



Glacial and hydrological process dynamics of a monsoonal temperate glacier in Mt. Gongga and their environmental implications

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Temperate glaciers are more sensitive to climate changes than polar or continental glaciers, and can drive remarkable runoff variation in local water catchments. The Hailuoguo Glacier, a typical monsoon temperate glacier located on east slope of Mt. Gongga in Southeastern Tibet Plateau, has retreated more than 2 km since Little Ice Age (LIA). The LIA preglacial zone (2980-2800 m), characterized by very fast primary succession due to local warm-wet hydrothermal conditions, possesses an integrated succession community from cold-adapted herbaceous to *Abies fabri* forest. During the past three decades, observed annual runoff from the Hailuoguo Glacier catchment has shown remarkable increase, indicating the enhanced glacier ablation. However, as warming and glacier shrinking continues, decreasing total runoff and its seasonal distribution will be projected. Glacier downwasting and permafrost thaw have also led to accelerated paraglacial erosion and increased frequency of proglacial debris flow and flash flood, which has occasionally disturbed the established preglacial vegetation. Accumulated surface moraine debris near the lowest ice tongue has suppressed local ice ablation and thus ice stagnation, leading the establishment of some supraglacial vegetation, although which are usually ephemeral due to frequent ice collapse and ice cliff backwasting. The changing glacier and its hydrological process, as well as their related sediment load, nutrition flux and preglacial stream morphodynamics have synthesized implications for proglacial environment.