Review

WILLIAMS, R. J. and J. G. FERRIGNO, *eds*. 2002. *Satellite image atlas of glaciers of the world: North America*. U.S. Geological Survey Professional Paper 1386-J. Washington, DC, U.S. Government Printing Office. 405 pp. ISBN 0-067098290-X, $76.

Satellite image atlas of glaciers of the world: North America is a collection of reports describing the mid-1970s state of North American glaciers (exclusive of Alaska), in which Landsat imagery plays an important role. Its publication is an example of the switch from the challenge and excitement of personally collecting data in the field to a near-total dependence on office-located computers and remote-sensing technology. The change was doubtless inevitable, and even I will admit that the new methods have some advantages over such things as digging snow pits in blazing sun or freezing storms. I must also confess that I am partly responsible for the switch to remote-sensing technology, with my ~30 years of glacier aerial observations and photography. Especially in the beginning, the aircraft were primitive, landing fields in the wilderness were few and far between, and home-based, home-made, darkroom facilities (with the 200 ft rolls of developed film hanging up on the backyard clothes-line to dry) were a far cry from the comforts of modern airplanes and photo-processing facilities. Nowadays, one does not even remove the aircraft door before taking off, and one's seat is not a 5 gal Blazo can of emergency fuel. Neither does one shiver over a vertical viewfinder at 20 000 ft in a drafty, beat-up, Lockheed 60 (the worst possible bush airplane design and therefore affordable) with the cabin temperature hovering around −25°C and the pilot passing out from economizing on expensive breathing oxygen. So aerial photography in those good old days was fieldwork too. Bradford Washburn, whose earlier photos I always admired, would probably agree.

Now for the present. In some ways Landsat seems to be at about the same primitive level of space imagery as glacier air photography was when I first began in 1960. The most serious failing with Landsat has been low resolution, as this and earlier atlases show. However, the same cannot be said for the latest developments in remote sensing, such as synthetic aperture radar and laser altimetry. These in many ways far surpass what can be done on the ground. The potential is staggering, and the future in glaciology doubtless will largely be based on such sophisticated remote-sensing technologies. The limitations of Landsat resolution have been noted by many authors of these reports and it is interesting to see how each handles the problem. S. Ommanney ("Glaciers of the Canadian Rockies") solves it by using a minimum of Landsat images in combination with aerial photos (such as on pages J232 and J233). (Since I took many of them, my bias should be evident!) Authors describing large ice caps and icefields are fortunate that Landsat has sufficient resolution to provide spectacular images, such as that shown on the cover and in Koerner's "Glaciers of the High Arctic islands" (J117).

Landsat generally has sufficient resolution to show drastically retreating iceberg calving glaciers such as shown by R. Koerner (J116). Some authors are not so fortunate, like S. White in "Glaciers of Mexico" where even the extent of snow cover is fuzzy (J394). Images in R. Krimmel's "Glaciers of the conterminous United States" fall in between; the enlarged image of Mount Rainier (J350) at least recognizably shows most of the larger glaciers. Probably near the ultimate in what Landsat can resolve is a superb image in Clarke and Holdsworth's "Glaciers of the St Elias Mountains" (J306), which shows one non-surging and several large surging and valley glaciers.

A few criticisms can be offered. For instance, in M. Jeffries' "Ellesmere Island ice shelves and ice islands", I find no reference to the Prince of Wales shelves which terminate in Baffin Bay (J117), also shown in an oblique aerial photo in Post and LaChapelle (2000, fig. 126). This is a particularly interesting area that evidently has the highest precipitation in the region (fig. 10, J127) and likely the lowest equilibrium-line altitude of any glaciers in North America.

In discussions of the lacunas ("highly hummocked surface") of Iceberg Glacier (R. Koerner, "Glaciers of the High Arctic islands" (J131)), I find no reference to their surge origin; instead these features are evidently attributed to rapid melting. Granted, enhanced melting doubtless takes place, but why would this be so on this glacier and not on most other glaciers of the region? Rather, these are unusually fine examples of lacunas such as are found only on a few exceptional surging glaciers (Post and LaChapelle, 2000, fig. 78, p. 77–78, 140; see also Sturm, 1987, who called them "potholes").

In "Glaciers of the St Elias Mountains" (J326), G. Clarke and G. Holdsworth discuss the complex history of the terminus position of Grand Pacific Glacier with respect to the U.S.A.–Canada border. The task of reconstructing the history has been complicated by at least two press reports of retreats into Canada between the 1960s and 1990s. The photographic record indicates that they never occurred, as W. Matthews (personal communication, 1964) and I showed. Also in Clarke and Holdsworth, Ferris Glacier (J326) is reported as "probably a surging glacier". From all evidence I have examined, this seems unlikely, although its major branch, Eliza Glacier, has surged repeatedly. A tiny hanging glacier on the west side of Eliza surges independently.

These criticisms are minor, however. The reports all make very favorable impressions. The authors, editors and publishers are to be commended for having produced this excellent volume.

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