

COLOMBIAN GLACIERS 1950s-2016

(4 maps)

J.L. Ceballos, F. Rojas
Institute for Hydrology, Meteorology and Environmental Studies -IDEAM-
Bogotá, Colombia, South América

Nowadays, Colombia hosts six tropical glacier systems (IDEAM 2012): Volcán Nevado Ruiz, Volcán Nevado Santa Isabel, Volcán Nevado Tolima, Volcán Nevado Huila, and the two Sierras Nevadas de Santa Marta y El Cocuy. For these regions, we present the glacier changes in surface area between the 1950s and 2016.

The four maps were elaborated based on aerial photographs and multispectral satellite images. The glacier outlines of the 1950s are a result of aerial photograph interpretation taken by Geographic Institute "Agustín Codazzi" (Proyecto Geosistemas de la Alta Montaña, Universidad Nacional de Colombia-IDEAM, 1997). The glacier outlines of the 1990s and 2000s are a result of processing and interpretation of Landsat TM satellite images. For 2015 and 2016, the glacier outlines are derived from Sentinel-2 and Spot 6 and 7 images (Proyecto: Glaciares Tropicales Andinos en un Contexto de Cambio Climático, IDEAM, Conservación Internacional Fundación, Banco Interamericano de Desarrollo). For the Sierra Nevada de Santa Marta, the outlines of 2017 are based on a photomosaic with 0.25 m spatial resolution provided by the Colombian Air Force (Multispectral Leica ADS100 sensor). Elevation contours are computed from SRTM. For the map of Sierra Nevada Santa Marta, elevations are based on a digital terrain model with 5 m spatial resolution elaborated by the Colombian Air Force (January 2017). ESRI ArcGIS 10.1 and ERDAS 2014 computer programs are used for mapping the glaciers.

Overall, the glacier area in Colombia was reduced from 110 km² in the 1950s to 42 km² in 2016. A detailed analysis of glacier area changes is published in Rabatel et al. (2017). Glaciological mass balance measurements have been carried out at monthly intervals at Glaciar Conejeras, Santa Isabel, since 2006 (Mölg et al. 2017) and in the Sierra Nevada de El Cocuy.

The maps were produced within the framework of the project *Capacity Building and Twinning for Climate Observing Systems* supported by the Federal Office of Meteorology and Climatology MeteoSwiss and the Swiss Agency for Development and Cooperation.

IDEAM (2012): Glaciares de Colombia, más que montañas con hielo. Bogotá, D.C., 344 pp.

Mölg, N., Ceballos, J.L., Huggel, C., Micheletti, N., Rabatel, A. and Zemp, M (2017): Ten years of monthly mass balance of Conejeras glacier, Colombia, and their evaluation using different interpolation methods. *Geografiska Annaler: Series A, Physical Geography*.

Rabatel, A., Ceballos, J.L., Micheletti, N., Jordan, E., Braitmeier, M., Gonzales, J., Moelg, N., Huggel, C. and Zemp, M. (2017): Toward an imminent extinction of Colombian glaciers? *Geografiska Annaler: Series A, Physical Geography*.