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Recent drainage events of glacial Lake Cachet 2, Patagonia

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Lake Cachet 2 (47°12' S, 73°15' W, 422 m a.s.l.) is a proglacial lake of 4 km2 located on the eastern margin of the Northern Patagonia Icefield (3,953 km2, Rivera et al., 2007), which is dammed on its southern margin by Colonia Glacier. Until April 2008 there was no historical evidence of catastrophic flooding of this lake. In 2008 three sudden drainage events occurred at Lake Cachet 2 (April 6-7; October 7-8 and 21-22 December). During each event the flood wave traveled down Colonia River to the confluence with Baker River, then affected Baker River to a distance of up to 25 km upstream from the confluence and downstream all the way to its mouth on the Pacific Ocean fjords at Caleta Tortel (100 km to the southwest), transporting abundant sediments. In April the runoff of Baker River close to the confluence with Colonia River increased from a base level of 1,200 m3/s on April 7 to a peak runoff of 3,570 m3/s within a period of less than 48 hours, resulting in a river level increase of 4.5 m and an associated water temperature drop from 8°C to 4°C. In October the base level was 573 m3/s, with a peak runoff of 3,007 m3/s, a river level increase of 4.7 m and a water temperature drop from 7.3°C to 4.8°C, while in December the corresponding values were 1,145 m3/s, 3,052 m3/s, 11°C and 8°C. The flood affected roads, bridges, farms and cattle, fortunately not resulting in any human damage. Similar floods had been reported on Colonia River several decades ago, the last having occurred in the 1970s, all of which originated at that time at glacial Lake Arco, located south of Colonia Glacier. Airborne and ground explorations carried out after each event in 2008 confirmed that the floods originated at Lake Cachet 2, draining under Colonia Glacier for a distance of 8 km and emerging at the front of the glacier. As a result parts of the glacier front collapsed after each event, where large ice fractures could be observed.

During the October event a complete drainage of Lake Cachet 2 occurred, which allowed shortly after to map the lake bed with the CECS airborne laser scanner onboard a helicopter (Wendt et al., 2008). Here we present the characteristics of each drainage event of Lake Cachet 2, including results from satellite imagery, airborne laser scanning, field inspection, hydrological and meteorological data. It is suggested that the cause of these sudden drainage events is the sustained thinning of Colonia Glacier due mainly to regional climate warming, glacier which acts as natural dam of the lake. The thickness of the ice has reached a critical point where the hydrostatic pressure of the lake level can exceed the overburden pressure of the glacier, thus producing water drainage under the ice. Such events should continue to occur in the future until the glacier recedes to an extent when a stable surface waterway may be formed.