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SUMMARY REMARKS

by

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The First Symposium on Remote Sensing in Glaciology was held in Cambridge, England, on 16–20 September 1974, and the proceedings were published in Volume 15 (No. 73) of the Journal of Glaciology in 1975. Most of the 31 papers and 20 abstracts described glaciological research using radio echo-sounding systems, traditional geophysical techniques, and side-looking airborne radar (SLAR). A few of the papers and abstracts were devoted to analysis of satellite image data for surveys of snow cover, sea ice, and glaciers. The first Landsat spacecraft (ERTS-1) had been launched on 23 July 1972, so early results of research with these data were also included.

The just-concluded Second Symposium on Remote Sensing in Glaciology, was held in Cambridge on 8–9 and 11–12 September 1986. On 10 September 1986, 10 invited lectures on the development of glaciological studies in the past 50 years were given during the special Fiftieth Anniversary Celebrations of the International Glaciological Society. Presentations at the Second Symposium on Remote Sensing in Glaciology covered topics similar to those represented 12 years earlier at the first symposium but had a greater emphasis on analysis of satellite data. Eight authors who presented a paper or abstract at the 1974 symposium were also involved with the 1986 symposium. The proceedings of the Second Symposium on Remote Sensing in Glaciology, to be published in Vol 9 of the Annals of Glaciology in 1987 (this volume) will include the 45 plenary-session and 10 poster-session papers and abstracts and the 14 abstracts accepted by the papers committee but not presented.

Progress has been made since the first symposium. Research described at the second symposium relies more on computers to process digital image data and other types of data, such as data from radio echo-sounding and seismic surveys. Solutions have been found to some of the complex equations used to model glaciological phenomena. Data in digital format are preferred to facilitate analysis, and digital processing of field data is now common. There is increased miniaturization of instruments, so that they can be used in the field in addition to the laboratory. There has also been increased research on the physical and spectral properties of snow, firn, and ice and the correlation of remotely sensed data with such properties. Cost and availability of satellite data remain serious impediments to their more widespread use on a regional or global basis by glaciologists, however.

A selection of 10 topics of papers and abstracts given in the 9 plenary sessions and 1 poster session of the second symposium provides a good overview of the type of remote-sensing research underway in glaciology:

1. Increased use of computers, especially the trend towards all-digital data and miniaturization of instrumentation, permitting the use of complex field instruments, such as "a back-portable microprocessor-based impulse radar system".
2. Mapping of glacier facies on Landsat multispectral-scanner (MSS) and thematic-mapper (TM) images of ice caps and ice sheets.
3. Preparation of Landsat MSS and TM image and image-mosaic maps of ice sheets and ice caps from enhanced digital image data.
4. Use of Landsat MSS images in conjunction with field studies of glacier hydrology in West Greenland.
5. Measurements of the surface topography of ice shelves by satellite radar altimetry.
6. Radio echo-sounding and seismic sounding of the till layer under "Ice Stream B".
7. Determination of physical properties of snow and ice from Landsat digital data.
8. Use of sequential satellite images and computer graphics technology to determine the dynamics of arctic sea ice.

9. Mapping glacier facies on synthetic-aperture-radar (SAR) data and mapping the surface morphology of the ice sheet in West Greenland from satellite radar images.

10. Use of sequential Nimbus 5 electrically scanning microwave radiometer (ESMR) images of polar sea ice to determine seasonal and inter-annual change in concentration and areal extent.

Although given in the special fiftieth anniversary symposium on 10 September, as one of 10 lectures on the development of glaciological research during the past half century, the outstanding lecture by H. Jay Zwally on "Technology in the Advancement of Glaciology" deserves special citation because of his superb review of the development of glaciological remote sensing during this period. The 10 lectures will be published in a special issue of the Journal of Glaciology in 1987.

Approximately 14 years from now, the Third Symposium of Remote Sensing in Glaciology will be held in Cambridge, on 11–15 September 2000, and the proceedings will be published in Vol 30 of the Annals of Glaciology. The expected themes of the third symposium will be global in their orientation, including results of research carried out under various large-scale international programs, such as Earth System Science, Global Geoscience, Global Change, and the International Geosphere–Biosphere Program (IGBP), and may even include results of astroglaciological research, such as satellite glaciological studies of the Martian polar ice caps from data acquired by the Mars Observer spacecraft.

The types of remotely sensed data and instrumentation expected to be available to glaciologists for research reported on at the third symposium include: higher resolution satellite images with at least 10 m instantaneous field-of-view (IFOV); inclusion of additional parts and (or) narrow bands of the electromagnetic spectrum; global stereoscopic image coverage; more field verification of remotely sensed data; global coverage with satellite SAR systems, radar altimetry, and scatterometry; global coverage with laser altimetry; data from full operation of the 18 satellites in the Global Positioning System (GPS), which will permit high positional accuracy in three dimensions of data acquired from ground, aircraft, and satellite platforms; routine use of optical disk technology for local storage and retrieval of vast quantities of image data; ready availability and accessibility of powerful microcomputers comparable in storage capacity and computational speed with present-day main-frame computers; and proliferation of national satellite programs.

In closing, I thank all the speakers and the session chairman for a most stimulating and productive symposium. I also want to give special acknowledgement to my colleagues on the papers committee, who selected the papers and abstracts presented and served as scientific editors for the scientific reviews of each paper for Vol 9, and to my good friend the House Editor for Vol 9 of the Annals of Glaciology, Eric L. Richardson. His superb business and editorial skills have markedly lessened my burden as Chief Scientific Editor for Vol 9. Special thanks go to the headquarters staff of the International Glaciological Society, to the many local volunteers who helped out in so many ways, and to the warm hospitality, which more than offset the frosty environment of the auditorium, offered by them and by the staff of the Scott Polar Research Institute, Cambridge University Chemical Laboratory, King's College, and the citizenry of Cambridge. It was a most memorable week, and I thank you all very, very much. I look forward to seeing you all at our next symposium here in Cambridge in September 2000.