6.3 Meteorological measurements on Midtdalsbreen

(Rianne H. Giesen)

An automatic weather station (AWS) has been operating in the ablation area on Midtdalsbreen, a north-easterly outlet glacier of Hardangerjøkulen (Fig. 6-2), since October 2000. The station (Fig. 6-6) is owned and maintained by the Institute for Marine and Atmospheric research Utrecht (IMAU), Utrecht University (contact: J.Oerlemans@uu.nl). The station records incoming and outgoing short wave and long wave radiation, air temperature, relative humidity, wind speed and direction, air pressure and distance to the surface. Sampling is done every few minutes (depending on the sensor) and 30-minute averages are stored. The record from this AWS span almost ten years (1st October 2000 to 24th August 2010) with only two data gaps; data is missing for 39 days in summer 2005 and 55 days in spring 2007.

Figure 6-6
The AWS site on Midtdalsbreen after maintenance on 24th August 2009. Photo: Rianne H. Giesen.

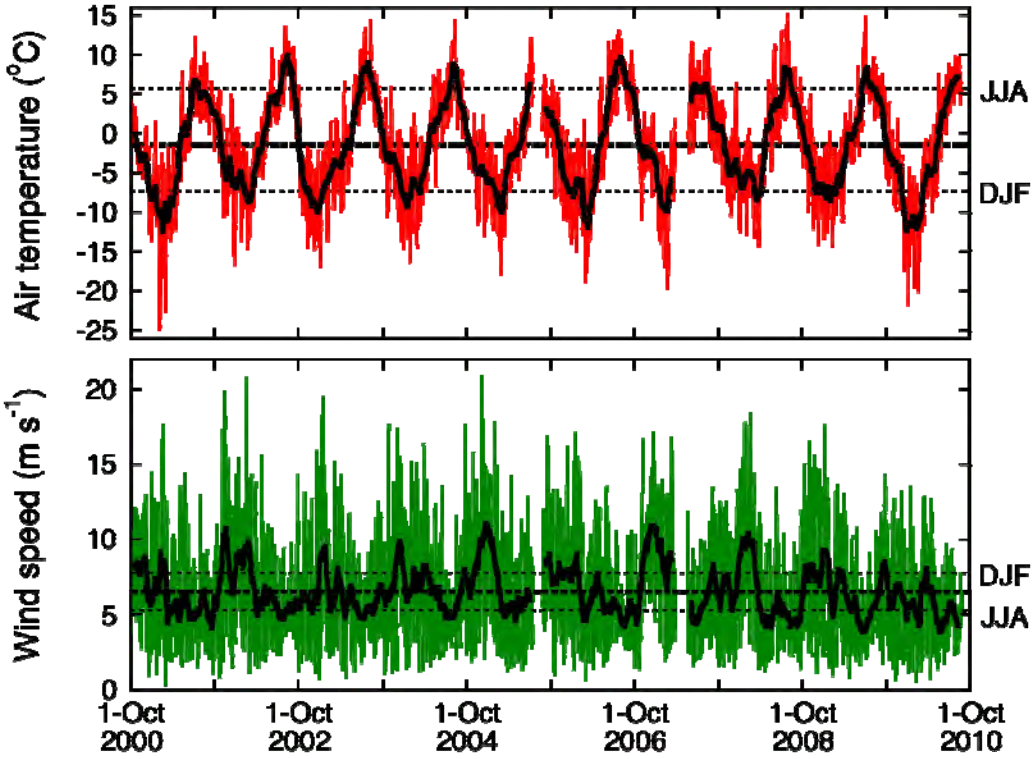

Figure 6-7
Daily mean values of air temperature and wind speed for the ten-year period (coloured lines) and the moving average over 31 days (thick solid lines). In both panels, the thick dashed line is the average of all daily mean values, the upper and lower thin dashed lines indicate the mean winter (December-February) and summer (June-August) values.

Air temperature and wind speed

Figure 6-7 shows daily mean air temperature and wind speed over the ten-year period. The mean air temperature over this period (excluding data gaps) was −1.5 °C, with mean summer and winter temperatures of 5.7 °C and 7.2 °C, respectively. The warmest summers were 2002 and 2006; the highest monthly temperature was 9.2 °C, recorded in August 2002. The mean summer temperature of 2010 (5.6 °C until 24th August) was close to the 10-year average. The winter of 2009/2010 was the coldest in the record, with mean monthly temperatures of −11.7 and −11.8 °C in January and February 2010.

The mean wind speed over the ten-year period was 6.5 m s^{-1}, with much higher variability in winter than in summer. Whilst the average winter wind speed was 7.7 m s^{-1}, the highest December to February average was recorded in 2005 (9.2 m s^{-1}) and the lowest in the winter of 2009/2010 (5.4 m s^{-1}).

Surface height change

For all ten years, the variation in surface height resulting from accumulation and ablation is shown in Figure 6-8. The records from the sonic rangers measuring the distance to the surface have more data gaps than the other records, due to melt out of the tripod or burial of the sensor in the snowpack. The maximum snow height was usually reached in April or May, ranging between less than 2 m of snow in 2002 and 2006 and more than 3 m in 2005. Depending primarily on the maximum winter snow depth, the underlying ice surfaced again between early June (in 2002) and middle July (2005). The melt rate in summer is related to the summer air temperature (Fig. 6-7), with the lowest melt rates in 2001, 2005 and 2007 and the highest in 2002 and 2006. The record from 2010 had many gaps caused by a damaged cable, but estimated maximum snow depth (2.0 m) and net ablation on 24th August (−2.7 m ice) indicate that the year 2009/2010 was an average year within this ten-year period.

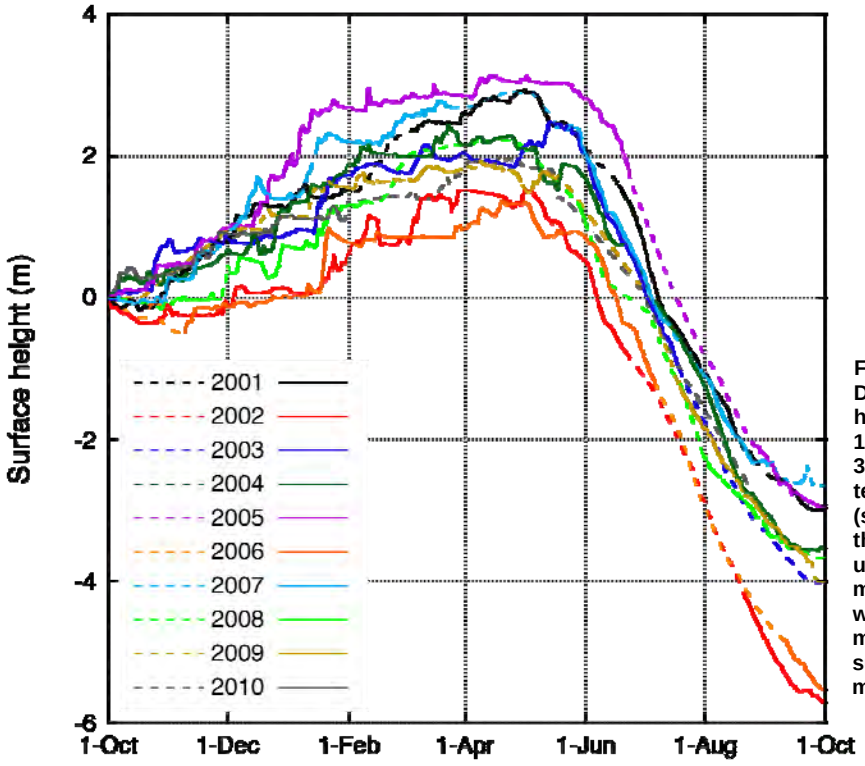

Figure 6-8
Daily mean surface height over the period 1st October to 30th September for the ten years in the record (solid lines). Gaps in the record were filled using precipitation measured at a nearby weather station and melt computed with a surface energy balance model (dashed lines).