Lead Author e-mail: *tadeusz.niedzwiedz@us.edu.pl*

Title: *The influence of atmospheric circulation on the variability ice days, freeze-thaw and warm days in Svalbard*

Tadeusz Niedźwiedź[1], Ewa Łupikasza[1], Łukasz Małarzewski[1]
[1]***University of Silesia in Katowice, Faculty of Earth Science, Department of Climatology, Poland***

Svalbard represents the Atlantic sector of the Arctic, with the large dynamics of the climate variability and change. This paper aims at research both the long-term variability in the ice days, freeze-thaw and warm days occurrence and their relations to atmospheric circulation.

Ice days are defined as days with daily maximum temperature below 0°C. Days with freeze-thaw events are those at which air temperature crosses the threshold of 0°C (Tmin≤0°C and Tmax>0°C). On the warm days air temperature is positive during 24 h (Tmin>0°C). All these extreme temperature characteristics are counted amongst the most important indices of current climate change. All available data on daily maximum and minimum temperature were used from four Norwegian stations (Svalbard-Lufthavn, Ny-Ålesund, Bjørnøya and Hopen), one Russian station in Barentsburg and from the Polish Polar Station in Hornsund.

Long-term variability of the mentioned days were compared with the mean annual temperature variability in Svalbard, as well as, in the Northern Hemisphere. Special attention is paid to the comparison of the early 20th century warming with the contemporary increase of temperature.

Atmospheric circulation has an important influence on the frequency of days with different extreme temperature conditions. For the period 1951-2012 we analysed the conditional probability of the investigated days in 21 circulation types, according to calendar prepared in Department of Climatology University of Silesia. Long-term variability and trends in the frequency of the investigated days were compared with macro scale circulation indices NAO (North Atlantic Oscillation) and AO (Arctic Oscillation), as well as with regional circulation indices elaborated for the Svalbard: westerly zonal circulation index (W), southerly meridional circulation index (S) and cyclonicity index (C).

The frequency of ice days were significantly lowering in May, June and August. The downward trend was also found in the annual index values. Seasonal differentiation of the relations between the ice days occurrence and atmospheric circulation are weaker than in case of days with freeze-thaw events, which trigger the processes of water melting and freezing. In the majority of the months the highest probability of the ice days occurrence is linked to the six anticyclonic types (Na, NEa, Ea, NWa, Ca and Ka). Advection of warm air from south results in rarer ice

days and increasing of the warm days frequency.

Days with freeze-thaw events occur throughout the year. Statistically significant trends in the occurrence of such days were found in June (downward trend) and December (upward trend). The directions of the trends are related to the magnitude of the average monthly temperatures and their growing tendencies. Relationships between the occurrence of days with Tmax > 0°C and Tmin < 0°C and atmospheric circulation change seasonally.