60 Years of Glacier Elevation and Mass Changes in the Maipo River Basin, Central Andes of Chile

David Farías-Barahona [1,*], Álvaro Ayala [2,3,4], Claudio Bravo [5], Sebastián Vivero [6], Thorsten C. Seehaus [1], Saurabh Vijay [7], Marius Schaefer [8], Franco Buglio [9], Gino Casassa [9,10] and Matthias H. Braun [1,]

[1] Institut für Geographie, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany; matthias.h.braunl@fau.de; thorsten.seehaus@fau.de
[2] Laboratory of Hydraulics, Hydrology and Glaciology (VAW), ETH Zurich, Zurich, Switzerland
[3] Swiss Federal Institute for Forest, Snow and Landscape Research (WSL), Birmensdorf, Switzerland
[4] Centre for Advanced Studies in Arid Zones (CEAZA), La Serena, Chile; alvaro.ayala@ceaza.cl
[5] School of Geography, University of Leeds, Leeds, UK; gycabl@leeds.ac.uk
[6] Institute of Earth Surface Dynamics (IDYST), University of Lausanne, Lausanne, Switzerland; sebastian.viveroandrade@unil.ch
[7] Byrd Polar and Climate Research Center, Ohio State University, Columbus, USA; vijay.20@osu.edu
[8] Facultad de Ciencias Físicas y Matemáticas, Universidad Austral, Valdivia, Chile; mschaefer@uach.cl
[9] Dirección General de Aguas, Ministerio de Obras Públicas, Santiago, Chile; gino.casassa@mop.gov.cl; franco.buglio@mop.gov.cl
[10] Universidad de Magallanes, Punta Arenas, Chile
* Correspondence: david.farias@fau.de; Tel.: +49-9131-852-2463

Figure S1. Melt conditions and bare ice upper sections of (a) Bello Glacier and (b) Yeso Glacier at 4600 m a.s.l. Photographs taken by Geoestudios© on 27 March 2013, which is approximately 4 days after the TanDEM-X acquisition. Hence, we discard any radar signal penetration at this altitude.

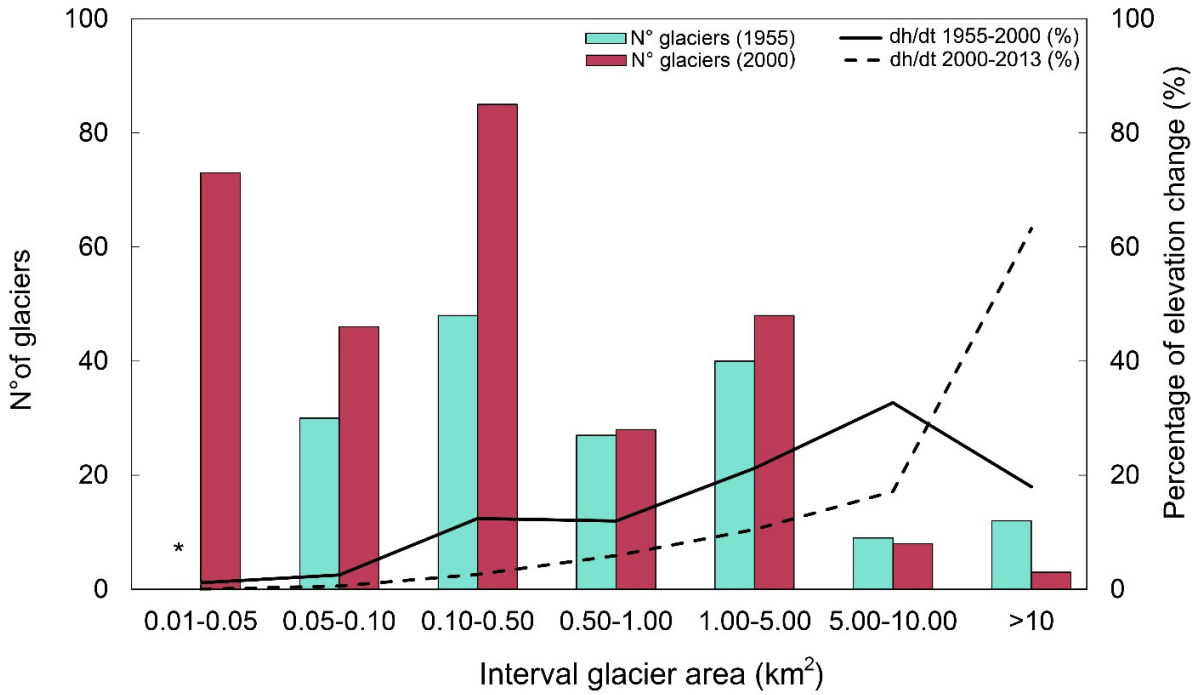

Figure S2. Basic glaciological parameters plot. Elevation change in percentage (%) per number of glaciers in relation to size interval (km²). * corresponds to very small glaciers (<0.05 km²) in the first glacier inventory (1955–2000), which were not taken into account.

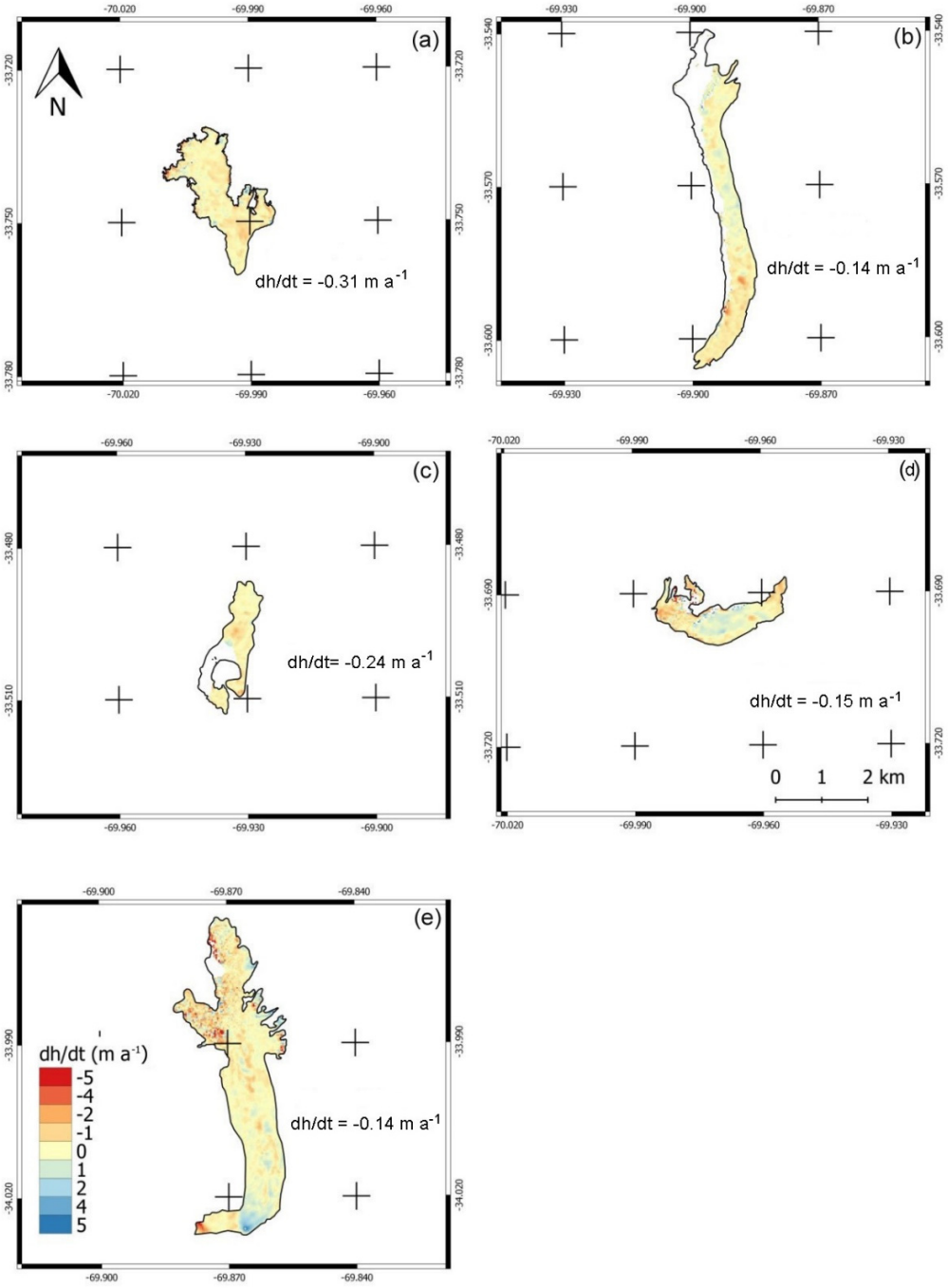

Figure S3. Selected debris-covered glaciers in Maipo catchment from 2000 to 2013. (**a**), (**c**), (**d**) unnamed glaciers, (**b**) Piramide, and (**e**) Cerro Castillo glaciers, with their respective mean elevation change rates (m a^{-1}).

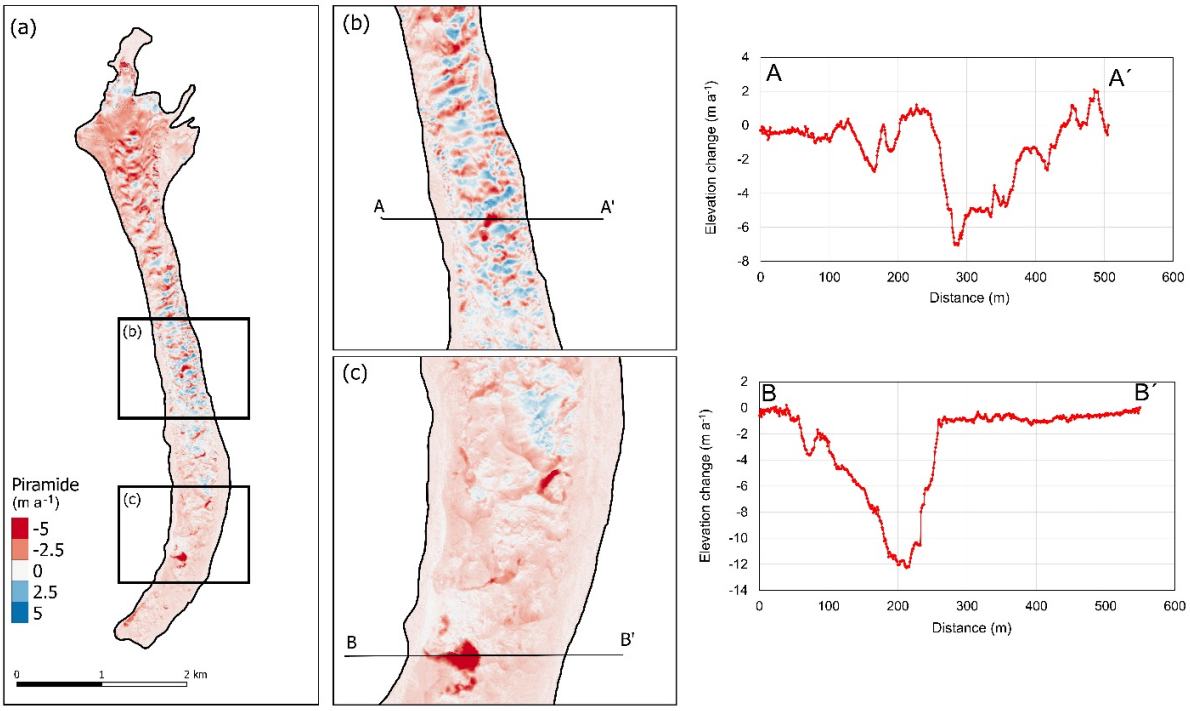

Figure S4. Elevation change maps of the Piramide debris-covered glacier, derived between LiDAR's 2012 and 2015. (**a**) corresponds to the entire glacier, (**b**) and (**c**) correspond to a specific section with supraglacial lakes with their respective profiles. Profile A-A' is display in Supplementary Figure S7.

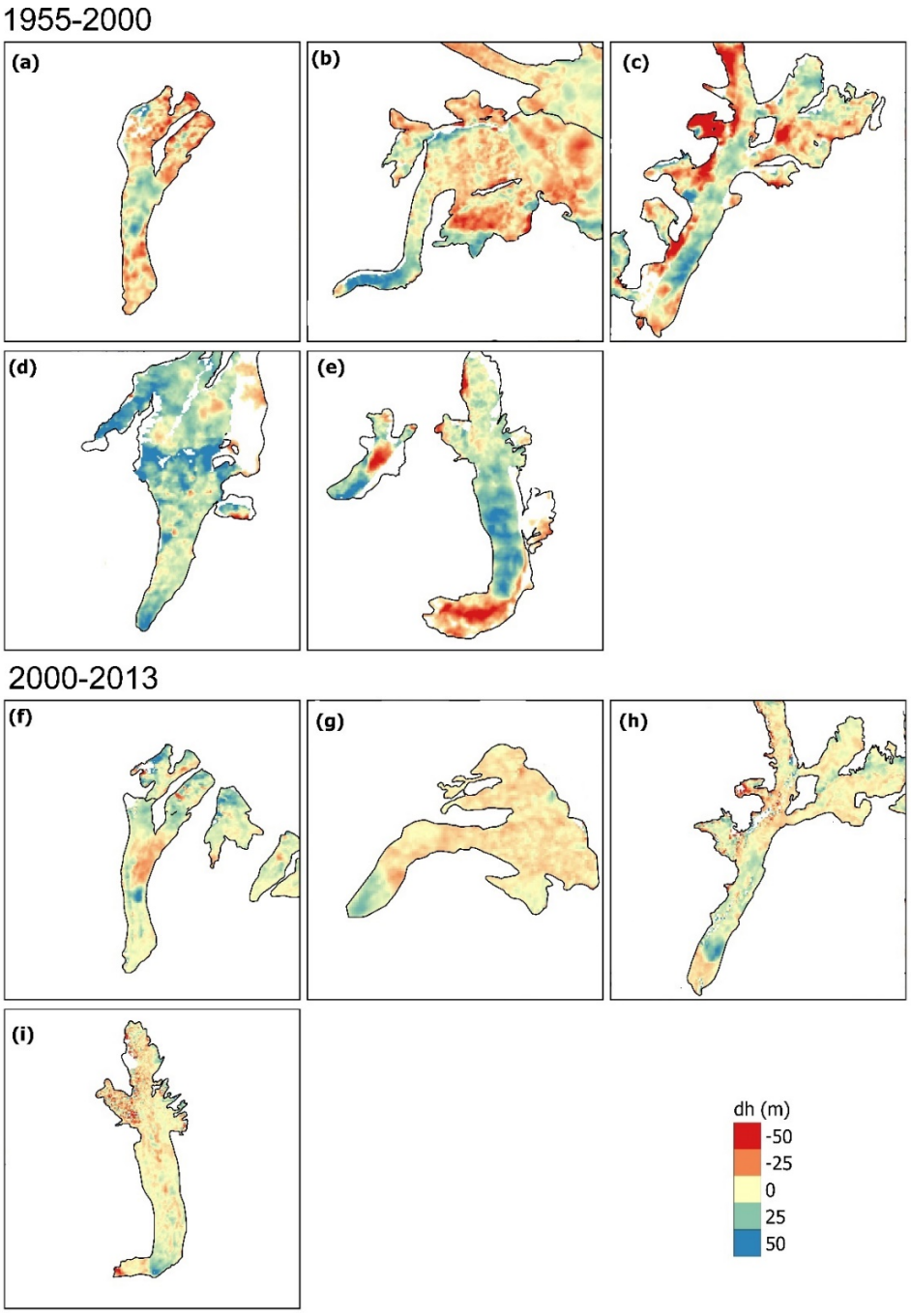

Figure S5. Elevation changes maps (m) between 1955 and 2000 (**a**–**e**) and 2000–2013 (**f**–**i**) of some small signal of surge derived from positive elevation changes at the glacier front: (**a**) corresponds to Sierra Bella Glacier, (**b**) Azufre Glacier (Tupungaiito volcanic complex), (**c**) Loma Larga Glacier, (**d**) Nieves Negras Glacier, and (**e**) Cerro Castillo, between 1955 and 2000. (**f**) corresponds to Sierra Bella, (**g**) Oeste del Cerro Alto, (**h**) Loma Larga, and (**i**) Cerro Castillo glaciers, between 2000 and 2013.

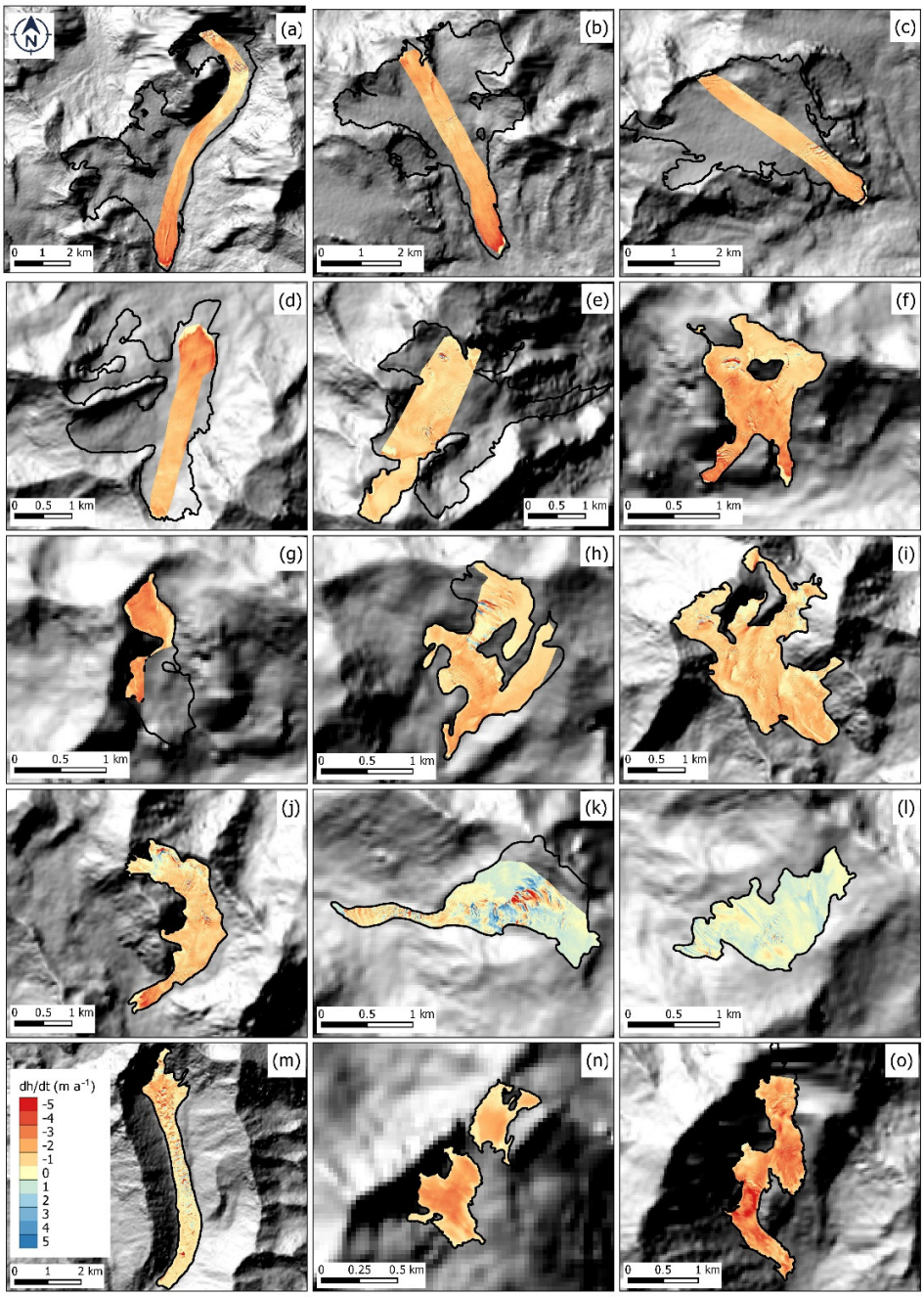

Figure S6. Glacier elevation changes measured with airborne LiDAR: (**a**) Juncal Sur Glacier, (**b**) Olivares Gama Glacier, (**c**) Olivares Beta Glacier, (**d**) Olivares Alfa Glacier correspond to the 2011 and 2015 period.(**e**) Esmeralda Glacier, (**f**) La Paloma Glacier, (**g**) Rincon Glacier, (**h**) Cerro del Plomo Glacier, (**i**) Bello Glacier, (**j**) Yeso Glacier, (**k**) Yeso 1 Glacier, (**l**) Yeso 2 Glacier, and (**m**) Pirámide Glacier were measured between 2012 and 2015. (**n**) Echaurren Norte Glacier and (**o**) San Francisco Glacier correspond to the 2009–2015 period.

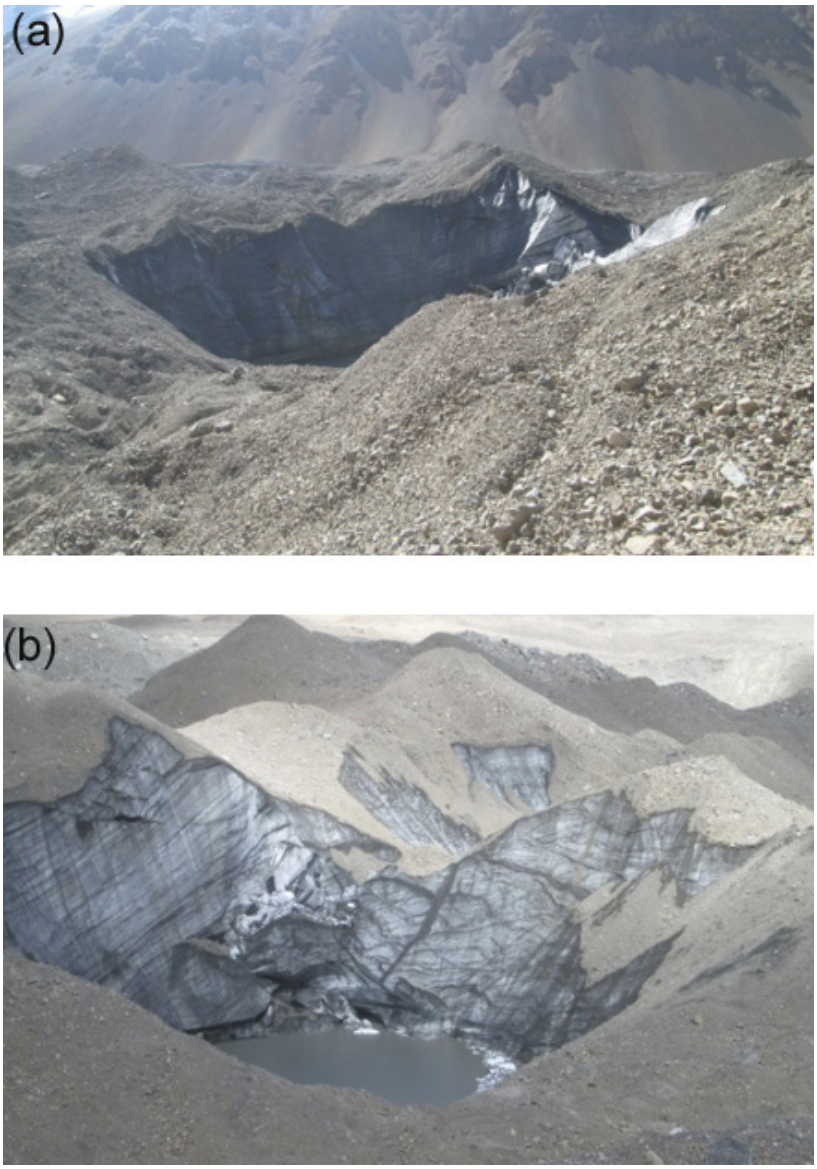

Figure S7. (**a**) Piramide Glacier located at elevation range of 3200–4100 m a.s.l. Several ice cliffs and supraglacial lakes were observed, which enhance negative elevation change rates. (**b**) corresponds to the supraglacial lake from Figure S4–b.