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Tree ring-dated retreat history of Hailuogou glacier since the Little Ice Age

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Under the warming climate, glaciers at the Tibetan Plateau and surroundings are largely experiencing shrinkage. Hailuogou glacier, located on the eastern slope of the Gongga Mt., eastern Tibetan Plateau, is a typical monsoonal maritime glacier. Due to the rapid warming, Hailuogou glacier has retreated rapidly during the 20th century. Continuity and integrity are very prominent in the chronosequence of the primary succession in the Hailuogou glacier the forefield .However, knowledge of this glacier historical fluctuation remains scarce owing to the limited available longer glacier records and reliable evidences. Tree-ring dating, as an accurate method, has been successfully used to reconstruct past glacier fluctuations in many areas of the world. Here, we sampled 9 retreat stages to collect tree cores along the glacier terminal moraines. Increment cores were sampled from trees of 2 dominant tree species, poplar (Populus purdomii), fir (Abies fabri). At least 5 dominant trees of the constructive species of the community were selected from each location. Tree ring samples were mounted, sanded, cross-dated and measured in the lab following the standard dendrochronological procedures. COFECHA program was used to check the accuracy of the crossdating. Fortunately, there was a remark of glacier retreat time on a stone, which facilitate us confirm the ecesis time of tree growth to base stem after glacier retreat. Results revealed after 10 years, poplar could grow to base stem, and after 33 years, fir could grow to base stem. The outermost lateral moraine of Hailuogou glacier was dated at least 1726 from tree ring dating. Between 1726 and 1892, the glacier retreated slowly. After 1930, the glacier retreat speed was accelerated. Since then, Hailuogou glacier retreat at average rate of 17 m yr-1. Our results imply trees growing on Little Ice Age glacier deposits proved to be very useful for deriving age estimates of historic glacier fluctuations in the southeastern Tibetan Plateau.