

# Glacier disasters as a specific type of glacial hazard

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Glacier related hazards such as lake outbursts and consequent floods and debris flows, ice avalanches, surges are widespread and highly dangerous because they are difficult to predict. But some events stand out from the conventional classification. Kolka-Karmadon glacier disaster (20 Sept. 2002, Caucasus, North Ossetia, Russia) was the largest registered catastrophic glacial event in the world by volume of transported material. This catastrophe was triggered by a series of ice-rock collapses from northern face of Mt. Dzhimarai-khokh onto the rear part of Kolka Glacier, that started two months earlier. A satellite image taken 8.5 hours before the disaster shows instability within the glacier body, whereas no signs of terminus movement are observed. The main part of Kolka glacier snout detached and travelled up to 19 km downstream with an extraordinary average velocity of 50 m/s despite low path angles ( $6^\circ$ ). The ice/water/rock mass moved from one valley side to the other within a belt 400-500 m wide, with the highest waves reaching 250 m in height.  $120 \text{ M m}^3$  of ice and debris were moved by this process to the Karmadon depression and covered  $2 \text{ km}^2$ , with a further distal debris flow which travelled for an additional 17 km downstream. The total area directly affected by the disaster was  $12.7 \text{ km}^2$ , and 125 peoples perished. The catastrophe had some distinctive features such as detachment of the glacier body on a low angle surface, extraordinary volume and velocities, and superelevations along transit path. These features were also typical for other glacier disasters (e.g., Huascarán, 1962, 1970; Devastation Glacier, 1975; Kolka-Karmadon, 1902, 2002) making them rare but devastating phenomena and differentiate them from other glacial hazards. We suggest the use of specific terms such as glacier-debris flow, ice-debris-water flow, glacier debris flood, depending on flow constitution. Such phenomena require special attention and approaches. A first draft of a new glacial hazards classification is proposed. This study is sponsored by NATO SFP Programme and Russian Foundation of Basic Research, project 06-05-64787.