Natural glacier events such as ice avalanches, debris flows or glacier lake outburst floods (GLOF) may have hazardous impacts on the downstream area of the glacier and can cause severe destructions. The Inylchek Glaciers in Kyrgyzstan are among the largest non-polar glacier systems in the world. In spring, an ice-dammed lake is formed (Lake Merzbacher) by melt-water from the northern tributary. The lake drains predominantly every year suddenly within a few days causing a destructive flood. To understand the mechanism of the GLOF and to evaluate the potential to develop an early warning system, a network of continuously operating GNSS stations at the Inylchek Glaciers provide horizontal and vertical positions of the ice-dam in front of the Merzbacher Lake. GFZ and CAIAG jointly operate this Global Change Observatory consisting of a network of GNSS stations.

Irrespective of the general motion of the glacier during the year, the ice-dam is strongly influenced by the formation and outburst of the Lake Merzbacher. Shortly prior and after the GLOF, the GPS time series show a substantial change in the ice-dam’s behavior. Especially the vertical position and surface velocities increase shortly before the GLOF supporting the assumption that the ice-dam adjacent to the lake becomes afloat. Water penetrated underneath the ice-dam and bend the ice upwards. After the discharge, e.g. in 2014, the elevation decreases rapidly by 20 m within eight days. In 2015, the GLOF changes in timing, magnitude and available lake water volume but the motion pattern of the ice-dam is similar compared to the years before.

Before the GLOF the ice-dam changes its direction of movement due to the counter-pressure of the lake’s water. After the discharge, the ice masses can stretch unhampered.

Around the GLOF dates, the surface velocities show a significant change and are 3-5 times higher shortly before and up to 16 times higher during the GLOF. These results show the potential to develop an early warning system for the glacier-dammed lake outburst flood using continuous GNSS monitoring.