



The evolution in the glacier mass balance of Hofsjökull ice cap, central Iceland, in 1986-2008, revealed by multi-source remote sensing data

Eyjólfur Magnússon (1), Helgi Björnsson (2), Helmut Rott (3), Sverrir Guðmundsson (2), Finnur Pálsson (2), Etienne Berthier (4), and Tómas Jóhannesson (5)

(1) The Nordic Volcanological center, Institute of Earth Sciences, University of Iceland, Reykjavík, Iceland (eyjolfm@raunvis.hi.is), (2) Institute of Earth Sciences, University of Iceland, Reykjavík, Iceland (hb@raunvis.hi.is), (3) Institute of Meteorology and Geophysics, University of Innsbruck, Innsbruck, Austria (Helmut.Rott@uibk.ac.at), (4) Université de Toulouse, CNRS, LEGOS, Toulouse, France (etienne.berthier@legos.obs-mip.fr), (5) Icelandic Meteorological Office, Reykjavík, Iceland (tj@vedur.is)

We assess how the net volume and area of Hofsjökull ice cap has evolved during the past decades from various remote sensing data obtained in the summer 1986, the winter 1995-1996, summer 2004 and summer 2008. First, we use 5m x 5m resolution DEM derived from the airborne TopScan Lidar data obtained in 2008. Second, a DEM from 2004 derived from SPOT5 optical images obtained during the SPIRIT project (20m x 20m resolution). Third, we use InSAR data from the ERS1/2 tandem mission to reconstruct a DEM for the winter 1995-1996. Twenty InSAR scenes were topographically corrected with the existing DEM's. We developed a data fusion method to extract the topographic residual signal in the interferograms and obtain a DEM corresponding to an average surface elevation in the winter 1995-1996. Fourth, we use a DEM derived by interpolating 20m interval contours from a cartographic map based on aerial photographs in 1986. The ice free areas of the high resolution TopScan DEM was used as a reference for co-registering and vertical offset-correction of the DEM's from 1986 and 2004. The four data sets were also used to delineate the glacier margin at each time. The glacier mass balance for the entire ice cap Hofsjökull, derived by subtraction of DEM's, was negative throughout our study period but declining from ~ -0.3 m yr⁻¹ w. eq. in 1986-1995 to ~ -1.1 m yr⁻¹ w. eq. from 1995 onwards, while the average summer temperature (at Hveravellir, central Iceland) increased from 4.6 °C in the period 1987-1995 to 5.6 °C in the period 1996-2008. At the same time the glacier has retreated from 918 km² in 1986 to 849 km² in 2008 or by 7.5%.