



Sensitivity of mountain permafrost to extreme climatic events; a case study from the 2006-2007 air temperature anomaly in southern Norway

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An unusual synoptic situation with long periods of warm and humid southerlies produced record breaking temperatures in southern Norway during the period from July 2006 to June 2007, particularly late summer, autumn and early winter 2006-2007. For the one-year period, the temperature anomaly was 2.5-3.0 °C above the 1961-1990 average, with highest anomalies in the eastern and northern parts of southern Norway. The homogenised mean air temperature for the station Kjøremsgrende (62°06'N, 9°03'E, 626 m a.s.l.) was 2.9 °C above the 1961-1990 average. This is the warmest since records began in 1867. The most striking month was December 2006, when mean air temperature was 7.5 °C above the 1961-1990 average. At the official mountain station Fokstugu (62°11'N, 9°29'E, 972 m a.s.l.), on Dovrefjell, there were no days with temperatures below freezing in August and September.

The late summer heat had a particularly strong impact on snow, ice and frozen ground in the mountains of southern Norway. Official mass balance investigations performed on three glaciers showed that they had their most negative net balances ever measured. Analysis of a leather shoe that melted out from a perennial snowfield at 2000 meters altitude was dated back 3,400 years old. Several complete arrows and a spade made from wood were also found in front of perennial snowfields.

This study seeks to analyse the impact of the 2006-2007 air temperature anomaly on the ground thermal regime, including permafrost and seasonal frost, in the high mountains of Jotunheimen and Dovrefjell in southern Norway. In Jotunheimen, ground temperature data are monitored in a 129 m deep permafrost borehole, located at Juvvasshøe (61°40'N, 8°22'E, 1894 m a.s.l.), established within the PACE-project (Permafrost and Climate in Europe). On Dovrefjell ground temperatures are measured in a transect from deep seasonal frost at 1039 m a.s.l. to discontinuous mountain permafrost at 1505 m a.s.l. in 11 boreholes, 9 m deep. This is the first transect of this type set up in Scandinavia. The monitoring programmes were started in autumn 1999 in Jotunheimen and in autumn 2001 in Dovrefjell and will be continued for several decades, along with measurements from associated weather stations.