



Nimbus Advanced Vidicon Camera System Remapped Visible Imagery Daily L3, GeoTIFF, Version 1

USER GUIDE

How to Cite These Data

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

Gallaher, D. and G. Campbell. 2013. *Nimbus Advanced Vidicon Camera System Remapped Visible Imagery Daily L3, GeoTIFF, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center.
<https://doi.org/10.5067/NIMBUS/NmAVCS3G>. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT <https://nsidc.org/data/NmAVCS3G>



National Snow and Ice Data Center

TABLE OF CONTENTS

| | | |
|-------|---|---|
| 1 | DETAILED DATA DESCRIPTION..... | 2 |
| 1.1 | Format | 2 |
| 1.2 | File Naming Convention | 2 |
| 1.3 | File Size..... | 2 |
| 1.4 | Spatial Coverage..... | 2 |
| 1.4.1 | Spatial Resolution..... | 2 |
| 1.4.2 | Projection and Grid Description | 3 |
| 1.5 | Temporal Coverage..... | 3 |
| 1.5.1 | Temporal Resolution..... | 3 |
| 1.6 | Parameter or Variable | 3 |
| 2 | SOFTWARE AND TOOLS | 3 |
| 2.1 | Software and Tools..... | 3 |
| 3 | DATA ACQUISITION AND PROCESSING..... | 4 |
| 3.1 | Data Acquisition Methods..... | 4 |
| 3.2 | Derivation Techniques and Algorithms..... | 4 |
| 3.2.1 | Trajectory and Attitude Data | 4 |
| 3.2.2 | Processing Steps | 4 |
| 3.2.3 | Errors and Limitations | 4 |
| 3.2.4 | Quality Assessment | 3 |
| 3.3 | Sensor or Instrument Description | 5 |
| 4 | REFERENCES AND RELATED PUBLICATIONS | 5 |
| 5 | CONTACTS AND ACKNOWLEDGMENTS | 5 |
| 6 | DOCUMENT INFORMATION..... | 6 |
| 6.1 | Publication Date | 6 |
| 6.2 | Last Revision Date | 6 |

1 DETAILED DATA DESCRIPTION

1.1 Format

Data files are available in Geographic Tagged Image File Format (GeoTIFF).

1.2 File Naming Convention

This section explains the file naming convention used for NmAVCS3G data files.

Example file name: NmAVCS3G.[YYYY].[MM].[DD].G.tif

Refer to Table 1 for descriptions of the file name variables listed above.

Table 1. NmAVCS3G File Naming Convention

| Variable | Description |
|----------|-----------------------|
| NmAVCS3G | Product |
| YYYY | Year (1964 or 1966) |
| MM | Month |
| DD | Day |
| G | Equatorial projection |
| .tif | GeoTIFF |

1.3 File Size

Data files are approximately 16 MB.

1.4 Spatial Coverage

Northernmost Latitude: 60° N

Southernmost Latitude: 60° S

Easternmost Longitude: 180° E

Westernmost Longitude: 180° W

1.4.1 Spatial Resolution

Roughly 10 km

1.4.2 Projection and Grid Description

Data are provided in a 10 km cylindrical equidistant projection. The grid was constructed by defining an initial 4000 east-west by 2000 north-south global array at the equator to establish roughly 10 km x 10 km cells. Only the portion of the grid from 60° N to 60° S (4000 X 1334) was saved for the final output.

1.5 Temporal Coverage

Nimbus 1

- 31 August through 22 September, 1964

Nimbus 2

- 15 May through 20 August, 1966
- 22 August through 2 September, 1966

1.5.1 Temporal Resolution

Daily

1.6 Parameter or Variable

The parameter of interest in this data set is visible brightness. See Section 3.

2 SOFTWARE AND TOOLS

2.1 Software and Tools

Any GeoTIFF-compatible software package can be used to read and display NmAVCS3G data files.

2.1.1 Quality Assessment

As discussed in the Nimbus Advanced Vidicon Camera System Visible Imagery L1, HDF5 [user guide](#), the images in these composites were calibrated by constructing individual histograms from all images in an orbit and matching histograms between many orbits. This helped remove some of the variations due to film exposure and developing. Although the calibration is not perfect, this approach yields a better composite compared with simply mixing the uncalibrated, raw images.

3 DATA ACQUISITION AND PROCESSING

3.1 Data Acquisition Methods

The Advanced Vidicon Camera System (AVCS) in effect acquired a snapshot every 91 seconds along the satellites' polar orbits. A vidicon pickup tube scanned the images and recorded brightness levels to a tape recorder. These data were then transmitted as an analog signal to ground stations within range of the satellite and eventually to Goddard Space Flight Center (GSFC). At GSFC, the images were reconstructed on a television picture tube and captured on black-and-white 35 mm film. The film images were then duplicated onto long reels and archived at NASA (and later NOAA). The film rolls remained in storage for some 40 years until NSIDC investigators undertook the task of digitizing the images for new climate research and preservation.

3.2 Derivation Techniques and Algorithms

3.2.1 Trajectory and Attitude Data

Navigation parameters were derived from the user guide description of the instrument. Satellite ephemeris and image times were used to calculate latitude and longitude for every pixel. Although the images contained tick marks indicating lines of latitude and longitude, the investigators believe the calculated positions better align the images with identifiable landmarks.

3.2.2 Processing Steps

To construct the daily composites, all AVCS images for the 24 hour period were accumulated from the [NmAVCS1H](#) data set. When multiple observations were available in a grid cell, the observation closest to satellite nadir was given preference.

3.2.3 Errors and Limitations

None of the original Nimbus calibration programs have survived. In addition, the navigation accuracy is limited by the satellite attitude control, which was no better than 1 degree, and no further information about the attitude is available. By eye, the navigation and continental boundaries line up with some random error.

The PIs estimate that the actual gray scale resolution is 4 bit, limited by the initial sensitivity of the AVCS and the accumulated degradation due to photo processing and digitization. However, the resolution is sufficient to at least qualitatively recognize clouds, ocean, land, and ice. Albedos and optical depths are likely irretrievable.

3.3 Sensor or Instrument Description

The Advanced Vidicon Camera System (AVCS) consisted of three earthward-facing cameras deployed in a fan-like array to produce a three-segment, composite picture. Each camera's field of view covered 37°; the center camera pointed straight down while the optical axes of other two was directed 35° to either side. The cameras utilized an f/4 lens with a focal length of 16.5 mm. A potentiometer attached to the solar array controlled the lens opening from f/16 when the spacecraft was over the equator to f/4 when it was near the poles. Eight-hundred scan-line, 2.54-cm-diameter vidicon pickup tubes yielded a linear resolution of better than 1 km at nadir from an altitude of 800 km. The camera array produced a composite picture covering an area of 830 km by 2700 km.

For additional information about the Nimbus AVCS, see the National Space Science Data Center's [Advanced Vidicon Camera System \(AVCS\)](#) Web page.

4 REFERENCES AND RELATED PUBLICATIONS

4.1 References

Gallaher, D., G. G. Campbell, and W. N. Meier. In Press. Anomalous Variability in Antarctic Sea Ice Extents During the 1960's with the Use of Nimbus Satellite Data. *Journal of Selected Topics in Applied Earth Observations and Remote Sensing*.

Meier, W. N., D. Gallaher, and G. G. Campbell. 2013. New Estimates of Arctic and Antarctic Sea Ice Extent During September 1964 from Recovered Nimbus I Satellite Imagery. *The Cryosphere Discuss* 7:35-53. doi: 10.5194/tcd-7-35-2013.

4.2 Related Data Collections

See the [Nimbus Data Rescue Project | Data Sets](#) page.

4.3 Related Websites

- [NASA Science | Missions: Nimbus](#)
- [Advanced Vidicon Camera System \(AVCS\)](#)
- [High-Resolution Infrared Radiometer \(HRIR\)](#)
- [Image Dissector Camera System \(IDCS\)](#)

5 CONTACTS AND ACKNOWLEDGMENTS

Investigators

David Gallaher

National Snow and Ice Data Center
CIRES, 449 UCB
University of Colorado
Boulder, CO 80309-0449 USA

G. Garrett Campbell

National Snow and Ice Data Center
CIRES, 449 UCB
University of Colorado
Boulder, CO 80309-0449 USA

Acknowledgments

The Nimbus Data Rescue Project: Nimbus 1, 2, 3 was supported by NASA contract #NNG08HZ07C as a subtask to NSIDC at the University of Colorado. The PIs also wish to thank Alex Calder, Carl Gallaher, and Anna Schroeder for their contributions to this project, and NSIDC student workers William Harris and Amy Randall.

6 DOCUMENT INFORMATION

6.1 Publication Date

September 2013

6.2 Last Revision Date

28 October 2020