Note

Meteorological Observations in 2000 at the Arctic Station, Qeqertarsuaq (69°15'N), Central West Greenland

Niels Nielsen, Ole Humlum & Birger Ulf Hansen

Abstract

An automatic meteorological station has been operating at the Arctic Station (69°15'N, 53°31'W) in West Greenland since 1990. This paper summarizes meteorological parameters during 2000 including snow and sea ice cover, ground temperatures and active layer development, and presents comments on the local permafrost thickness.

Birger Hansen, e-mail: buh@geogr.ku.dk.
Niels Nielsen , e-mail: nn@geogr.ku.dk.
Ole Humlum, e-mail:oh@geogr.ku.dk
Institute of Geography, University of Copenhagen, Øster Voldgade 10, DK 1350 Copenhagen K, Denmark
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Outline of the Meteorological Year 2000

Climate, arctic, permafrost, active layer, snow cover, sea ice cover, Greenland, Disko. Manuscript closed 30 May 2001. Outline of the Meteorological Year 2000. The mean annual air temperature (MAAT) at the Arctic Station in 2000 was -2.5°C (Table 1), somewhat higher than the average since the station's establishment in late 1990 (Nielsen et al., 1995), but equal to the mean temperature in 1998. The MAAT at the station is -4.4°C for the whole period 1991-2000. According to official meteorological data 1961-1990 the MAAT at nearby Qeqertarsuaq is -3.9°C. Since 1996 the winter temperature has increased continuously and the higher MAAT 2000 is primarily the result of higher winter temperatures, while summer temperatures were close to normal. The lowest 2000 air temperature (-22.8°C) occurred on 1 March, while the highest air temperature (18.6°C) was registered on 7 July. This maximum temperature occurred within a 3-week warm period from the last week in June to mid-July, where the mean temperature was 9.8°C. The remaining part of the summer was cooler (mean: 6.7°C) except for a 5-day 'Indian' summer in late August, where the mean temperature was 9.0°C (Figure1). A maximum solar radiation of 1103.7 W/m^2 was registered 1 June, before the warm period mentioned above. Notice also the pronounced minima in the incoming SW-radiation in July and August, indicating prolonged 'poor' weather periods during the summer.

The mean annual wind speed was 3.6 m/s, the same as in 1999. On 19 February a maximum wind speed of 14.5 m/s (daily mean), with wind gust of 25.6 m/s which was recorded in connection with a foehn situation with easterly winds. Several foehn events with high wind velocities can be observed during the year especially during the winter and early spring. Characteristically the temperature rises dramatically during these events (Figure 1). Easterly winds due to air masses flowing off the Greenland Ice Sheet to the east prevailed during periods of the winter and autumn, while southwesterly winds were more frequent during the summer.

2000 was a very rainy year. Liquid precipitation was registered on 74 days throughout the year except for February and December with an annual total of 476.7 mm. This amount exceeds the official (DMI) annual mean precipitation, which, including snowfall, was 447 mm in the area

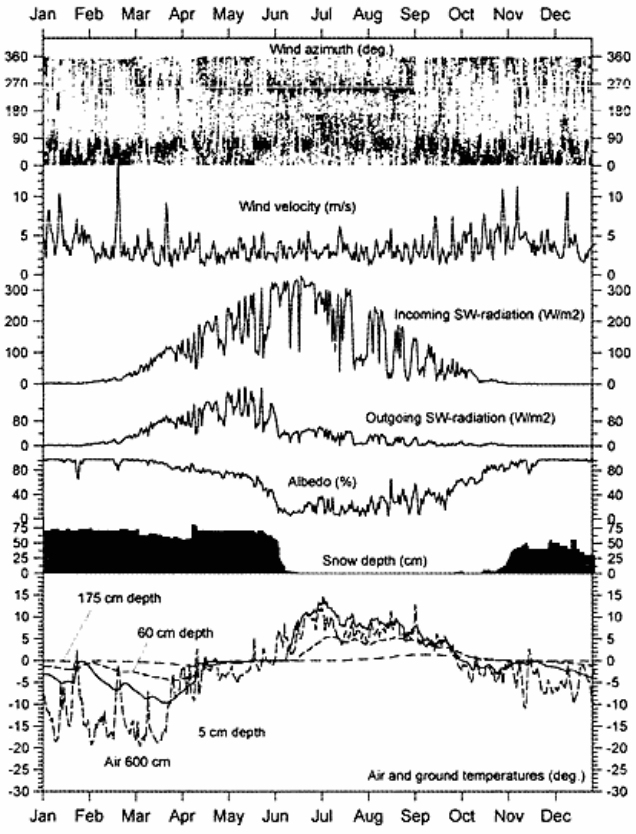

Figure 1: *Diagrams showing various mean daily meteorological parameters and ground temperatures at the Arctic Station 1999. The snow cover thickness was measured daily.*

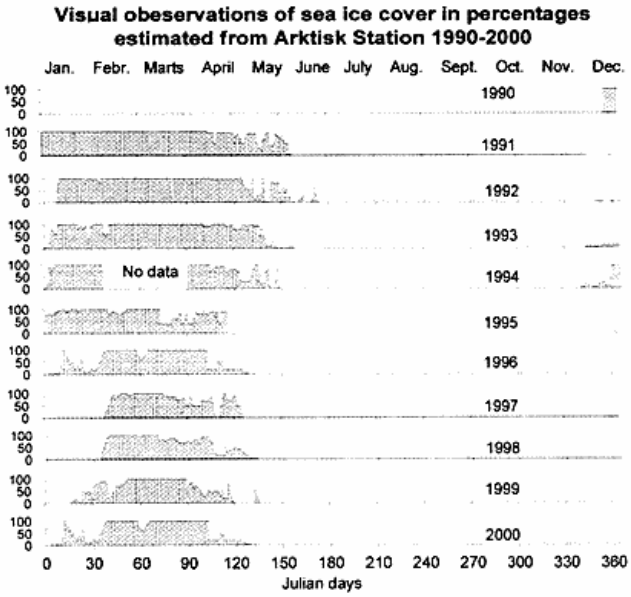

Figure 2: Daily visual observations of the sea ice cover estimated from the Arctic Station 1991-2000

(1961 - 1990), and more than the double of the normal for the period 1990-1999, which was 225 mm. In August the precipitation was particularly heavy -215 mm, or 5 times the normal (40 mm) for this month. On four days more than 30 mmfell: 32.2 mm, 39.8 mm, 33.5 mm and 35.7 mm on the 17., 18., 30. and 31. respectively. Several earth slides in the area has been reported in this period (pers. com. Morten Rasch) and the harbour in Qeqertarsuaq turned red from sediments washed-out from the basalt mountains. Comparable precipitation values have, however, been recorded previously during the last 10 years. In 1997 (11 and 12 August) a precipitation of 165 mm was registered within 1.5 day. The annual precipitation as snowfall is not measured. During the winter 1999-2000 snow cover at the station was typically about 50 cm thick and lasted until early June.

2000 became the fifth successive year that M/S Porsild, the research vessel of the Arctic Station, was only ice-bound in Qeqertarsuaq harbour for 3 months in contrast to the beginning of the 1990s, where the harbour and Disko Bugt outside Arctic Station was covered by sea ice about 5 months, Figure 2. The reduced duration of sea ice might be explained by milder winter temperatures, which our data indicate. Another reason could be a penetration of warmer sea water from the north-bound West Greenland current. That water temperatures in Disko Bugt have increased in recent years is also indicated by the fact that cods now are again being caught in the area for the first time since the mid 1960s. Whether the warming of Disko Bugt is a brief and incidental fluctuation or a first sign of a longer trend is of course uncertain. From 2001 Arctic Station will follow the hydrographic conditions and commence a CTD-monitoring (salinity (conductivity), temperature, pressure (depth), back-scatterance (turbidity) and fluoroscence, and biospherical PAR light. These measurements will be recorded for a fixed position 4 nautical miles off the coast at Qeqertarsuaq once every two weeks.

The mean annual ground temperature at 5 cm depth was 0.4°C, which is 2.9°C above the MAAT (Table 1). At 60 cm and 175 cm depth, the mean annual ground temperatures were 0.4°C and -0.0°C, respectively. All three ground temperatures are 1 - 2°C above 1999 registrations and the highest recorded since the climate station was established in 1990.

The date for initiation of thawing of the active layer, defined as the time in spring when the near-surface ground temperature (5 cm depth) becomes stable above 0°C, was on 6 June. Maximum thawing depth was reached on 11 September, inferred from the temperature at 175 cm depth. Initiation of autumn freezing, defined as the time from when the near-surface temperature (5 cm depth) is consistently below 0°C was on 6 October. Finally, the time for complete freezing of the active layer, defined as the time when ground temperatures at all levels in the active layer again were below -1°C, was not reached before the end of 2000.

At Qeqertarsuaq (Godhavn), the complete 1991-2000 data series indicate that the initiation of the spring ground thaw usually falls in early June, although some years it may occur in May or even as early as late April. In this respect 2000 represents a normal initiation of ground thaw. The maximum thaw depth occur more consistently in mid- or late-September, so 2000 represents an early date for this parameter. Autumn freezing typically begins in late September or early October, which was also the case in 2000. The complete freezing of the active layer occurs, more variably, from late December to late January, and in this respect 2000 was normal. Data measured at the meteorological station at the Arctic Station are validated at the Institute of Geography, University of Copenhagen, and stored in databases and standard spreadsheet formats. The data are available for researchers. Applications for data should be directed to Arctic Station's secretariat: c/o Gitte Henriksen, Øster Voldgade 3, DK-1350 Copenhagen K, e-mail: gin@adm.ku.dk.

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