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 destruction. In Kyrgyzstan, the Inylchek Glacier is the second-largest glacier in the world comprising a northern and southern valley glacier stream, both stretching from east to west (Fig. 3). The glacier is located at the central Tian Shan Mountains in the north-eastern region of Kyrgyzstan close to the border of China and Kazakhstan (Fig. 1). In spring, a glacier-dammed lake is formed (Lake Merzbacher) by melt-water from the northern tributary which drains suddenly at least once a year within a few days causing a destructive flood. To understand the mechanism of the GLOF, it is essential to study the kinematic behavior of the lake’s ice-dam before, during and after the outburst.

Irrespective of the general horizontal motion of the glacier towards the ice-dam during the year (Fig. 3), the elevation change is dominated by melting and freezing processes due to temperature changes and additionally influenced by the formation and outburst of the Lake Merzbacher. During the year the elevation slightly increases during the winter time due to freezing processes and decrease when the temperatures are above 0 °C and the surface ice starts to melt (Fig. 4). Shortly prior and after the GLOF, the GPS time series show a substantial change in the ice-dam’s behavior. Especially in 2014, the vertical position significantly increases before the GLOF and decreases rapidly of almost 20m within three days after the GLOF. This huge change in elevation was not that dominant in the years before.

During winter and spring time the surface velocities are nearly constant with minor changes due to locally induced stress and abrupt release of the moving ice. These surface velocities vary between 0.18 and 0.24 m/s only.

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 (Fig. 5). These results show the potential to develop an early warning system for the glacier-dammed lake outburst flood using continuous GNSS monitoring.