



## Repeated Glacial-Lake Outburst Floods in Patagonia: An Increasing Hazard?

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Patagonian glaciers are recording one of the fastest glacial retreats on Earth, inferred to be a direct response to recorded climate change in South America. The dynamic response of the region's glaciers to climate change was evident when two self-similar glacial-lake outburst floods occurred in April and October 2008, the largest floods from this glacier on record. On each occasion, the lake Cachet 2, in the Northern Patagonia Ice-Field, dammed by the Colonia glacier, released about 200 million m<sup>3</sup> water into the Colonia river. The lake is refilling rapidly, such that further outbreak floods can be expected. This paper anticipates future events, by providing an assessment of the hydraulic properties of the 2008 events. Pipeflow calculations of the subglacial tunnel drainage and hydraulic models of the river flood give consistent results, with an estimated peak discharge of between 2500 and 3000 m<sup>3</sup>s<sup>-1</sup>. However, geomorphological analysis of the Colonia valley shows evidence of former catastrophic outburst floods, with flood discharges possibly as high as 16,000 m<sup>3</sup>s<sup>-1</sup>. Given the impacts of climate change on glacier dynamics in the area, the frequency and high magnitude jökulhlaups may increase future flood risks for infrastructure and population, particularly relevant in view of the current development of hydropower projects in Chilean Patagonia.