

**ДЕРЖАВНЕ АГЕНТСТВО З ПИТАНЬ НАУКИ, ІННОВАЦІЙ
ТА ІНФОРМАТИЗАЦІЇ УКРАЇНИ
НАЦІОНАЛЬНА АКАДЕМІЯ НАУК УКРАЇНИ
ІНСТИТУТ ГЕОЛОГІЧНИХ НАУК
НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ УКРАЇНИ «КПІ»
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Abstracts

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METEOROLOGICAL CONDITIONS ON THE ECOLOGY GLACIER (KING GEORGE ISLAND, WEST ANTARCTICA) AND THE WALDEMAR GLACIER (NW SPITSBERGEN) IN SUMMER SEASONS

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The article compares meteorological conditions on an alpine glacier — the Waldemar Glacier (WG) — West Spitsbergen (the Arctic) with those on a quasi-valley Ecology Glacier (EG) flowing from the Warszawa Icefield (King George Island, West Antarctica). In those areas the air temperature trends to rise substantially and the glacier fronts quickly retreat. Automatic weather stations and temperature and humidity devices were installed on the glaciers, reaching from the moraines to the firn field (WG-3 stations EG-4 stations). The obtained results were then collated with the data from coast base stations: Kaffiøyra (KH) on the Spitsbergen and Arctowski (HA) on King George Island.

The investigations on Spitsbergen were carried out in the period from 21 July until 31 August in the years of 2005–2010, whereas on Antarctica they lasted from 19 December 2006 until 17 February 2007. In spite of the big difference in latitude between Spitsbergen (79°N) and King George Island (58°S), in both regions the sub-polar climate occurs. In summer, it is manifested in cloudy weather (HA 6.4, KH 6.8 in the scale of 0–8) with little sunshine duration (HA 2.9 h/day, KH 4.0 h/day) — Table. On HA only $15.94 \text{ MJ m}^{-2} \text{ day}^{-1}$ reaches the ground surface, and on KH $10.45 \text{ MJ m}^{-2} \text{ day}^{-1}$. The mean temperature of air is positive: 5.5°C on KH and 2.5°C on HA, and the relative humidity is high (KH 88.0%, HA 77.2%). The mean atmospheric pressure is 1012.6 hPa on KH and 989.1 hPa on HA, whereas the mean wind velocity reaches 4.0 m s^{-1} on KH and 5.0 m s^{-1} on HA. The weather is very changeable, depending on the type of inflowing air masses.

Table. Mean values of meteorological elements on the Ecology Glacier (19.12.2006-17.02.2007) and Waldemar Glacier (21.07-31.08, 2005-2010)

Meteorological element		HA	Ecology Glacier				KH	Waldemar Glacier		
			EGF	EG1	EG2	WI		ATA	LW1	LW2
Altitude (m a.s.l.)		3	5	78	170	463	11	137	130	375
Air pressure (hPa)		989,1					1012,6			
Cloudiness (0-8)		6,4					6,8			
Solar radiation (MJ m ² day ⁻¹)		15,94					10,45			
Sunshine duration (hours day ⁻¹)		3,9					4,0			
Wind velocity (m s ⁻¹)		5,0		4,8			4,0	1,9	2,1	1,8
Air temp. (°C)	Tmean	2,5	2,1	1,6	1,1	-1,0	5,5	5,0	4,4	3,1
	Tmax mean	4,6	4,4	3,7	3,2	1,1	6,8	6,7	6,3	4,8
	Tmin mean	0,6	-0,1	-0,3	-0,9	-2,6	3,8	2,6	2,5	0,9
	Daily temperature range	4,1	4,4	3,9	4,2	3,8	3,0	4,1	3,8	3,9
	Tmax abs	10,4	10,1	8,2	8,0	5,4	14,9	15,0	14,7	12,8
	Tmin abs	-1,4	-3,1	-3,7	-5,1	-6,0	-0,2	-1,6	-1,7	-4,7
Relative air humidity (%)		77,2	80,3	86,4	91,8	97,3	88,0	81,3	82,5	84,5

Analyzed glaciers are situated in different orographic circumstances, however on both glaciers a katabatic flow is noticeable. The dominant wind directions coincide with the axis of the glacial tongue and definitely differ from those on the base stations. The mean wind velocity on EG was 4.8 m s⁻¹ and the highest velocities are associated with WSW and W glacial winds over 11.4 m s⁻¹. On WG, the most frequent are glacial winds from the eastern sector. The mean velocity increases from 1.3 m s⁻¹ on the firn field to 1.8 m s⁻¹ on the glacier front. On the glaciers the temperature drops with altitude, e.g. on EG from 2.1°C ahead of the front (EGF) to -1.0°C on the Warszawa Icefield (WI). On WG it decreases from 5.0°C on the moraines (ATA) to 3.1°C on the firn field (LW2). At the glacier fronts the temperature gradients are substantially horizontal (0.6°C/100 m over 300 m on WG) and vertical (1.17°C/100 m on EG). The gradient on the glaciers is close to saturated adiabatic (EG 0.67°C/100 m, WG 0.52°C/100 m). In insolation weather, particularly on WG, air temperature inversions are often formed. Within 24 hours the most dramatic differences between glacial and non-glacial areas occur in the afternoon hours.

The relative humidity of air is high on the glaciers and it increases with the elevation of the land above the sea level. On both glaciers foehnic winds substantially affect the courses of temperature and humidity, causing drops to as much as 60%.

There are differences between the glaciers. On WG, the air masses formed over the non-glacial areas have a bigger share, therefore the air temperatures occurring there are higher, exceeding the zero even on the firm field (370 m a.s.l.). The wind velocity is lower due to the surrounding mountain ranges, however the glacial winds reveal a greater stability, intensifying on insolation days when thermal and barometric gradients increase.

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