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Climate conditions of the coastal zone of Petuniabukta, Billefjorden (Spitsbergen) in the period 2008 – 2010

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The main goal of the presented study was to evaluate spatiotemporal variability of the climate conditions of the coastal ice-free zone of Petuniabukta, north-western branch of Billefjorden, Spitsbergen. Since 2008, several automatic weather stations (AWS) have been operated along the northern coast of Petuniabukta at different altitudes ranging from a seashore level to the mountain ridge up to 500 m a.s.l. To examine variation of the local climate conditions the meteorological data from lower (AWS1 – old marine terrace at 15 m a.s.l.) and higher part (AWS4 – mountain ridge of Mumien Peak at 475 m a.s.l.) of the coastal zone were used. Each AWS was equipped with an identical set of sensors to measure air temperature and relative humidity at a height of 2 m, soil temperature and volumetric water content (VWC) at the depths of 5 and 15 cm. Apart from that, an extended monitoring program was carried out at AWS1. It consisted of the measurements of global and reflected shortwave radiations (used for albedo calculation), photosynthetically active radiation, wind speed and direction, air pressure, surface temperature of tundra vegetation and soil temperature profile up to 150 cm. In the period of 21 June 2008 to 11 September 2010, the mean air temperature ranged from -3.9°C (AWS1) to -6.1°C (AWS4). The absolute temperature maximum was recorded on 28 July 2009 at AWS1 (16.2°C), the absolute temperature minimum -36.0°C was recorded on 12 January 2009. We found that the mean soil temperatures at depths of 5 to 75 cm ranged slightly from -4.3°C to -3.4°C at 75 cm. For the whole investigated period, the mean global shortwave radiation was 79 W.m-2, meanwhile during the summer season (June-August 2009) it was 186 W.m-2. Contrastingly, it was found that during the short summer period the maximum surface temperature of tundra vegetation (Bryum taxa, Ditrichum sp. div., Silene acaulis, Saxifraga) can reach up to 26.5°C. The wind direction at AWS1 was influenced by local orography of the coastal zone of Petuniabukta and location of the glacier valleys – Ragnarbreen, Hørbyebreen and Svenbreen. In the study period, the predominant wind was from the S to SE direction that clearly corresponded with the local orography and longitudinal axis of Petuniabukta. The second prevailing wind occurred from the NE sector that could be connected with the location of Ragnarbreen glacier in the Ragnardalen valley where local (e.g. katabatic) winds exists. The mean wind speed recorded at AWS1 was 3.9 m.s-1. The summer mean wind speed was estimated at 3.3 m.s-1. Furthermore, it was found that the strongest winds blow from the NE sector and it can rarely exceed 20 m.s-1.

Keywords: Petuniabukta, Billefjorden, automatic weather station, Ragnarbreen, Spitsbergen