

Areal changes of glacial lakes from the Northern and Southern Patagonia icefields

Thomas Loriaux[†]; Jose Luis Rodriguez; Gino Casassa

[†] Centro de Estudio Cientificos, Chile

Leading author: thomas@cecs.cl

Current melting of terrestrial glaciers is affecting the periglacial lake environment. The Patagonia icefields represent the largest temperate ice mass in the Southern Hemisphere outside of Antarctica. In this context, they play an important role in sea-level rise. The purpose of this paper is to quantify the areal changes of glacial lakes located at the periphery of the Northern and Southern Patagonia Icefields (NPI and SPI) experienced in recent decades. For this purpose we have realized an inventory of the Patagonian glacial lakes. Based on Landsat ETM+ scenes, the total glacial lake areas were estimated as $299 \pm 19 \text{ km}^2$ for the NPI in 2001, and $3,900 \pm 88 \text{ km}^2$ for the SPI in 2000. For SPI a total lake of area of $410 \pm 30 \text{ km}^2$ results for 2000 when the large eastern piedmont lakes (O'Higgins/San Martín, Viedma, Argentino including Brazo Rico) are not considered. At NPI there is only one tidewater calving glacier (San Rafael) located on the west. At SPI there are 27 large tidewater glaciers on the western side, with only a few land-terminating glaciers which give rise to periglacial lakes. Analysis of earlier satellite imagery (Landsat TM and Landsat MSS) shows a total lake area of $239 \pm 26 \text{ km}^2$ for NPI in 1979, $3903 \pm 89 \text{ km}^2$ for SPI in 1986 including the large lakes, and $391 \pm 29 \text{ km}^2$ for SPI in 1986 excluding the large lakes. This results in an areal increase of 20.25% for NPI lakes within the period 1979-2001. For the SPI, there is a slight areal reduction of lakes of 0.06% for the period 1986-2000 considering the large lakes, and an areal increase of 4.63 % excluding the large lakes. Both glacier variations and climate changes in the region are analyzed in order to try to understand and seek the causes for the observed changes in glacial lake area. Implications for the contribution of the Patagonia icefields to sea-level rise and for the potential impact on Glacial Lake Outburst Floods (GLOFs) are discussed.