERM to test the relative contributions of tropospheric interference from co-collapse ash plumes. GOES infrared imagery was used to verify the temporal and spatial progression of ash plumes and cloud cover by extracting gray scale values ranging from 0 to 255 for specific pixels proximal to the location of each GPS station. No variation was observed between gray scale values in the GOES infrared band for specific pixels centered on the GPS sites. In addition, the GPS-derived zenith-wet-delay from HERM shows a slight decrease in moisture during the peak dome collapse, when the ash plume was at its maximum intensity. These data are not consistent with a significant moisture contribution from a volcanic plume. Accordingly, the moisture content associated with the ash plume cannot solely account for the apparent vertical displacement of 1.98 m observed at the HERM site and that some significant portion of the displacement is related to actual crustal motion during the peak collapse event.