Meltwater dynamics beneath Skeiðarárjökull from continuous GPS measurements

Here we present results from ongoing measurements of surface movement in the lower ablation zone of Skeiðarárjökull (Figure 1). In April 2006, motivated by frequent floods and regional-scale seismicity from the glacier, we deployed three continuous, high-accuracy global positioning systems (Figure 2); our preliminary results are outlined in Figures 3 to 5.

SKE1: 16 September 2006; see Figure 2 for location

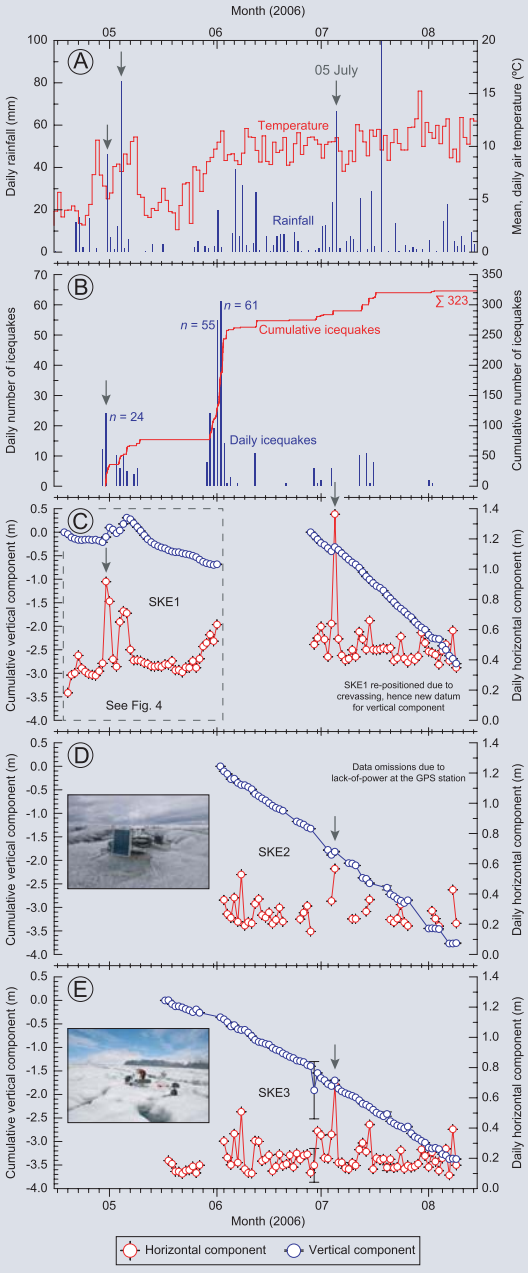


Figure 3: Stacked, time-series plots of rainfall and air temperature data from Skaftafell (A); icequake activity in Skeiðarárjökull (B); and movement of the three GPS stations (C–E). Geodetic data were processed relative to CGPS station HOFN, sited 100 km east of Skeiðarárjökull. Each GPS data-point represents a 24-hour solution based on satellite data collected continuously at 15-second intervals. Note the interdependence between intense rainfall and increased displacement rates.

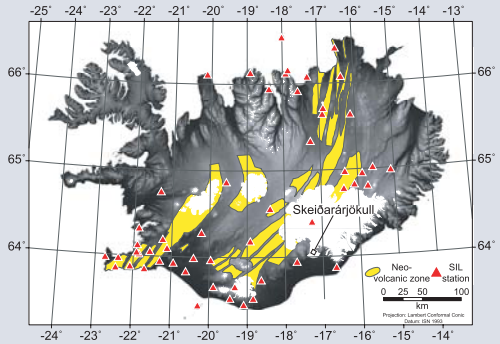


Figure 1: Skeiðarárjökull (~1,380 km^2) and the *SIL* seismic network, which is utilised to monitor seismicity from glacier (see Fig. 2).

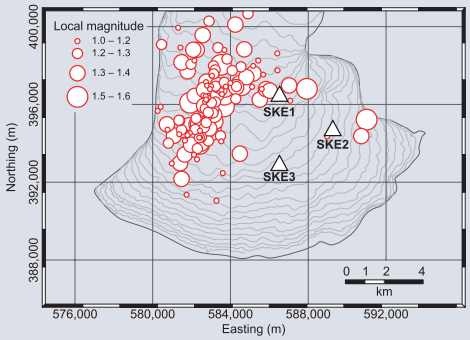


Figure 2: Location of GPS stations on Skeiðarárjökull and nearby icequake epicentres registered during the study (see Fig. 3B).

Figure 4: Increased horizontal movement at SKE1 (~450 m a.s.l.) and subsequent vertical uplift of the ice surface. Note the period of sustained ice-surface uplift in association with increasing temperature and intense rainfall in Skaftafell (~120 m a.s.l.). The return – 18 days later — to the vertical datum from 29 April implies that meltwater was released slowly from beneath the glacier.

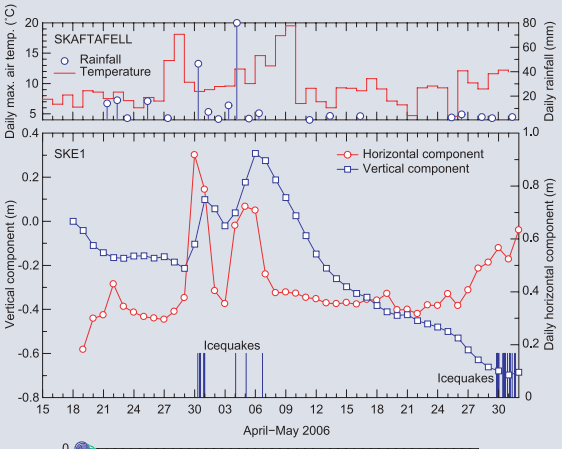


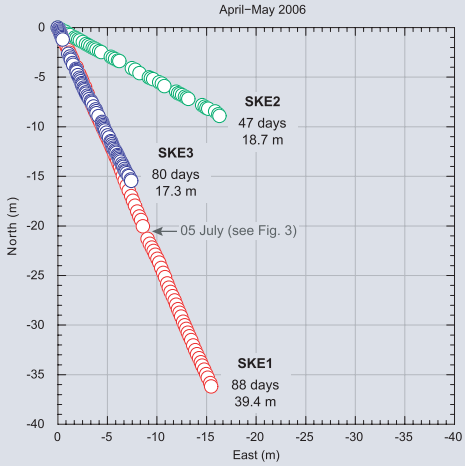
Figure 5: Total horizontal vector for each GPS station, yielding the following displacement-rate averages:

SKE1: 0.45 m d^{-1}
(18/04 – 09/08/2006)

SKE2: 0.40 m d^{-1}
(02/06 – 09/08/2006)

SKE3: 0.22 m d^{-1}
(17/05 – 09/08/2006)

The largest horizontal displacement occurred on 05 July, when SKE1 moved 1.36 m over 24 hours.



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Matthew J. Roberts	– Physics Department, Icelandic Meteorological Office E-mail: matthew@vedur.is
Eyjólfur Magnússon	– Institute of Earth Sciences, University of Iceland
Halldór Geirsson	– Physics Department, Icelandic Meteorological Office
Rick Bennett	– Department of Geosciences, University of Arizona
Erik Sturkell	– Institute of Earth Sciences, University of Iceland