

# SPATIAL AND TEMPORAL DIFFERENTIATION OF GROUND SURFACE TEMPERATURE IN THE REGION OF ADMIRALTY BAY IN 1998 (KING GEORGE ISLAND, SOUTH SHETLANDS)

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## ABSTRACT

Measurements of ground temperature were taken out at three places in the region of Arctowski Station: in the meteorological station from January to December, on the recent storm ridge from January to August and at six points in the valley near the Jardine Peak from January to March. Measurements were made at 1 and 5 cm depth in various meteorological conditions, exposure, kind of cover and soil structure. The temperature at the ground surface reached 17,8°C in the summer and in the winter decreased to -8,9°C. The mean annual ground temperature was 0,5°C at the 1 cm depth and which was 1,2°C higher than the air temperature (-0,7°C), the warmest was at the 5 cm depth (0,9°C). Daily fluctuations of ground temperature was 13,6°C at the 1 cm depth and 9,1°C at the 5 cm depth according to changing meteorological conditions. The temperature fluctuated less in the vicinity of Admiralty Bay (the storm ridge and meteorological station) 9,2°C than in the valley near Jardine Peak (12,4°C). Interestingly, the maximum and minimum temperatures were lower and higher respectively in the vicinity of Admiralty Bay. Sites without plants and with northern exposure i.e. sun were warmest (mean temperature 5,1°C); the lowest mean temperature (3,7°C) occurred on the floor of the valley, on the sites covered with plants and close to flowing water.

**KEY WORDS:** Arctowski Station - ground temperature - meteorological factors

## INTRODUCTION

Ground absorb the best part of solar radiation, therefore it is the main source of heat for the atmosphere (Chromow, 1969). Degree of ground warmth is an important parameter that the conditions of plants and animals existence in soil and on the surface (Olech, 1998). Temperature of ground in the climatic conditions of Maritime Antarctic has a particular pattern resulting from extensive variability of atmospheric conditions (Marsz, Rakusa-Suszczewski, 1987). Distribution of ground warmth also depends on contents humidity, and of air, humidity, mineralogical composition, porosity and soil structure. Thermal conditions of ground are also determined by its exposure and kind of cover (Washborn, 1979).

## MATERIALS AND METHODS

The measurements of ground temperature were taken out at three sites in the region of Arctowski Station: in the meteorological station from January to December, on the recent storm ridge from January to August and at six sites in the valley near the Jardine Peak from January to March during XXII Polish Antarctic Expedition in 1998. Dependence of thermal conditions on the type of ground cover and exposure was studied in the small valley, below

Jardine Peak, 200 metres above sea level. Thermometers were placed along NW-SE profile, on different types of slopes: sunny and shaded, wet and dry, with or without vegetation cover. Measurements were made from 1 cm until 130 cm depth, but only ground surface temperature (1 cm and 5 cm) is describing in this study.

## RESULTS

The mean annual ground temperature was 0,5°C at the 1 cm depth which was 1,2°C higher than the air temperature (-0,7°C) on the standard height. The warmest was at the 5 cm depth (0,9°C). In January (Fig. 1) mean temperature was 5,5°C at the 1 cm depth and 6,3°C at the 5 cm. The temperature often exceeded 10,0°C (17th January 17,8°C at 1 cm depth) in the warm, sunny days. Daily fluctuations of ground temperature was 13,6°C at the 1 cm depth and 9,1°C at the 5 cm depth. The lowest temperature occurred in May (-8,9°C at 1 cm depth, -7,3°C at 5 cm depth) when there was no snow cover but already an influence of cool air masses from the South was marked. In August and September temperature of ground increased to -0,7°C and -0,6°C respectively at 1 cm depth and to -0,6°C and 0,5°C at 5 cm. That was a result of a thick snow cover which limited the heat exchange between the atmosphere and the ground. Almost constant, close to zero ground temperature (-0,1°C) was result thaw and flooding of moss bank in October.

Ground surface temperature in the valley close to Jardine Peak (Fig. 2) had a high spatial differentiation. The highest temperatures (13,4°C) were observed at the 1 cm depth on sites without plant cover, dry, with northern (sunny) exposure (V and VI). The lowest temperature as at sites located on the shaded slope (with southern exposure) -1,5°C (I and II). The most thermally stable sites (III and IV) were situated close to flowing water on the floor of the valley, which was wet when covered with plants and very wet without a plant cover. The highest mean average 5,1°C occurred on the dry slope (VI) and the lowest 3,7°C at the site III.

The highest temperature difference among the sites at 1 cm depth was 7,0°C at the same date.

## CONCLUSIONS

Great influence of meteorological factors on the ground temperature was observed. The highest surface ground temperature (17,8°C) was reached during the summer with high sunshine duration. The cloudiness and the strong winds decreased ground temperature.

The lowest ground temperature was -8,5°C when there were noted two coexisting factors: no snow cover and an influence of cool air masses from the South. The thick snow cover limited the heat radiation from ground. Almost constant ground temperature was result thaw.

The ground temperatures on the storm ridge and neighbouring moss banks in the vicinity of Admiralty Bay had the lowest maximum temperatures and higher minimum than in the valley near Jardine Peak (amplitude was 9,2°C and 12,4°C respectively) during the summer

Mean ground surface temperatures were higher in the valley, than close to the sea level. The nearness of Admiralty Bay has the influence on the soft course of ground temperature.

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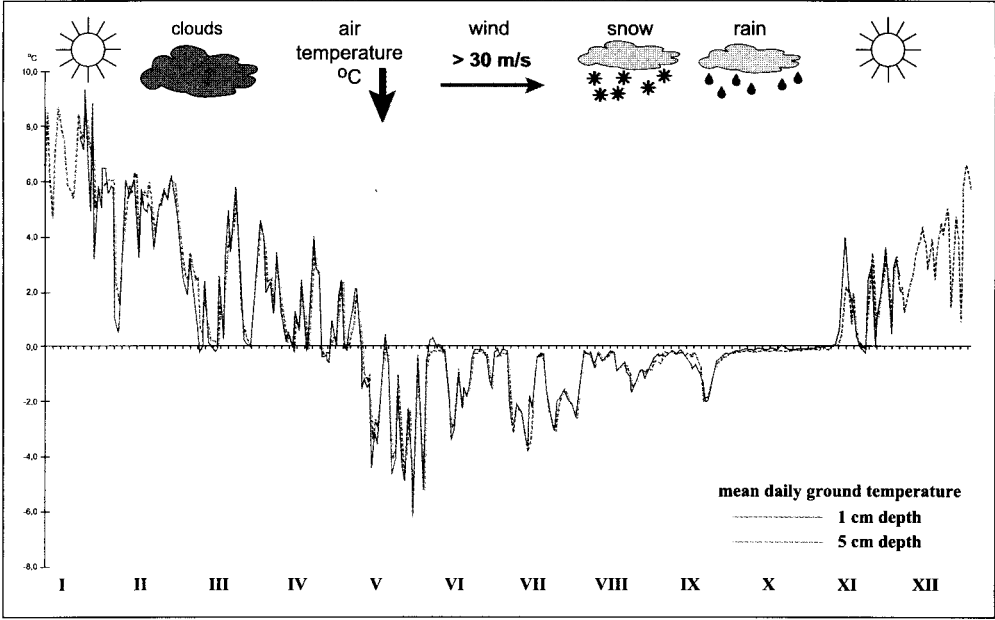


Fig. 1. Influence of meteorological factors on the seasonal change of ground surface temperature

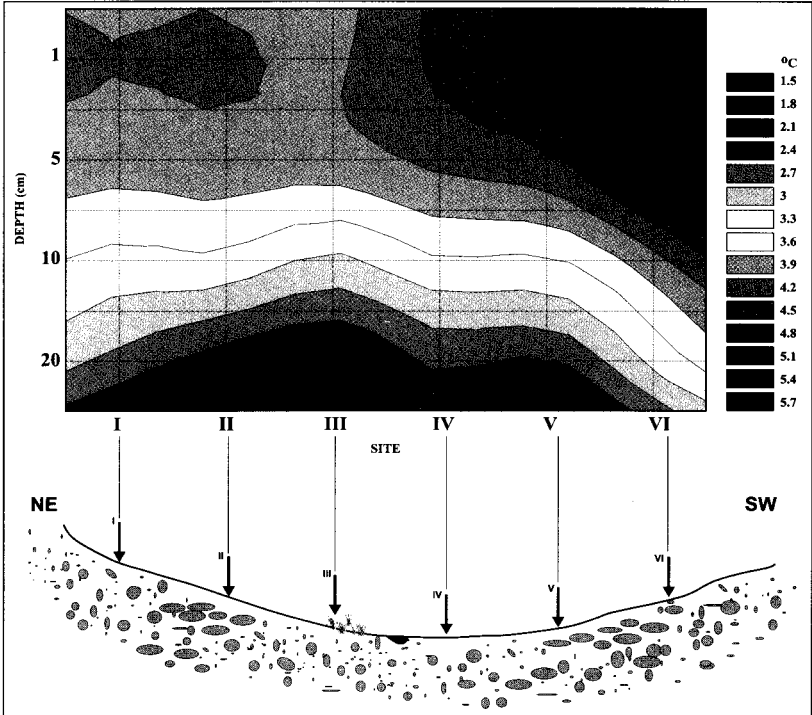


Fig. 2. Ground's temperature distribution in the valley near Jardine Peak

