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GLACIER KOLKA COLLAPSE ON SEPTEMBER 20, 2002 IN NORTH OSSETIA

Zaalishvili V.B.

Geophysical Institute, Vladikavkaz Scientific Centre, Russian Academy of Sciences
vzaal@mail.ru

Abstract. *Based on the processing of digital instrumental recordings, the main stages of the Kolka glacier (North Ossetia) collapse process were defined. 15 special points of the collapse process were identified in digital recordings. In addition, the main movement stages of the ice-rock mass were clarified on the basis of seismological data. Based on the detailed analysis, the velocities and accelerations at different stages were estimated and the nature of changes in velocities and accelerations caused by the features of the terrain relief (slope steepness, cross-section) along the movement path was determined.*

Keywords: *geological catastrophe, glacier, ice-rock flow, modeling, analysis.*

On September 20, 2002, a geological catastrophe occurred in the form of a sudden collapse of the Kolka glacier with a volume of ice-rock flow of about 140 million cubic meters in the Karmadon Gorge in North Ossetia. As a result, the village of Nizhny Karmadon completely disappeared. About 130 people, including children, died. The film crew of Sergei Bodrov also died. A large part of the houses in the village of Gornaya Saniba were flooded and submerged underwater.

In this study, the instrumental observation data were compared with macroseismic survey of the territory and results of mathematical modeling for the movement of the avalanche flow, taking into account the geometry of the gorge. As a result of the analysis, the length of the flow was calculated and the seismic intensity manifested by the ice-rock flow on the rocky mountain massif in the area known as Karmadon Gates was determined.

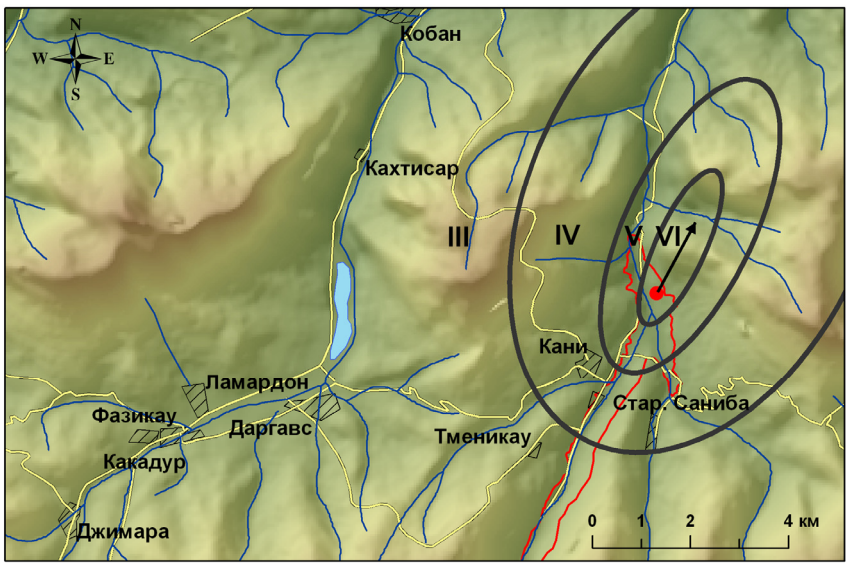

Fig. 1. Isoseists of the seismic event associated with the Kolka glacier collapse on 20.09.02 (the arrow indicates the direction of impact).

Based on the processing of digital instrumental recordings, the main stages of the Kolka glacier collapse process were defined. 15 special points of the collapse process were identified in digital recordings. In addition, the main movement stages of the ice-rock mass were clarified on the basis of seismological data. Based on the detailed analysis, the velocities and accelerations at different stages were estimated and the nature of changes in velocities and accelerations caused by the features of the terrain relief (slope steepness, cross-section) along the movement path was determined.

The model considering the movement of the glacier is most similar to an avalanche. The velocities of the ice-rock flow were 57.2 m/s, 105.8 m/s, 49.4 m/s, and 24.8 m/s at different sections. This was due to a significant change in geomorphological conditions in the discharge zone. The length of the ice-rock flow varied from 5 km to 3 km at the height of 150-200 m.

The intensity of event caused by colliding with the mountain massif reached VI (Fig. 1). The event is characterized by a high-frequency spectrum of vibrations. It should be noted that the formulas used in seismology were obtained for earthquakes and were used in present study solely as approximate relations.