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Calculation of the thermal diffusivity coefficient of the snow cover for the snow temperature measurement

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Tomsk 2018

Temperature sensors

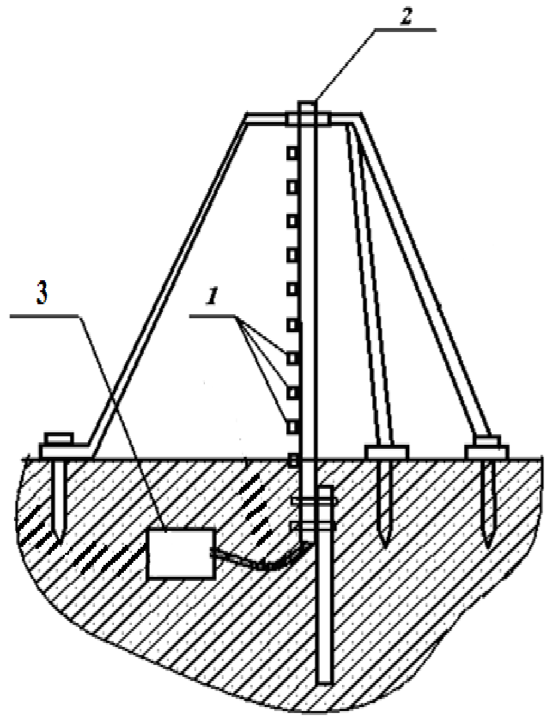


Figure 1: 1- digital thermometers; 2 – rail; 3 – device.

Technique of calculating

The heat transfer equation:

$$\frac{\partial \Phi}{\partial t} = \alpha \frac{\partial^2 \Phi}{\partial x^2}$$

Φ – the temperature, °C; t – time;
x – the coordinate of the snow cover depth;
a =$\lambda_s/(c*\rho_s)$ – the coefficient of thermal diffusivity, ρ_s – density, *c* – heat capacity.

Finite differences form

$$\frac{\Phi_m^{n+1} - \Phi_m^n}{\Delta t} - \alpha \frac{\Phi_{m+1}^{n+1} - 2\Phi_m^{n+1} + \Phi_{m-1}^{n+1}}{\Delta x^2} = 0$$

Initial and boundary conditions

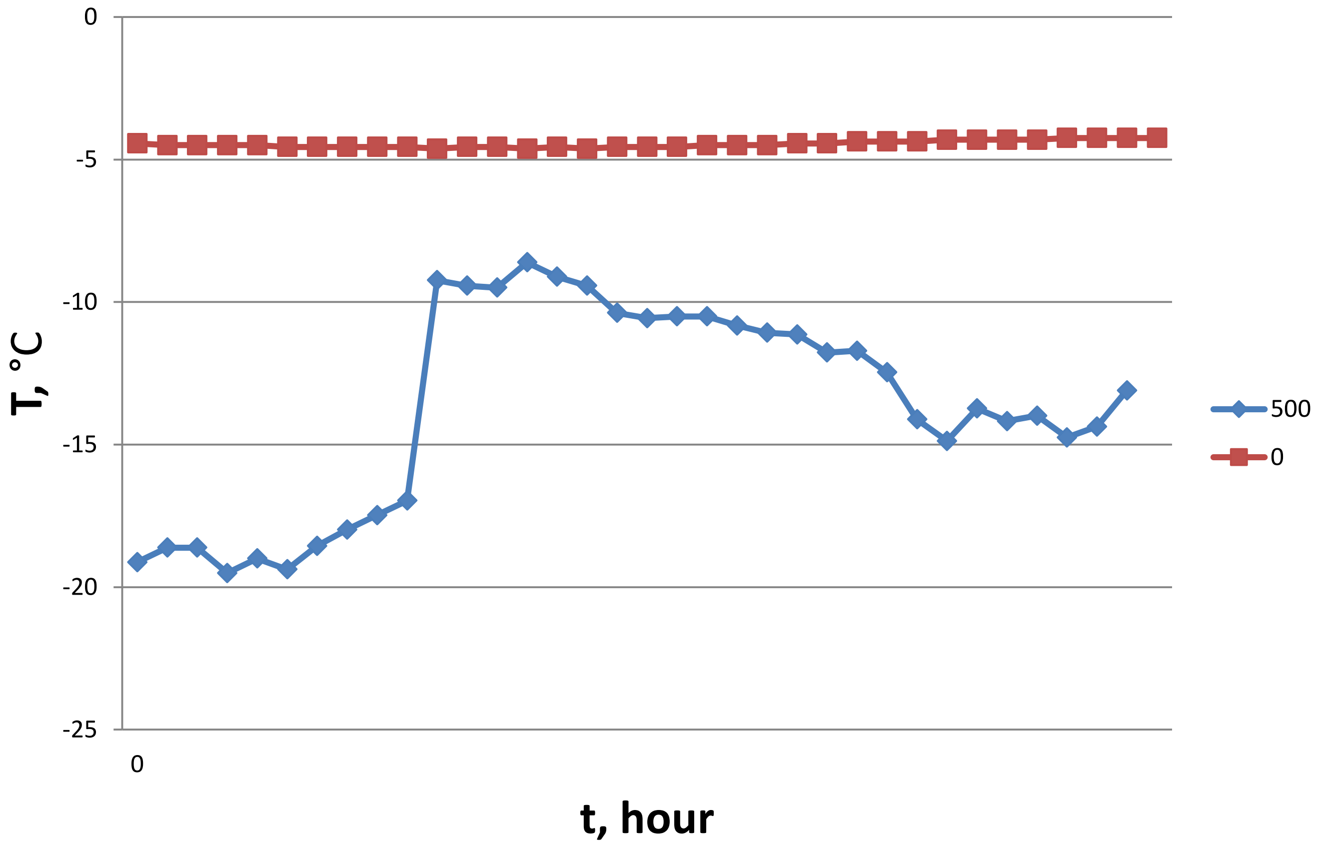
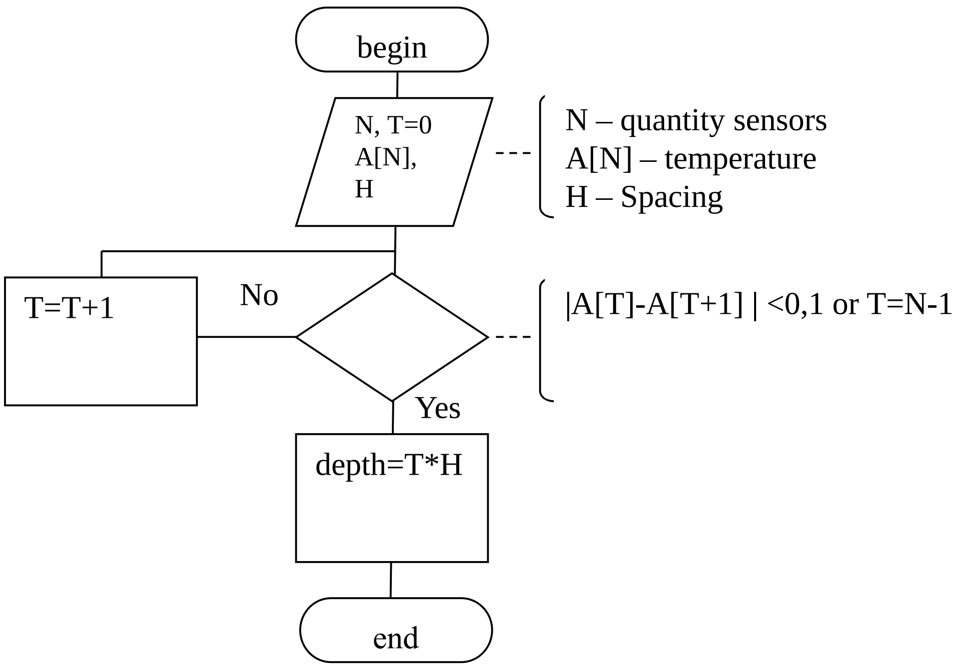
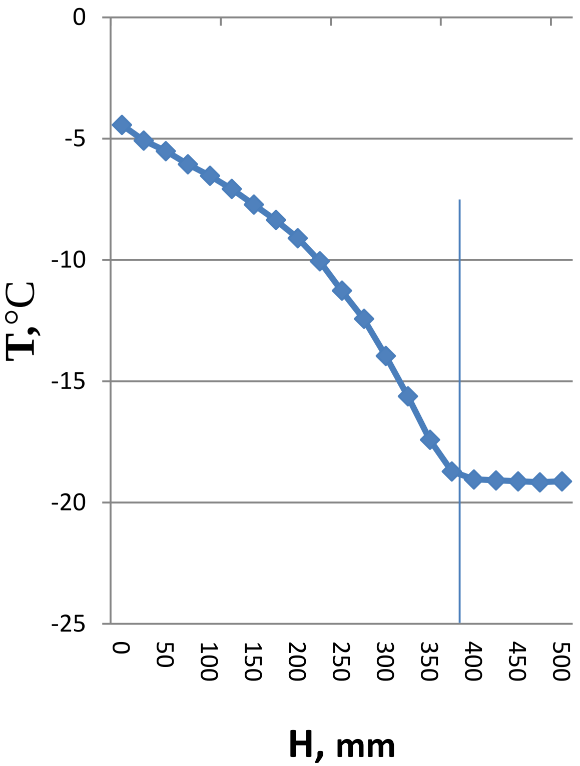


Figure 3: 0 – soil-snow interface ; 500 – snow-air interface.

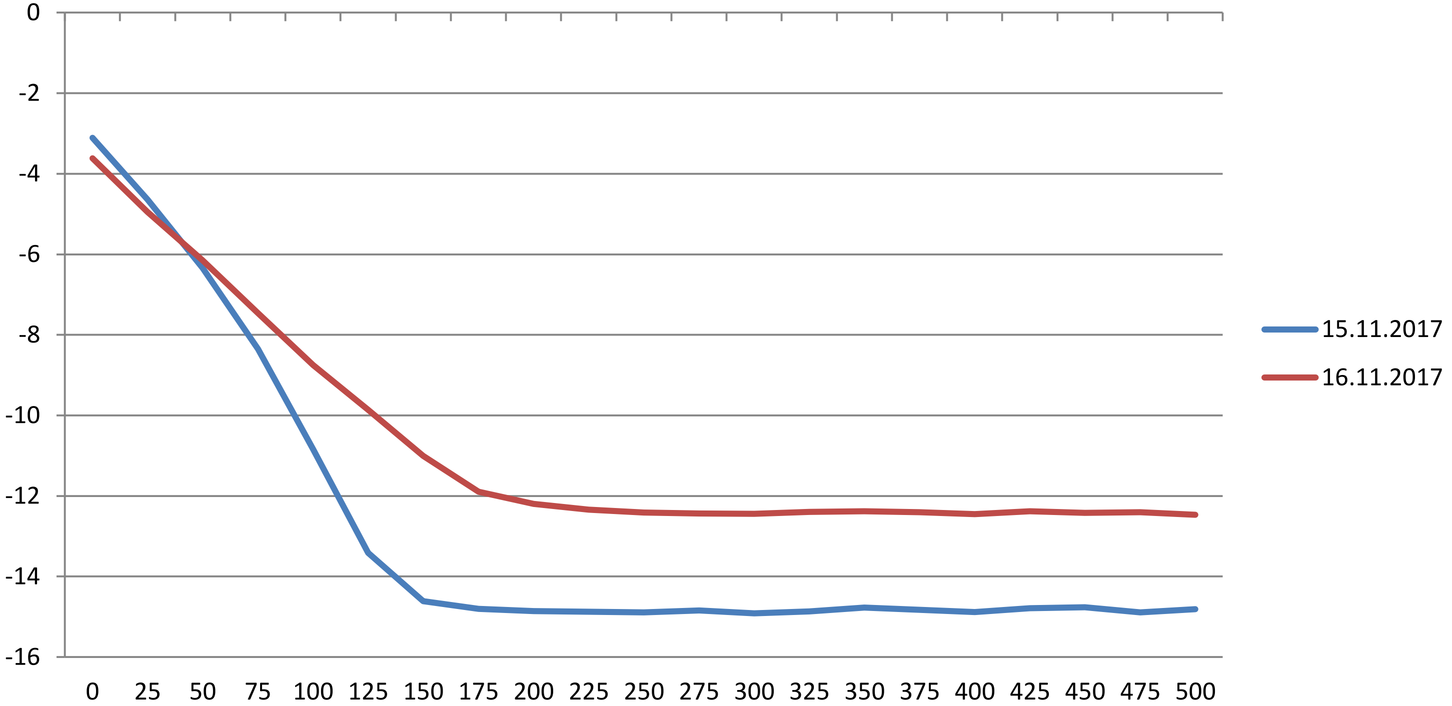
algorithm

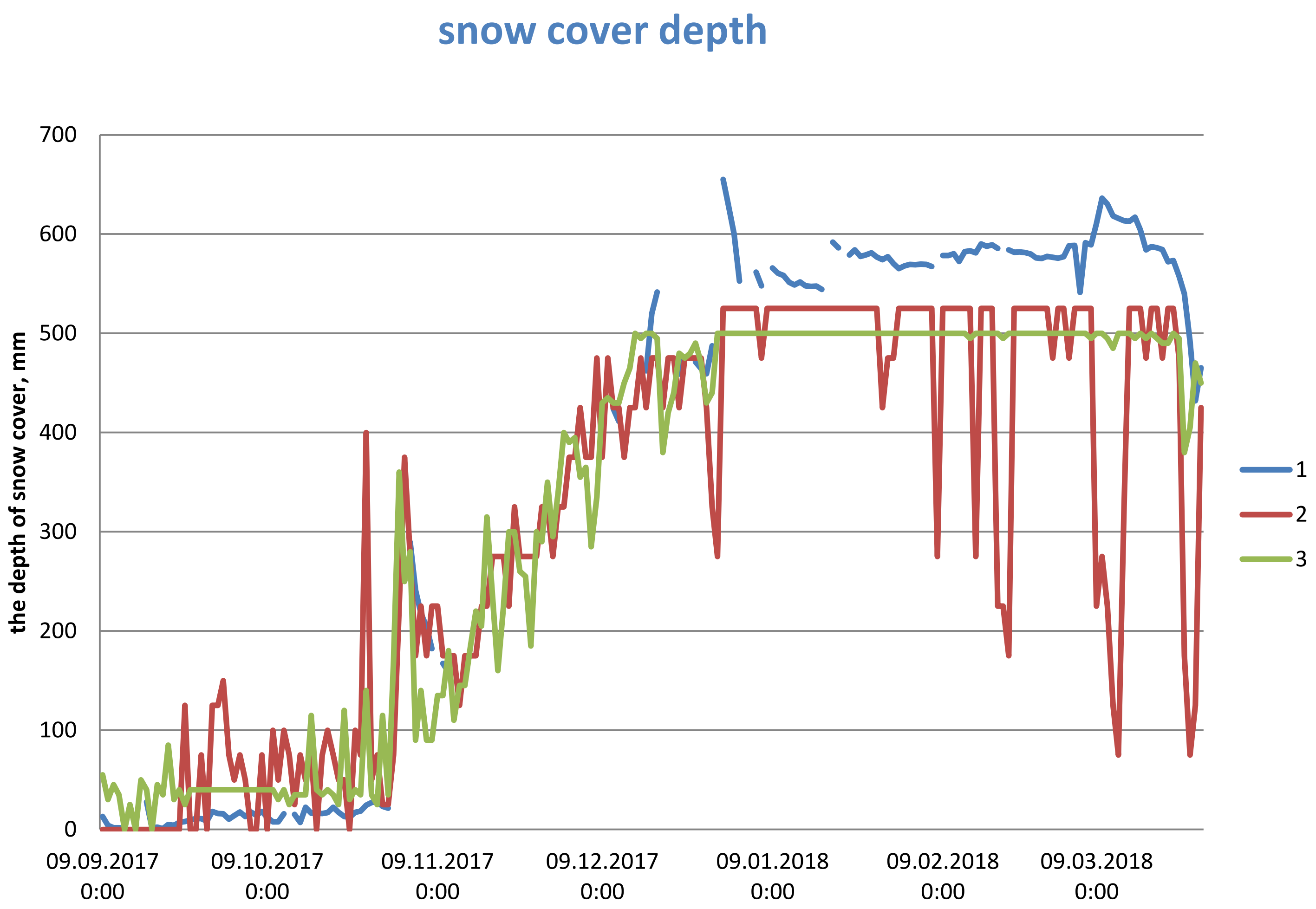




Vertical line is the snow-air interface

snow temperature



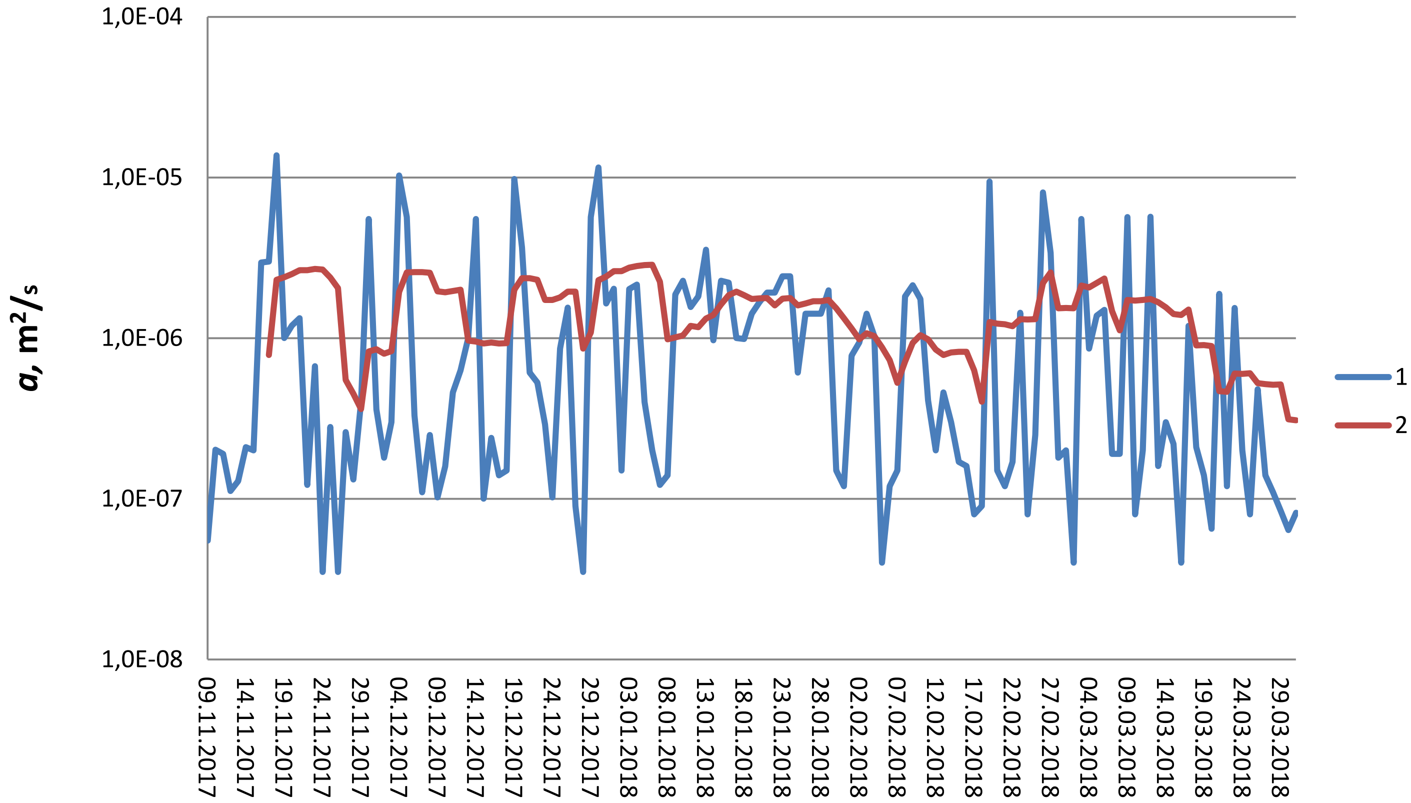


1 – ultrasonic sensor;

2 – calculations of preliminary algorithm.

3 – upper boundary condition

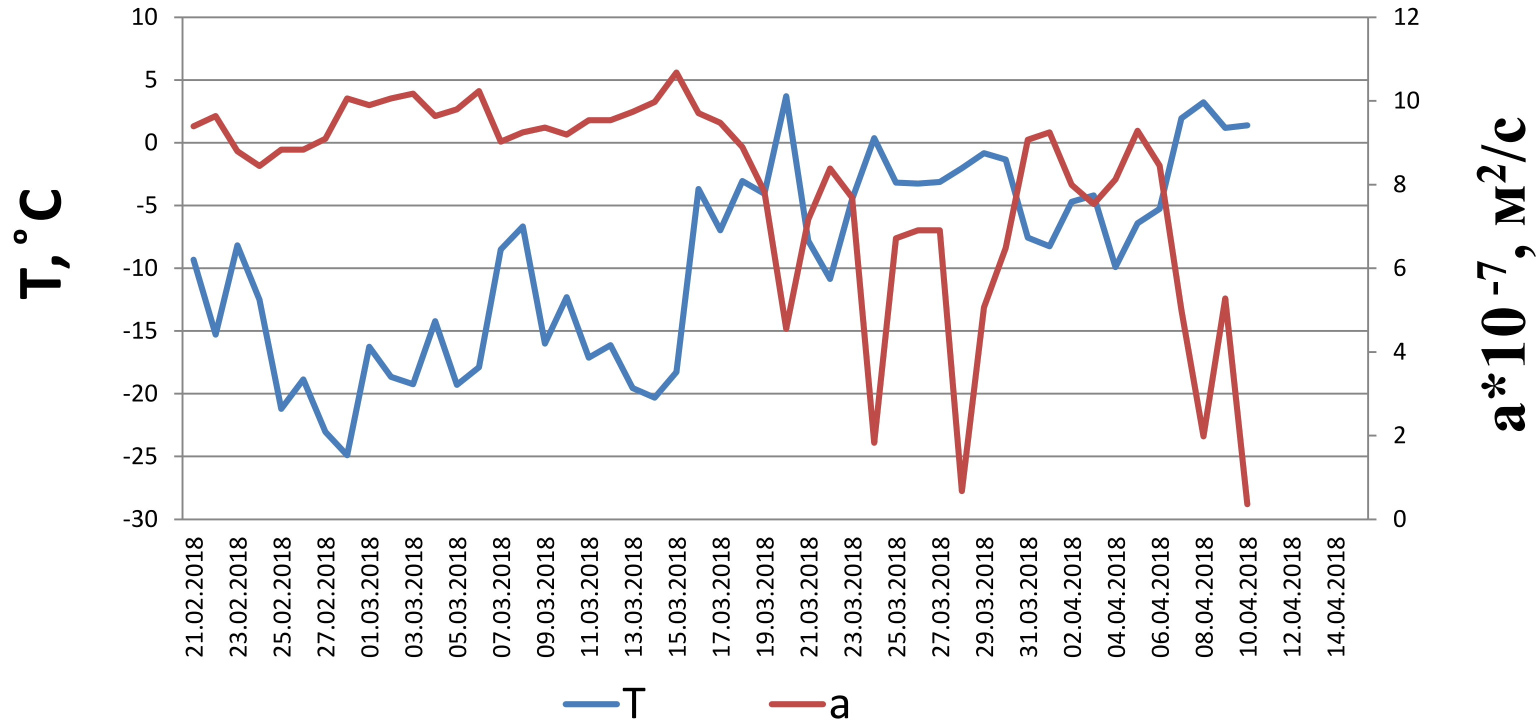
Results of the thermal diffusivity coefficient



1 – Results of calculating

2 – moving average

Results of the thermal diffusivity coefficient



T – Air temperature;

a – thermal diffusivity coefficient

Thank you for attention