

LiDAR mapping of the Snæfellsjökull ice cap, western Iceland

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Abstract — *The surface of the Snæfellsjökull ice cap in western Iceland was mapped with airborne LiDAR in 2008. A comparison with a DTM from 1999 derived by aerial photogrammetry shows that the surface of the ice cap has been lowered by 14.0 m on average during this nine year period, corresponding to an annual average mass loss of 1.25 m_{w.e.} per year when a correction has been made for the different timing of the LiDAR survey and the aerial photographs. The area of the ice cap was reduced from 12.5 km² in 2002 to 10.0 km² in 2008. Based on meteorological observations at Stykkishólmur, ~60 km to the east of the ice cap, the ice volume reduction indicates a mass balance sensitivity of $-1.9 \text{ m}_{\text{w.e.}} \text{ a}^{-1} \text{ } ^\circ\text{C}^{-1}$ for the ice cap. This is within the range of sensitivities estimated for other ice caps and glaciers in Iceland in recent years. As the average ice thickness of Snæfellsjökull is only 30 m, most of the ice cap is likely to disappear within a few decades if the warm climate of Iceland in recent years persists. The LiDAR DTM has been successfully used to delineate the location of crevasses with an automated procedure based on the calculation of the local curvature of the ice surface.*