



Using energy-balance distributed modelling to estimate glacier ice and snow meltwater contribution to the upstream of Syr Daria basin

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An energy-balance distributed model A-Melt was used to calculate the meltwater yield from Sary-Tor glacier and Glacier No.354 in the Central Tian Shan, the Ak-Shyirak massif, Syr Daria river headwaters. Rapid and accelerating deglaciation is characteristic of this region. Sary-Tor glacier was chosen as representative for Ak-Shyirak massif in course of International hydrological decade and was an object of direct massbalance measurements in 1985-1991. Glacier No.354 was an object of direct mass-balance measurements for 2011-2016. Validation of modeling results showed a good reproduction of direct ice and snow melting measurements data on the ablation stakes net and mass loss according to geodetic method. The relation between temporal oscillations of modeled water yield from the glaciers to monthly discharges during the warm period in 2003-2014 was drawn for different gauging stations in the upstream of Syr Daria basin. For the small river watersheds of less than 500 km² area with more than 10-15 % glacier cover the relation is the strongest, correlation coefficient amounts to 0.86-0.91. Receding from the alpine headwaters the influence of glacier melt is gradually diminishing. The relation between monthly discharges during the warm period and modelled water yield is strongly significant ($R=0.76$) for Naryn river at Naryn city gauge with the watershed area of 10 500 km².

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