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Hot water drilling and glaciological observations at the terminal part of Rhonegletscher, Switzerland in 2007

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Abstract

After the retreat of Rhonegletscher over a bedrock ridge, a proglacial lake has been forming at the glacier forefront since 2005. The lake and the glacier draw glaciological attention because the retreat may be accelerated by calving into the lake. As an initial investigation into studying the impact of the lake formation on the glacier, hot water drilling and preliminary observations were carried out at the terminal part of Rhonegletscher in the summer of 2007. Eight boreholes were drilled down to the bed and accurate ice thickness was determined from the borehole depth. The ice was 135 m thick at a point 700 m from the terminus and it gradually decreased downglacier. This observation revealed that the ice in this region was significantly thinner than previous estimation by an ice-radar survey. The water level in the 135-m borehole showed diurnal variations. The daily minima were steady during the study period at about 10 m higher than the surface elevation of the proglacial lake. After injecting a water jet into the bottom of the borehole, fine sediment was observed in the upwelling water. At some of the other drilling sites, however, scratches on the drilling nozzle suggested that the ice was underlain by solid rock. Thus, it is likely that the glacier bed conditions are inhomogeneous. The rate of change in ice thickness from 2000 to 2007 was determined to be $-2.8\,\mathrm{m\,a^{-1}}$, which indicates that glacier thinning has accelerated in the 21st century.