Supplementary Material for: "**Recent Geodetic Unrest at Santorini Caldera, Greece**"

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## Survey GPS data collection and Processing:

All campaign GPS measurements are performed using 0.5 m fixed-height spike-mounts, and are leveled using precision machinist levels, in order to that minimize user-error in both vertical and horizontal measurements. During surveys, sites were occupied for 3-day periods, with the exception of the 2011-I survey in which sites were occupied for 2-day periods due to timing constraints.

For all GPS data precise point positions are determined at the University of Miami Geodesy Lab using version 6.1 of the OASIS-GIPSY software using *Blewitt's* (2008) Ambizap algorithm to resolve ambiguities, an using NASA- Jet Propulsion Laboratory precision satellite orbits. All solutions are determined in ITRF2008. Such data reduction methods represent the state-of-the-art in precision GPS processing, and require on average a 2-week latency before solutions can be resolved. More rapid, but noisier solutions are also determined using rapid orbit products from JPL. These orbits have about a factor of 2 increase in their rms positions, but are available within 2 days, and are hence more valuable for warning.

## Additional References:

Blewitt, G. (2008). Fixed point theorems of GPS carrier phase ambiguity resolution and their application to massive network processing: Ambizap. *Journal of Geophysical Research*, *113*(B12). doi:10.1029/2008JB005736.

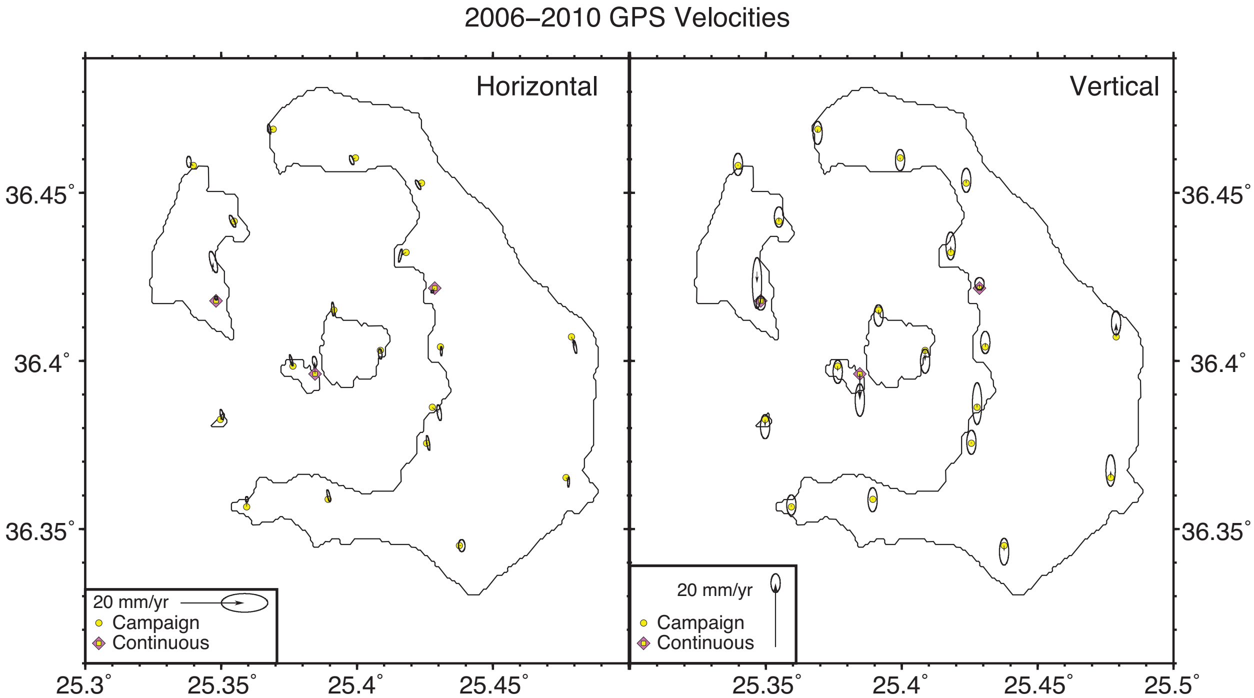



**Figure S1**: [left] Horizontal and [right] vertical GPS velocity field for Santorini using campaign GPS in 2006, 2008 and 2010, and 3 continuous GPS operating through this time. For all illustrations the mean island velocity (East, North = 7.06, -15.78 mm/yr) as determined by these 22 stations is removed. Velocities are scaled to be comparable to other figures in this study.

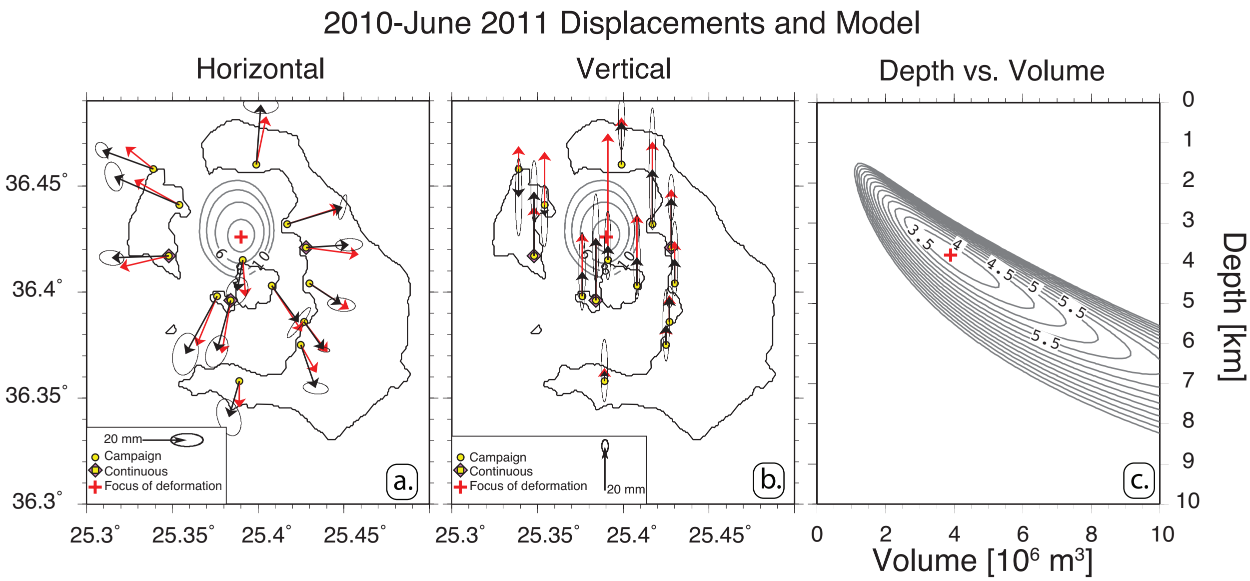



**Figure S2**: [a] Horizontal and [b] vertical GPS velocity vectors (black arrows) along with model predictions (red arrows) for the best fit spherical source solution (red cross) for the period between the last campaign or continuous GPS data in 2010, and June 2011. [c] Also shown is the depth versus volume trade-off.

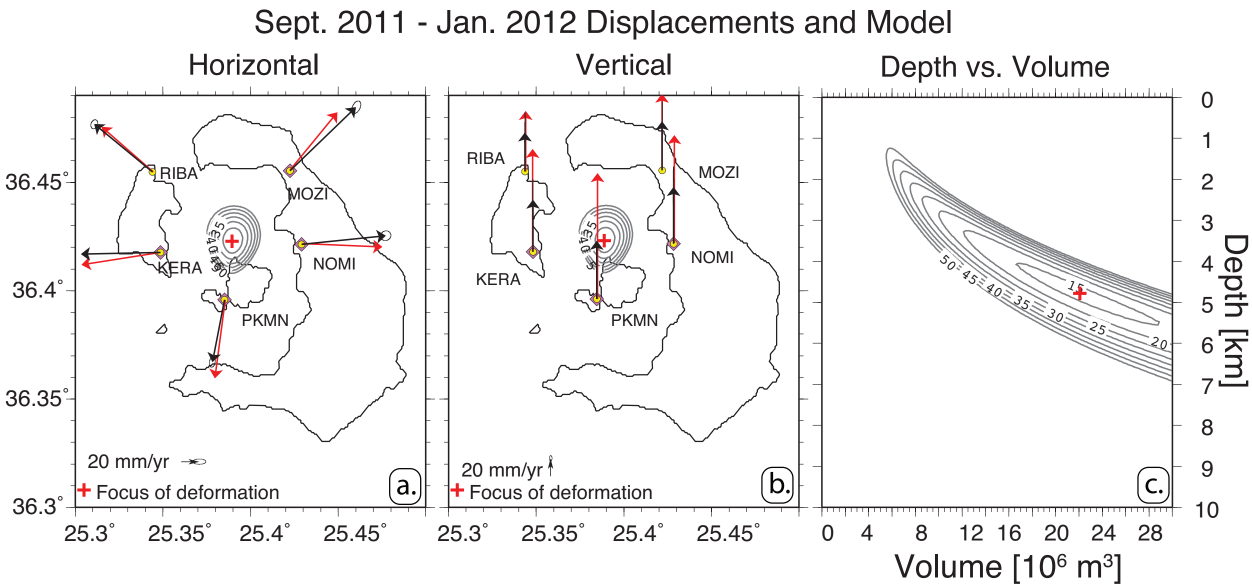



**Figure S3**: [a] Horizontal and [b] vertical GPS velocity vectors (black arrows) along with model predictions (red arrows) for the best fit spherical source solution (red cross) for the period between September 1, 2011 and January 21, 2012. [c] Also shown is the depth versus volume trade-off.

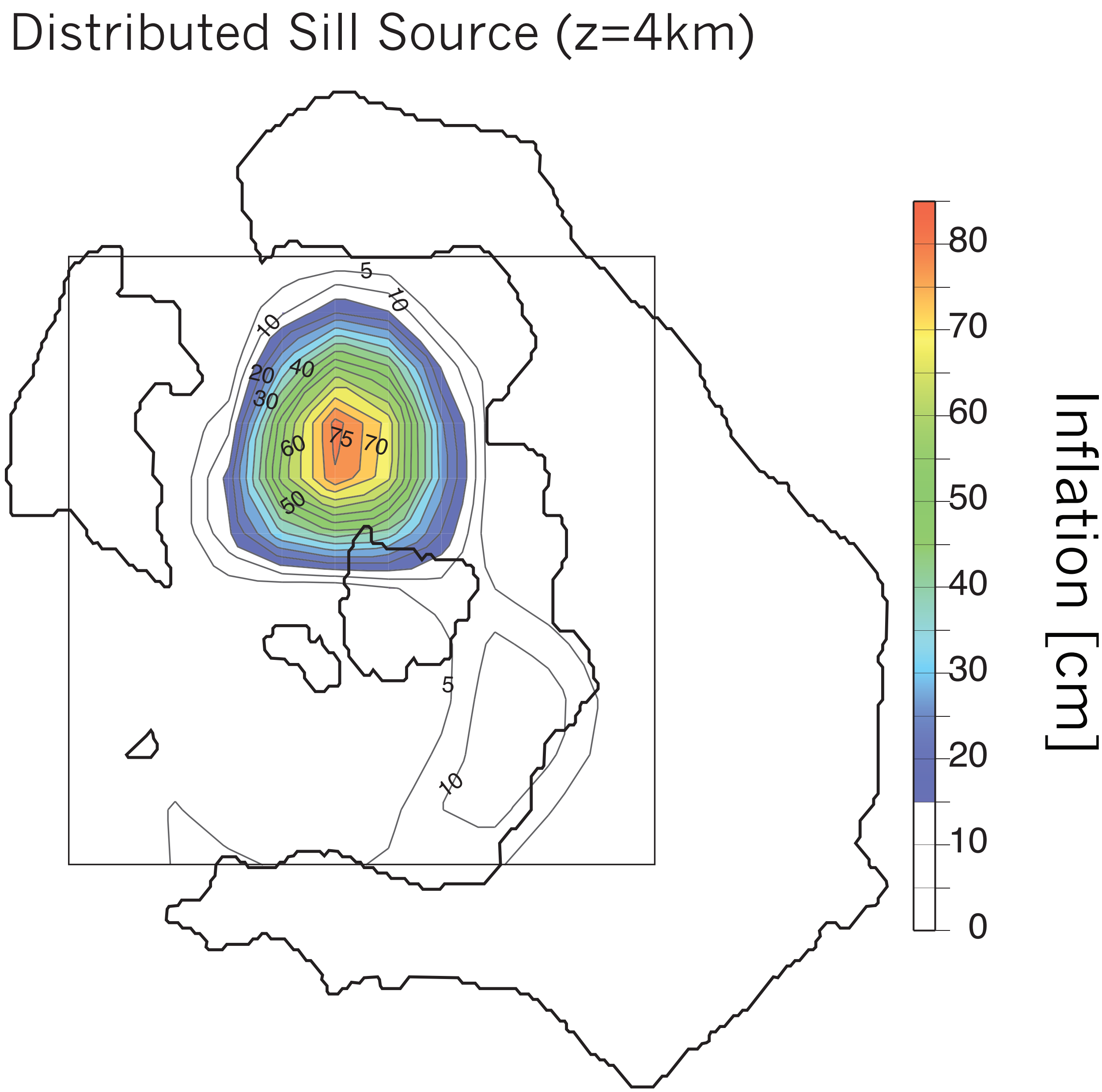
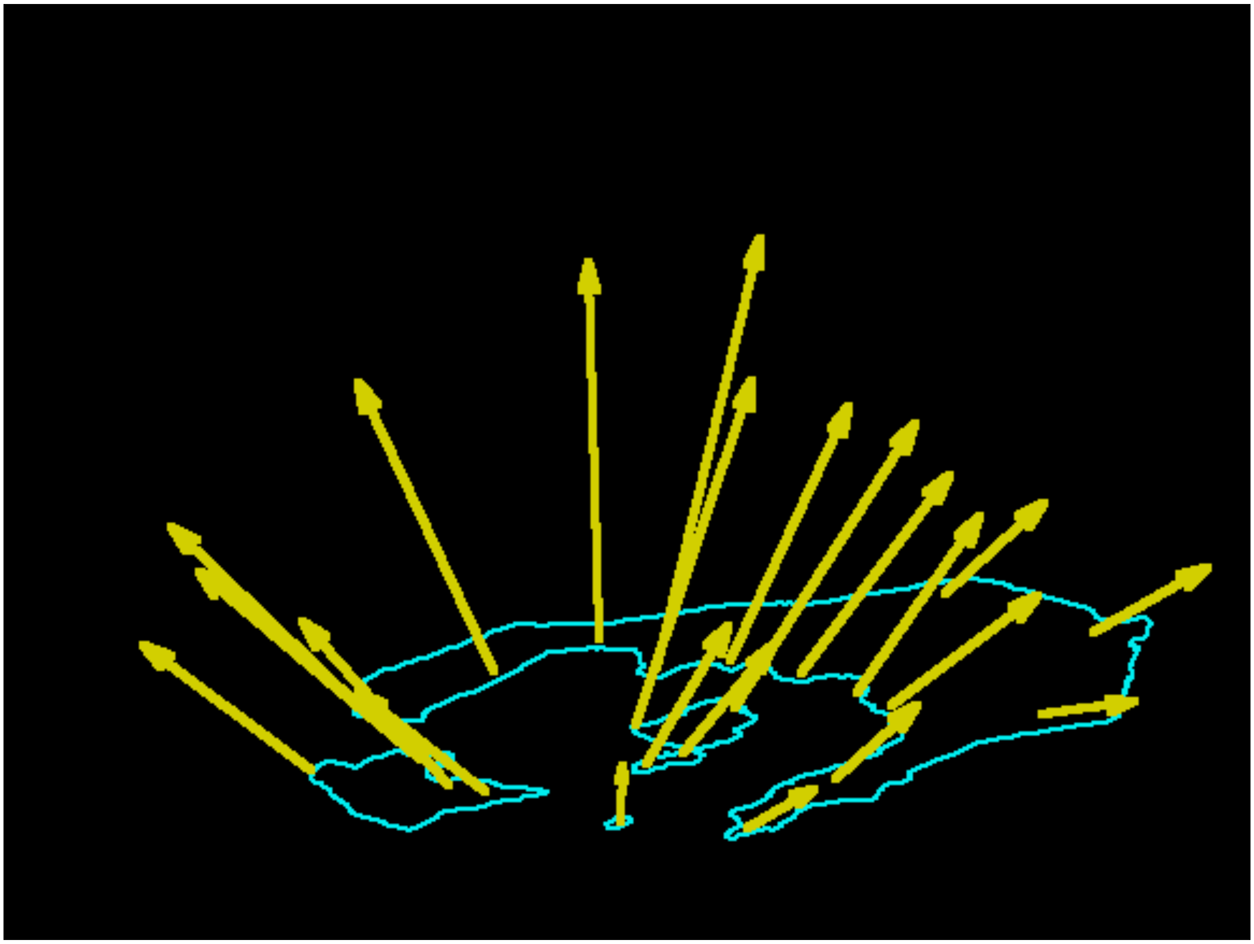



**Figure S4**: Best fit solution for a distributed sill model for Santorini. This model is fixed at 4 km depth, uses 144 - 0.01°x0.01° patches to describe opening-mode dislocations following *Okada* [1985]. The solution is smoothed using Laplacian constraint to minimize the reduction in fit quality with model roughness. The model finds a maximum inflation of up to 80 cm in the central caldera, and a volumetric growth of 9.2 million $m^3$. While the sill model has about 2x worse misfit (rms = 1.5 cm) than the best spherical source models, the data is useful because it illuminates the potential lateral contribution of inflation.



**Animation S1**:  Three-dimensional animation of the static displacement field between the 2010 and September 2011 surveys, corresponding to data shown in Figure 1.  Vector magnitudes scale between 1.9 and 7.7 cm, and all radiate from a point in the northern section of the caldera. Animation available at: *http://geophysics.eas.gatech.edu/anewman/research/papers/Newman_etal_GRL_2012ms01.gif*