



The evolution of supraglacial moraine and its impact on glacier melt in Southern Siberia

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Glaciers act as water reservoirs on different time scales. Especially high mountain ranges in arid regions can provide glacial melt water as an important source for irrigation during the growing season. This is also the situation in the Altay mountains in Southern Siberia, where a considerable ice cover of $>700 \text{ km}^2$ is slowly decreasing. The observed glacier retreat is accompanied by an expansion of supra-glacial debris cover, which itself strongly influences the ablation rates.

To quantify the effects of debris cover on ice melt and glacier reaction, the spatial evolution of debris cover since 1952 was analysed for three glaciers in the North Chuya Ridge using satellite and airborne imagery, as well as suitable field measurements.

In the ablation season of 2007, the debris covered parts of Maliy Aktru glacier were investigated in detail. Thermistors in different depths within the moraine provided data of temperature gradients which were used to calculate thermal resistance of the debris. Ablation stakes were installed at locations with differing debris thickness and observed regularly throughout the entire melt season. Air temperature recorded by a nearby automatic weather station was used for determining degree day factors. This allowed the calibration of ice melt on the basis of the calculated thermal resistance of the debris cover. Also the influence of the topography of the glaciers and the entire mountain range on solar radiation was considered in the ablation calculations by including the varying shading effect throughout the summer. With this methodology we were able to extrapolate the measurements from Maliy Aktru glacier to the other glaciers and to estimate ice melt rates for the entire basin. This melt model was then used to investigate variations in summer runoff for available data from the 1960s and compare changes in potential melt with the evolution of the debris cover.