



Monitoring the 2005 dam failure event of Merzbacher glacier lake with ground-based observations of reflected GPS signals

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The glaciated Tianshan mountain chains of Kyrgyzstan represent the main reservoir of water supply of large parts of Central Asia. The regression of glaciation in this area, observed since the last two decades, caused changes in the dynamics of the glaciers. Hence, especially at the largest glacier lake of Central Asia – the Merzbacher Lake – the number of dam failures raised dramatically and causes massive damage of the infrastructure of the regions situated below the glacier outflow every year.

During the Inylshik 2005 expedition, conducted between July 22 and August 13, 2005, a GPS altimetry/reflectometry experiment was installed at the border of the Merzbacher Lake at 42.196°N, 79.847°E and a height of 3271 m above sea level in order to monitor changes of the lake level. A single unmodified RHCP GPS patch antenna was mounted at a secure iceberg-free location in a height of 43 m above the lake and was tilted 45° toward the lake surface. The 12-channel L1 frequency receiver was modified to allow for open-loop tracking of reflected signals and autonomously records up to 4 different reflected GPS signals simultaneously, depending on the constellation of the satellites and the ground-based receiver.

Although the lake surface was fully covered with ice floes and icebergs, the OpenGPS receiver collected several height profiles every day and monitored the temporal change of the lakes water level during 15 days, between July 27 and August 10, 2005. The replenishment with an estimated rise rate of 5 cm/h ended on August 1 when the lake's dam failed. During the following days the water level dropped by more than 20 m.