Geophysical Research Abstracts
Vol. 13, EGU2011-4451, 2011
EGU General Assembly 2011

Surface energy balance and meteorology (2007–2010) in the ablation zone of Langfjordjøkelen, an ice cap in northern Norway

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Langfjordjøkelen (70°10'N, 21°45'E) is a small ice cap (7.7 km^2) in the northernmost part of mainland Norway. Surface mass balance measurements have been carried out on an east-facing part (3.2 km^2) since 1989, revealing a cumulative and annual mass balance of –18.2 and –0.87 m w.e./a respectively for the period 1989–2009. The mass deficit of Langfjordjøkelen is stronger than observed for any other glacier in mainland Norway. From September 2007 to August 2010, an automatic weather station (AWS) was operated in the ablation zone (650 m a.s.l.) of the glacier. Measured variables were incoming and reflected solar radiation, incoming and outgoing longwave radiation, air temperature, relative humidity, air pressure, wind speed and wind direction. In addition, surface height change was monitored. The mean air temperature over the measurement period was –1.0°C and is highly correlated (r^2=0.97 for hourly values) with measurements from a second AWS, located on a rock surface above the glacier (910 m a.s.l.). Compared to this AWS, wind speeds measured by the AWS on the glacier were a factor 0.6 lower. The winter snowpack had a maximum depth of more than 3.5 m every winter and did not disappear before late July in all three summers. The majority of the surface melt takes place between May and October, but even in mid-winter, short melt periods occur during stormy conditions. The energy available for melt is largest in August, when the surface consists of ice. Surface melt is dominated by net solar radiation, over the three-year period the total ice ablation at the AWS location amounted to 6 m. Even though this AWS was located at a much higher latitude, the seasonal cycles of the meteorological variables and surface energy fluxes are not very different from results obtained from two AWSs on glaciers in southern Norway.