Climatic Conditions During the ETH Measurement Campaign at Summit, Greenland, 2001-2002.

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European Geosciences Union
1st General Assembly
Nice, France, 25.- 30. April 2004

Introduction

A detailed micrometeorological measurement campaign was conducted by ETH Zurich at the Greenland Summit Environment Observatory (72°58'N, 34°46'W, 3203 m a.s.l.) from June 2001 until July 2002. Meteorological variables were continuously observed throughout the measurement period in the lowest 50 m of the atmosphere using a tower. In addition, radiosondes were launched on a daily basis to monitor the free atmosphere. The Observatory is situated in the centre of the dry snow zone of the Greenland Ice Sheet approximately 28 km NW of the true summit of the ice cap. The surroundings are characterised by a homogeneous and smooth snow surface. This poster presents the general features of the climate at the site in the time of the measurement campaign.

Wind regime

The prevailing wind direction at Summit is SSW, and the wind distribution for the campaign period can be seen in the wind rose (Fig. 1). Most notable is the sector S - SW, which represents 27% of the cases, while the sector with a positive northerly component represents only 15%. The summertime wind distribution is typically more uniform than the winter, which is characterised by persistent wind directions, typically over 3-4 days.

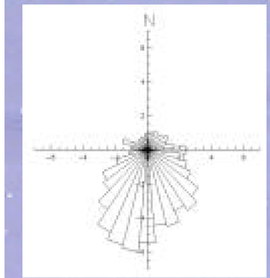


Fig. 1

Fig. 2

The influence from katabatic wind flow is relatively small over Summit compared to sites closer to the ice edge, and will therefore not contribute to large seasonal wind speed variations (Fig. 2). The wintertime boundary layer is characterised by periods of low winds followed by shorter periods of strong advection, reflected by the monthly maximum wind speeds in Figure 2. The vertical wind gradients in the boundary layer show a seasonal variability (Fig. 3) and a wind maximum is often present within the lowest 50 metres in wintertime.

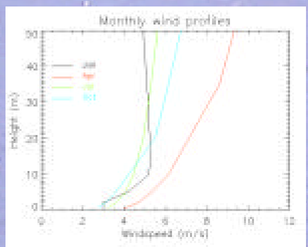


Fig. 3

Temperature

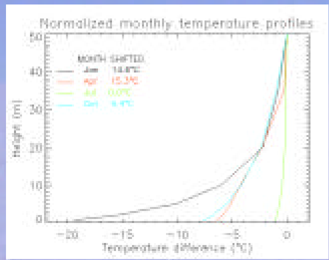


Fig. 4

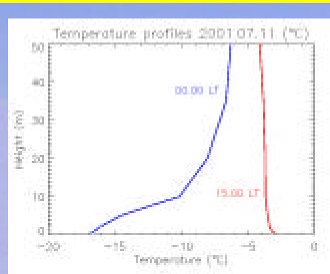


Fig. 5

The wintertime boundary layer is always stably stratified while summer days often show a diurnal stability cycle with weakly unstable conditions occurring close to surface (see Fig. 4 and 5). The temperature in the summer months can occasionally reach melting point close to the surface but the monthly averages for the 2-metre level tends to stay much lower. Warmest 2-metre temperature (10-minute average) during this field campaign was –1.3°C, recorded on the 20th of July 2002. The near surface temperatures in the winter are, on average, extremely low but with a wide range between maximum and minimum temperatures occurring over each month (Fig. 6). The pressure (Fig. 7) shows a similar variability. Occasionally, strong winds, associated with the large scale flow, break up these highly stable wintertime inversions, causing the temperature to rise rapidly. Spring and fall seasons are characterised by high diurnal variations in temperature (Fig. 8).

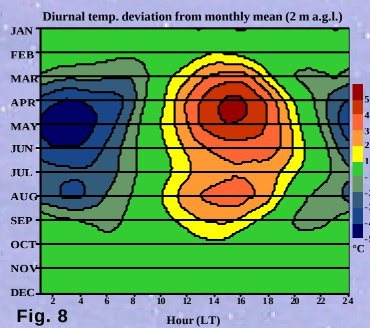


Fig. 8

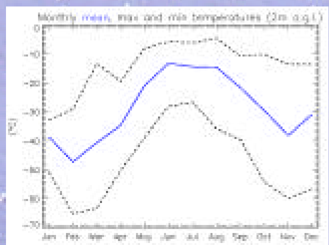


Fig. 6

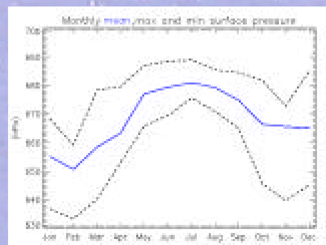
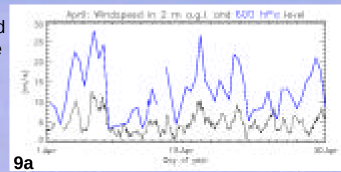


Fig. 7

Upper air conditions

As the occurrence of katabatic winds is relatively small, large day-to-day variations in boundary layer temperature and wind speed are induced by the large scale flow (Fig. 9a,b). The situation in the free atmosphere above Summit depends on the large scale wind direction (Fig. 10). Southerly and westerly wind components tend to raise both temperature and wind speed in the free atmosphere.



9a

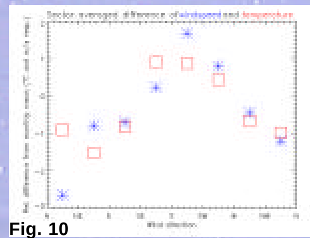
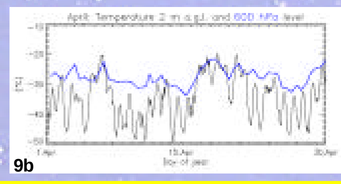


Fig. 10



9b

Cloudiness

Monthly mean total cloud cover is presented in Figure 11. Cloud cover shows an annual cycle, with a minimum of about 4/10 in spring and a maximum of 8/10 in late summer. The late summer maximum cloud cover is dominated by low clouds, while the minimum cloud cover in spring mainly consists of middle and high clouds.

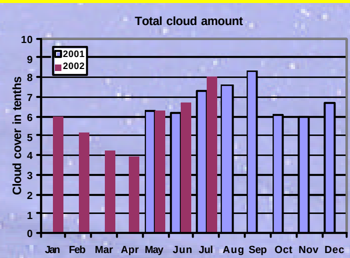


Fig. 11

Snow accumulation

The total gain of snow at the measurement site in the period July, 2001 to June 2002 was 80.5 cm (Fig. 12). This corresponded to a mass balance of 242 mm WE, which is in good accordance with the annual accumulation of the area presented in Ohmura and Reeh (1991).

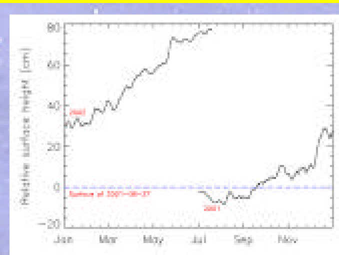


Fig. 12

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Acknowledgements

Swiss National Science Foundation
US National Science Foundation,
Veco Polar Resources, US National Guard