HASTENRATH, S. 2008. *Recession of equatorial glaciers: a photo documentation.* Madison, WI, Sundog Publishing, 142pp. ISBN-13: 978 0 9729033 3 2, softback, US$80.

Published time-series collections of historic photographs of glaciers are uncommon but make absorbing browsing. Having recently visited the tropical glaciers of eastern Africa, I was keen to open this book to see the nature of and changes to these distinctive glaciers. I was not disappointed with the nearly 200 photographs together with maps and diagrams.

After a long career dealing with tropical glaciers, Stefan Hastenrath is to be congratulated on assembling a rare set of photographs and presenting a timely contribution to documentation of the long-term ice recession in the three glaciated high mountain regions at the equator: East Africa, the Ecuadorian Andes and New Guinea.

This small book has a short overview, followed by maps and photographs given in four parts. Part A gives a brief description of each area, with a short summary of the source and content of each of the maps and photos. Part B gives a comprehensive list of references, including the previous books by the author. Part C presents maps and diagrams, grouped into the three main regions of East Africa, the Ecuadorian Andes and New Guinea, prefaced with a basic table of contents. Within each main region the comprehensive collection of maps, dating from the end of the 19th century, is grouped by individual mountains (e.g. Mount Kenya, Kilimanjaro and Ruwenzori in Africa) and arranged in a rational chronological order. This part concludes with useful summary maps locating the named glaciers and includes maps and diagrams of ice losses. The few Ruwenzori maps are less comprehensive and do not include the four ice recessional maps from 1906 to 1990 of Osmaston and Kaser (2001).

The glaciers of Ecuador are shown on maps of the three mountains Chimborazo, El Altar and Antisana. The maps for Chimborazo span the period from 1892 to the 1970s, with a table of the sources of conflicting glacier names. Sketch maps are provided for the glaciers of El Altar and Antisana, although moraine ridges of the Chimborazo and Antisana glaciers mentioned in their captions (pp. C20 and C23) have not been mapped. The retreat history of the New Guinea (Irian Jaya) glaciers since 1850 is illustrated with an excellent map. This part concludes with a set of impressive plots comparing the area losses of each region/mountain within the East African, Ecuadorian and New Guinea areas and a summary plot comparing losses from each of the three regions.

Part D presents the photos, prefaced, as for the maps, with a basic table of contents following the tables of data for each photo. The layout of glaciers is also similar to that of the maps. For each mountain, the temporal changes at each glacier can easily be compared, as the photographs are grouped into views of each individual glacier. The Mount Kenya group includes a series for eight glaciers (including historic sketches) and a set of general views. The Kenya set concludes with an unusual set of cloud-free vertical aerial photos, which provide spectacular overall coverage of the mountain. The Kilimanjaro sets are similarly grouped by direction and chronological sequence. Two aerial photos (D46 1.2.4 and 1.2.5) show the slopes of the mountain as very steep, suggesting that they may have been digitally compressed. The satellite images provide good background for identification and location of these glaciers. In the Ruwenzori section, the clarity and number of views from many directions belie the fact that the glaciers here exist in almost perpetual cloud.

By comparison with East Africa, coverage of the Ecuadorian glaciers is somewhat skimpy. The photos of Chimborazo appear to be taken on the one expedition around the mountain. This has given a good coverage, but at a distant low angle with unfortunate fresh snow. A painting and photos of Caldera Gl on El Alta from the same viewpoint make an impressive series. Some annotated comparative photos close to the fronts of the Antisana glaciers provide details of changes. Annotations of moraine ridges identified in the caption are missing from the Antisana photos. Cotopaxi is included with only two distant photos.

The final set, the elusive glaciers beneath the clouds of Irian Jaya, have been given full coverage, with photos 3.1.3 in 1936 and 3.1.4 in 1991 (on p. D98), providing perhaps the most spectacular record of ice loss of all of the comparative photos.

I found the introductory overview disappointingly brief and would have liked more comment on the unique features of tropical glaciers: the intriguing effects of the absence of separate winter and summer seasons, where the only 'seasonal' changes are from wet and dry seasons. This difference in seasonality causes the position of the glacier snowline (equilibrium-line altitude (ELA)) to be a function of the time since the last snowfall, rather than an end-of-summer value. In addition, by latitude, these glaciers are at such high altitudes that they reach 'above the weather', with maximum snow accumulation occurring lower down, toward the centre of the glaciers. This effect makes tropical glaciers especially susceptible to climate change. In Kenya, the entire glaciers are now icy ablation zones.

It is good to see a ground photo of the Furtwangler Glacier ice cliffs on Kilimanjaro. These spectacular features are remarkably similar to those of cold glaciers in Antarctica but have completely different origins. Many of the photos reflect the problems of altitude and cloud that accompany any visit to these glaciers. Despite such obstacles, this book presents a unique and spectacular record of the rapid contraction of the tropical glaciers, which should be read by all with an interest in glaciers and climate.

REFERENCE

Osmaston, H.A. and G. Kaser. 2001. *Glaciers and glaciations: Rwenzori Mountains National Park, Uganda and Parc National des Virungas, Democratic Republic of Congo, 1:65,000 and 1:100,000.* H. Osmaston. (Map also included in Kaser, G. and H.A. Osmaston. 2002. *Tropical glaciers.* Cambridge, Cambridge University Press.)

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