The complex topography of high mountain environments causes a wide variability of solar radiation and snow cover characteristics. Therefore, the pronounced relief is one main factor controlling the near surface ground temperatures. The quantitative knowledge of the complex ground heat transfer processes induced by differences in topography is still fragmentary.

In order to contribute to their quantification, ground temperature regimes within the upper part of the active layer are currently recorded at Stockhorn plateau (3410 m a. s. l.) in the southern part of the Matter Valley / Switzerland (Fig. 1). Data clearly demonstrate that the complex topography induces big variations in the ground thermal regime.

The sites differ in topography and aspect in order to quantify their effects on the thermal regime. Ground temperatures are registered hourly in different sensor depths down to max. 100 cm. The test area incorporates a permafrost monitoring site with two boreholes (100 and 30 m deep), which have been drilled in July 2000 within the framework of the EU-project PACE. Even though the shallow borehole is located only 28 m more south, the surface of the plateau consists of a thin debris cover with some spots of mosses and lichens (Fig. 3). The annual precipitation at Stockhorn is estimated to be 1500 mm, the mean annual air temperature (1961-1990) between -5 and -6 °C (KING 1990).

Data Collection Measurements has started in September 2003. Six UTL-Loggers, have been arranged in a N transect of 50 m length (Fig. 3), recording ground surface temperatures in a hourly interval. More detailed data are available since August 2004: Five-channel-data-loggers have been installed in twelve vertical profiles.

The exposed location of Stock6 inhibits the formation of a deep snow cover, whereas Stock5 - situated in a local depression - is covered by snow from the beginning of October on and becomes snow free again in the middle of July (Fig. 6).

Table 1 summarizes the thermal differences between the spots by showing the minimum, the maximum and the mean temperatures between 1st Oct. 2003 and 31st July 2004.

<table>
<thead>
<tr>
<th>Locations from N</th>
<th>Stock1</th>
<th>Stock2</th>
<th>Stock3</th>
<th>Stock4</th>
<th>Stock5</th>
<th>Stock6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max</td>
<td>-8.86</td>
<td>-6.91</td>
<td>-2.83</td>
<td>-3.23</td>
<td>-0.53</td>
<td>-2.96</td>
</tr>
<tr>
<td>Mean</td>
<td>-7.46</td>
<td>-3.69</td>
<td>-2.83</td>
<td>-3.23</td>
<td>-0.53</td>
<td>-2.96</td>
</tr>
</tbody>
</table>

Conclusions Data clearly demonstrate that local site characteristics induce massive differences in the thermal regime of the ground. Therefore, accurate knowledge of the local distribution of ground temperatures is needed to better understand the effects of the pronounced topography in high mountain environments.

References


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