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Mathematical simulation of melting mountain glaciers

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Freshwater shortage is one of the global problems of our time. Glaciers contain a large amount of freshwater on the Earth. Nowadays mountain glaciation is decreasing almost throughout the world (Panov, 1993; Duethmann et al., 2016; Fausto et al. 2016). This effect leads to an increase in the water content of mountain rivers, but also cause a decrease in glaciers freshwater reserves (Trenberth et al., 2007; Sorg et al., 2012). This impact is already felt in the arid regions of our planet. Recently in Central Asia was observed a shortage of water resources. According to the estimates, the total area and mass decrease of the Tien Shan glaciers, from 1961 to 2012, amountes to 18 ± 6% and 27 ± 15% (Farinotti et al., 2015). The degradation of the area and volume of the Tien Shan glaciers, in the period from 1961 to 2012, was 18 ± 6% and 27 ± 15% (Farinotti et al., 2015). About 15% of the runoff in the Republic of Kyrgyzstan is fed by glacial nutrition, but this contribution may even be 1.5-3 times greater during the warm season (Dikikh et al., 1995; Kemmerikh, 1972). The average annual rivers runoff in the Republic of Kyrgyzstan increased from 47.1 km3 (~ 1947–1972) to 50 km3 (1973–2000) (Mamatkanov et al., 2006). The representative glacier of the Central Caucasus - Dzhankuat can serve as an example of depletion of freshwater in the glaciers of the Caucasus. Over the past decades, since 1974, the Dzhankuat glacier has lost large volumes - almost twice, and at the time of 2013 it is equal to 0.077 ± 0.002 km^3. From 2006 to 2015 the volume of the Dzhankuat glacier decreased by 25%, as a consequence, there is an increase in the rate of degradation (Lavrentiev et al., 2014).

In this article is presented mathematical simulation, which allows to solve a number of problems. One of the most important problem is the calculation of the water supply into the river network because of snow and ice melting in mountain areas. Weather conditions are taken into account in the simulation calculation of snow and ice melting over the entire glacier surface.

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