DISP Yearly Satellite Photographic Mosaics of Greenland 1962-1963, Version 1

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

Zhou, G. and K. C. Jezek. 2002. *DISP Yearly Satellite Photographic Mosaics of Greenland 1962-1963, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/RPK99U1963E1. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/NSIDC-0118

National Snow and Ice Data Center

TABLE OF CONTENTS

1 DATA DESCRIPTION

1.1 Parameters

The number of Icebergs crossing south of 48 degrees N.

1.2 File Information

1.2.1 Format

The mosaics are tagged image files (TIFs).

1.2.2 File Contents

The files are large: the 1962 mosaic image dimensions are 17,092 by 28,484 pixels and the file size is 464.3 MB. The 1963 image dimensions are 17,792 by 27,805 pixels and the file size is 471.8 MB.

1.2.3 Directory Structure

1962 image dimensions are 17,092 by 28,484 pixels, file size is 464.3 MB. The 1963 image dimensions are 17,792 by 27,805 pixels, file size is 471.8 MB

1.2.4 Naming Convention

Naming convention is based on the year of the original photographs: DISP62_grlnd.tif and DISP63_grlnd.tif

1.3 Spatial Information

1.3.1 Coverage

Table 1. 1962 Mosaic Coverage

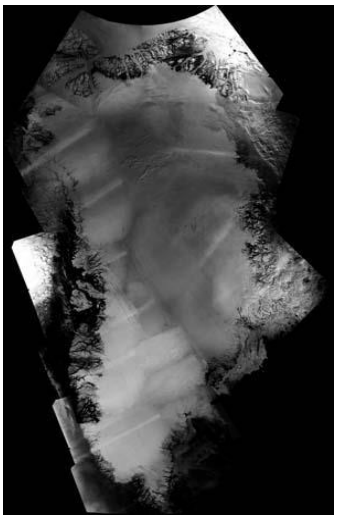
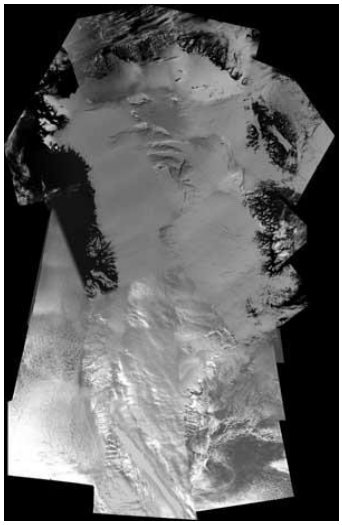
	x (km)	y (km)	
Upper Left	-727805.5625	-535256.375	 Figure 1. A low-resolution thumbnail of the 1962 image
Lower Right	981294.4375	-338556.375	

Table 2.1963 Mosaic Coverage

	x (km)	y (km)	
Upper Left	-808514.4375	-645039.4375	 Figure 2. A low-resolution thumbnail of the 1963 image
Lower Right	970585.5625	-3425439.4375	

1.3.2 Resolution

Images in these mosaics have resolutions (pixel size equivalent) of 100 m.

1.3.3 Geolocation

Polar stereographic map projection

WGS84 spheroid and datum

Longitude of central meridian: 315

Latitude of true scale: 70 N

False easting (meters): 0

False northing (meters): 0

1.4 Temporal Information

1.4.1 Coverage

The first mosaic consists of images taken in May, 1962. The second mosaic consists of images taken in August and September, 1963.

2 DATA ACQUISITION AND PROCESSING

2.1 Background

In 1962 and 1963, the U.S. reconnaissance satellite ARGON recorded photographic images of Greenland. These and thousands of other images became available to the public in 1995 through an executive order signed by President Clinton. The principal investigators (PIs), Guoqing Zhou and Ken Jezek, developed the images to create a mosaic image of Greenland for each year. They used the Digital SAR Mosaic and Elevation Map of the Greenland Ice Sheet as control data.

Photographs were digitized and assembled into mosaics. Geometric distortions were corrected by using ground control points and the camera model in ERDAS IMAGINE software to orthorectify the images.

The images were then resampled to a 100-m pixel size. Radiometric balancing and blending operations corrected for radiometric variations, using IMAGINE and ARCInfo software and proprietary algorithms and programs.

The photographs provide high ground resolution (about 140 m) and extensive coverage. Ground swath is 556 km by 556 km. Many of the photographs contained cloud cover, so the investigators used photographs with the least amount of cloud cover.

2.2 Acquisition

The United States government launched the secret reconnaissance satellites in the 1960s. The imagery was declassified on February 24, 1995 by President Clinton in the Executive Order "RELEASE OF IMAGERY ACQUIRED BY SPACE-BASED NATIONAL INTELLIGENCE RECONNAISSANCE SYSTEMS." The U.S. Geological Survey archives the original data. The DISP black and white films were digitized at 7µm resolution using a high-resolution scanner. The mosaic method required the latitude and longitude of the central point and four corner points for each image and a 70 percent overlap of neighboring images. The PIs applied corrections for geometric and radiometric distortions. See Processing Steps for the procedures they used.

2.3 Processing

The investigators used several steps to orthorectify the images and correct for geometric and radiometric distortions.

Geometric rectification for orthophoto generation: Geometric distortions result from camera lens distortion, atmospheric refraction, earth curvature, and other factors. Earth curvature caused a significant distortion, so the camera model in ERDAS IMAGINE software was used to orthorectify the images. The lack of distinct and consistent outcrops as ground control points was a problem that was solved by using clusters of points in neighboring images having better ground control as reference points.

Quality control: Investigators checked for quality control on the orthorectified images by comparing features on the SAR mosaic. Relative accuracy was better than 200 m (two pixels) in most cases.

Radiometric balancing: Radiometric differences in the images are due mainly to differing weather conditions over the days the photographs were taken. Applying radiometric balancing and blending operations prevented a patchy or "quilted" appearance in the mosaic. These operations were developed in ERDAS IMAGINE and ARC Info software, as well as the investigators' own programs.

An ARCInfo tool adjusted for brightness variations between adjacent photographs. The tool, a cubic Hermite function, calculates the weights for blending individual scenes along a specified buffer zone:

W=1-3d2+2d3W

G=W G1+(1-W)G2

where W is the weighting function applied in the overlap area (its values range from 0 to 1), d is the distance of a pixel to the buffer line, which is normalized into 0-1, G1 and G2 are brightness values of neighboring images, and G is the final brightness value. The Hermite function is an S-shaped curve.

Adaptive filtering: Scanning the photographs for digitization introduced noise into the images. Since no existing filters met their requirements, the PIs developed a new one that works by locally adjusting the filter size and shape and weighting the output. (Zhou and Jezek, 2002.)

Bright strip removal: Some of the original photographs contained bright strips that affected the appearance of geographic features. To diminish the bright strips, the PIs determined the center line of the bright strip, then developed an algorithm that uses the neighboring areas to "blend" those features into the bright strip area.

Mosaic postprocessing: After the individual images were orthorectified using the above methods, the investigators created the mosaics and then performed additional processing. Their methods include noise filtering, and contrast enhancement via Gaussian transformation of the histogram.

Accuracy evaluation: The investigators re-verified the accuracy of the final photographic mosaics against the Digital SAR Mosaic and Elevation Map of the Greenland Ice Sheet from 1992.

2.4 Quality, Errors, and Limitations

The cameras mounted on the ARGON satellite had a wide field of view, approximately 59°, which causes some image distortion. Because of the large area (2,800 km by 1,600 km) covered by each mosaic image, there is high earth-curvature distortion.

3 CONTACTS AND ACKNOWLEDGMENTS

This research work is supported by a grant from the National Science Foundation (NSF) Office of Polar Programs (OPP) and a NASA Center of Excellence Grant for Historical Satellite Data.

Dr. Guoqing Zhou
Department of Civil Engineering and Technology
Old Dominion University
Kaufman Hall, Rm 214 Norfolk, VA 23529

Dr. Kenneth C. Jezek
Department of Geological Sciences and Byrd Polar Research Center
Ohio State University
Columbus, OH 43210

NSIDC User Services
National Snow and Ice Data Center
University of Colorado Boulder, CO

4 REFERENCES

Zhou, G. and K. Jezek, 2002. Satellite photographic mosaics of Greenland from the 1960s era. Int. *J. Remote Sensing*, vol. 23, no. 6, p. 1143-1159.

Zhou, G., K. Jezek, W. Wright, and J. Granger, 2002. Orthorectification of 1960s Satellite Photographs Covering Greenland. IEEE Trans. *Geosci. and Rem Sens*, vol 40, no 6, p. 1247-1259.

Slater, Philip N., Robert G. Reeves, editor-in-chief. Manual of remote sensing. 1st ed. *Am. Soc. of Photogrammetry*, 1975, vol. 1. Falls Church, VA.

5 DOCUMENT INFORMATION

5.1 Publication Date

07 January 2003

5.2 Date Last Updated

11 February 2021