INSTITUTE OF GEOGRAPHY
Russian Academy of Sciences

Founded in 1918

IGU MOSCOW 2018

The 2018 IGU Thematic Conference dedicated to the centennial of the Institute of Geography of Russian Academy of Science

PRACTICAL GEOGRAPHY AND XXI CENTURY CHALLENGES

CONFERENCE BOOK

PART1

JUNE 2018, MOSCOW

Organizers

Official Sponsors

BACK

SNOW THICKNESS AND DENSITY ON AUSTRE GRØNFJORDBREEN, SVALBARD, FROM RADAR MEASUREMENTS AND STANDARD SNOW SURVEY

I.I. Lavrentiev, S. S. Kutuzov, A.F. Glazovsky, Yu.Ya. Macheret, N.I. Osokin, A.V. Sosnovsky, R.A. Chernov, G.A. Cherniakov

Institute of Geography, RAS, Moscow, Russia, macheret2011@yandex.ru

Ground-based radar measurements at 500 MHz, performed in the spring of 2014 on Austre Grønfjordbreen, Svalbard, along a dense network of profiles at 34754 points with interval ~ 2 m, showed a close relationship ($R^2 = 0.98$) with data of standard measurements of the snow cover thickness at 77 points and a similar but more detailed picture of its spatial distribution. The average discrepancy of radar and standard measurements is within 30 cm and equal to 18.8 % and 9.4 % for average and maximum snow thickness of 160 cm and 320 cm respectively. The standard interpolation error of radar snow thickness data for the entire glacier was on average 18 cm. The distance between the radar measurement points at which the spatial covariance of the snow thickness disappears was on average 236 to 283 m along the glacier, and from 117 up to 165 m across the glacier. Comparison of the delay time of radar reflections from the base of the snow cover with standard snow thickness measurements at 10 points gave the average radio wave velocity in the snow cover V_{av} = 23.4 ±0.2 cm ns^{-1}. This velocity was used to estimate the average density ρ of snow cover applying the Looyenga and Kovacs formulas: ρ_L = 353.1 ± 13.1 kg $m^{-3}$and ρ_K = 337.4 ±12.9 kg m^{-3}. The difference of these values from average density $\rho_{av\ meas}$ = 387.4 ±12.9 kg m^{-3} measured in 12 pits was -10.8 % and -14.8 %. According to snow thickness probing and radar measurements, the altitudinal snow accumulation gradient at the glacier in 2014 was 0.21 m/100 m. Snow thickness probing shown that the average thickness of winter snow cover in 2011-2014 was bigger by 17 cm than in 1979. In the snowiest year 2012 it was 21.5 cm bigger than in 1979, and its spatial variability (the standard deviation σ_H) increased by 25.6 cm. Estimation of spatial and temporal variability of snow thickness and density on the glacier can be used to estimate their influence on mass balance and hydrothermal state of the glacier due to climate changes.