



Modelling mountain lakes outburst floods in the Gorno-Badakhshan autonomous region, Tajikistan

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Mountain lake outbursts studies are very relevant due to difficulty of the outbursts prediction and high potential hazard that they can pose to downstream valleys, especially for developed and populated river valleys. The hazardous processes aggravate in mountains because the main economic activities are concentrated there in narrow parts of the valleys along river beds. Direct studying methods for the mountain objects are extremely difficult, therefore the main research methods are remote sensing and scenario hydrodynamic modeling.

Over recent years the urgency of the outbursts studies in Tajikistan increases. The Barsem debris flow, which occurred in June 2015, destroyed and flooded residential areas, social facilities and infrastructure of Barsem village and neighboring villages. The mud mass blocked the Gunt river and formed a dam lake, bringing great economic losses.

The aim of the study was to estimate to calculate flood characteristics (flood depth, velocities, lag time) and their distribution in 9 mountain valleys in the Gorno-Badakhshan autonomous region in the eastern part of Tajikistan. The studied objects – glacial and barrier lakes – are located on the tributaries of the Gunt River and pose hazard to a great amount of people and important infrastructural objects, especially the Pamir Highway, Horog city and 2 hydroelectric power stations.

Mathematical modeling techniques were used. We used a two-dimensional (2D) model for GLOF simulation, which was based on the implementation of the numerical methods for solving the system of Saint-Venant equations and showed spatial distribution of flood parameters. The FLO-2D PRO Software Package was used. The input data for the calculations was: relief characteristics and scenarios of the outbursts, the results of the modeling was flow depth and velocity distribution.

The flood zones obtained as the results of scenario modeling allowed to evaluate the hazardous zones in the studied valleys, to identify the most vulnerable objects. The need for field researches was identified to refine heights of settlements about rivers water surface, because the relief used not always described the floodplain well. The calculated scenarios can be also refined as a result of a complex of field surveys in the upper reaches of the valleys.