Abstract

The thesis deals with hydrological conditions in a proglacial environment, focusing on the development of glacial lakes and the assessment of their susceptibility to outburst. The study site is the Adygine glacier-moraine complex located in the north-facing valley of the Kyrgyz Ridge, northern Tien Shan, Kyrgyzstan, at an altitude of 3400-4200 m a.s.l. In the past 50 years, the receding glacier allowed formation of several lakes, which form a three-level cascade and are fed by glacier meltwater. Below the glacier, there is a complex of several generations of moraines, through which the glacier meltwater is routed downstream. The aims of the work were to evaluate the development of individual lakes, their susceptibility to sudden outburst and possible triggers, to estimate the probable development of the site in the future, to analyse the hydrological regime of the lakes and to obtain basic information on the subsurface flow of water from the site to the stream. For the purposes of assessing the development of the lakes, the data obtained in the field (geodetic surveying of a shore line, bathymetric measurements), as well as satellite and aerial images were used. Fluctuation of lake water level was monitored by pressure sensors and the processing of this data allowed to analyse the hydrological regime of these lakes on a daily, seasonal, and annual scale. For the purposes of assessing the susceptibility of lakes to outburst, a regionally-based approach, using field data and observation together with digital map data, have been developed. The probable further development of the site (glacier retreat, formation of new lakes) was introduced using GERM model outputs. Lastly, the passage of meltwater through subsurface routes in the morainic complex was investigated - the connection between the lower lake and the stream was tested with dye tracing method. Thanks to the observed dye concentrations in the stream it was possible to determine the duration of the water passage as well as significant dilution of the traced water in the drainage system. The connection of small tarns found in the morainic complex to melt water was found by analysing the isotopic composition of their water. Some of the tarns actually had a very similar water composition to the large lakes fed by glacier meltwater, others showed only partial or very little influence of meltwater on their hydrological balance.

Key words: Glacial lake, Proglacial area, Lake outburst, Hydrological regime, Glacial meltwater