



Glacial lake hazard in the Central Caucasus, Russia

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In the last few decades glaciers have been retreating in the majority of the glaciated mountain regions of the world. This phenomena is accompanied by the formation of glacial lakes. These lakes threaten destructive debris flows which present immediate danger to the population. Dangerous glacial lakes have been investigated in the Himalayas, the Alps, the Tien Shan, Pamir and other regions of the world. However, in the Central Caucasus the glacier risk hazard is not sufficiently studied. Location and size of the lakes is not shown on the topographical maps, which were compiled for this region some fifty years ago. The current state of the lakes and their hazard is not fully clear.

We have combined field research and satellite image analysis to map these lakes, to monitor debris flow initiation zones in periglacial areas and to assess the potential danger. Since 1999, annual expeditions have been organised to the headwaters of the AdylSu river. In 2005 the total area of lakes in this valley reached $9.3 \times 10^4 \text{ m}^2$, and the total volume exceeded $0.9 \times 10^6 \text{ m}^3$. Buildings, bridges and camping sites are in the in the danger area of potential outburst debris flows. On the north-east slopes of Mt. Elbrus, the highest summit of Europe and Russia (5642 m), 13 significant glacier lakes have been identified. The total area of lakes has increased sixfold from 1957 to 2005 and now exceeds $2.5 \times 10^5 \text{ m}^2$. A mineral water resort is being built in the danger zone. In the Genaldon River valley 13 new lakes formed after a glacier disaster resulting from the collapse of Kolka glacier in 2002. By 2005 nine lakes have been drained. The volume of water in lakes decreased from $5 \times 10^6 \text{ m}^3$ to below $0.3 \times 10^6 \text{ m}^3$. In the future we hope to develop detailed recommendations for debris flow protection measures. A glacier lake research station is envisioned on the basis of a permanent expedition near Bashkara glacier. The authorities have only started to realize the potential danger and much has to be done for the delineation of potential risk zones.