NEWS

Slow Slip Event at Kīlauea Volcano

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Early in the morning of 1 February 2010 (UTC; early afternoon 31 January 2010 local time), continuous Global Positioning System (GPS) and tilt instruments detected a slow slip event (SSE) on the south flank of Kīlauea volcano, Hawaii. The SSE lasted at least 36 hours and resulted in a maximum of about 3 centimeters of seaward displacement. About 10 hours after the start of the slip, a flurry of small earthquakes began (Figure 1) in an area of the south flank recognized as having been seismically active during past SSEs [*Wolfe et al.*, 2007], suggesting that the February earthquakes were triggered by stress associated with slip [*Segall et al.*, 2006].

SSE deformation was superimposed on long-term seaward motion of the south flank of about 7 centimeters per year, which occurs along a décollement or related low-angle faults shallower than 10 kilometers. Earthquakes triggered by an SSE in 2007 coincided spatially with typical décollement earthquakes [*Syracuse et al.*, 2009], suggesting that the SSEs also occurred on the décollement.

The February 2010 SSE displacement pattern was similar to those of previous SSEs, especially to large ($M_w > 5.5$) events in 1998, 2000, 2002, 2005, and 2007, suggesting a common source [*Brooks et al.*, 2008; *Montgomery-Brown et al.*, 2009]. Preliminary models indicate $M_w = 5.9$ for the 2010 event, similar to the $M_w = 6.0$ of the January 2005 SSE, the largest recorded SSE at Kīlauea since continuous GPS monitoring was initiated on the south flank in 1996. Between 1998 and 2005, large SSEs were characterized by a periodicity of 774 ± 7 days [*Brooks et al.*, 2006], but the two more recent SSEs, in 2007 and 2010, had longer recurrence intervals of 872 and 960 days, respectively.

Kīlauea remains the only volcano on Earth on which SSEs have been detected. The February event provides an opportunity to further explore SSE source processes and south flank dynamics. For example, there is currently no indication as to whether nonvolcanic tremor accompanies Kīlauea SSEs, as is the case for episodic tremor and slip in Cascadia. The presence of volcanic tremor and high microseismic noise in this near-coastal region in Hawaii complicates the identification of a potential SSE-related tremor, although new data may address this problem. The periodicity of SSEs prior to 2007, and the subsequent lengthening of the recurrence interval, may provide clues about the driving forces behind SSEs and may have implications for the magnitude and/or timing of future events. Finally, subdaily GPS solutions and high-rate tilt data offer opportunities to investigate the SSE propagation. Data from the February 2010 SSE may add to the understanding of the causal mechanisms of SSEs at Kīlauea and their volcano-tectonic implications.

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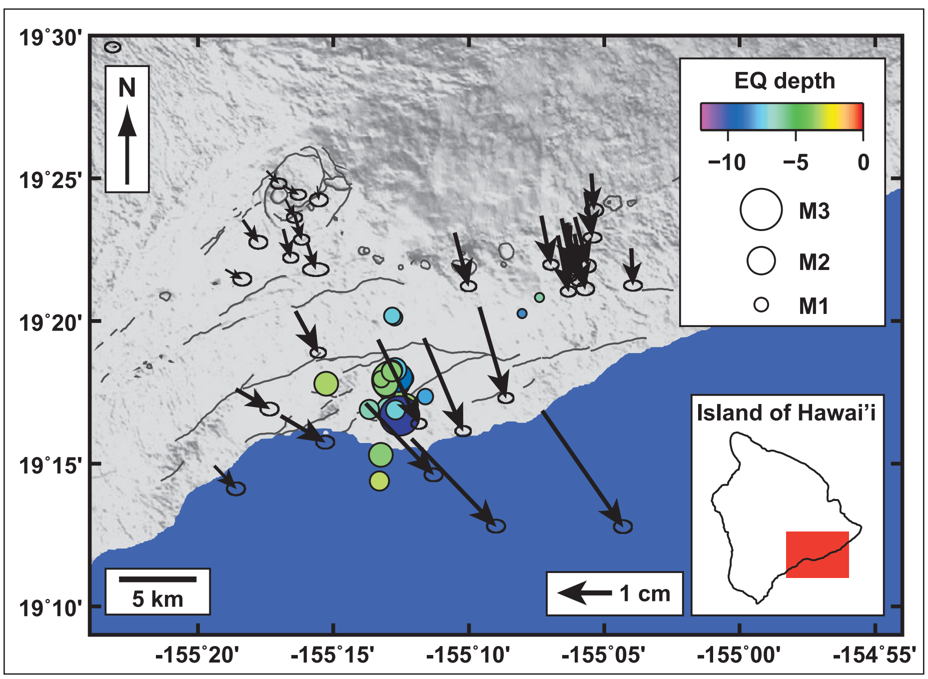

Fig. 1. Map of Kīlauea volcano, Hawaii, showing horizontal displacements (black arrows; inset arrow scale shows arrow length for 1 centimeter of displacement) associated with south-southeast motion (as recorded by continuous Global Positioning System sites) and earthquake epicenters (circles with color corresponding to depth and size giving magnitude), both covering 1–3 February 2010.