Nimbus Image Dissector Camera System Remapped Visible Imagery Daily L3, HDF5, 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 Image Dissector Camera System Remapped Visible Imagery Daily L3, HDF5, 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/NmIDCS3H. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/NmIDCS3H

NSIDC National Snow and Ice Data Center

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1 DETAILED DATA DESCRIPTION

1.1 Format

Each composite is provided as a set of three HDF5–formatted files: separate North and South Polar projections in the 5 km Equal-Area Scalable Earth Grid (EASE-Grid) and an equatorial projection in a 10 km equidistant grid for the region between 60 N and 60 S. Browse images are also available.

1.2 File Naming Convention

This section explains the file naming convention used for NmIDCS3H data files.

Example file name: `NmIDCS3H.[YYYY].[MM].[DD].[P].hdf`

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

Table 1. Semi-Automatic Landslide Detection

Variable	Description
NmIDCS3H	Product
YYYY	Year (1969 or 1970)
MM	Month
DD	Day
P	Projection/Grid: N=North Polar; S=South Polar; G=Equatorial
.hdf	HDF–formatted file

Note: if no data were available for an entire region (north polar, south polar, or equatorial), the file was not generated. As such, some daily composites consist of fewer than three files.

1.3 File Size

Data files typically range between 5 MB - 25 MB.

1.4 Spatial Coverage

Coverage is global, however some regions (parts of Alaska, for example) are not available due to technological limitations at the time of the mission.

1.4.1 Spatial Resolution

Roughly 5 km for the north and south polar projections, 10 km for the equatorial projection.

1.4.2 Projection and Grid Description

Composites were constructed using two projections/grids. North and south polar views are provided in the 5 km Equal-Area Scalable Earth Grid (EASE-Grid). Please see NSIDC's Original EASE-Grid Format Description page for details.

The region from 60° N to 60° S is 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 1332) is saved for the final output. GeoTIFF versions of the equatorial projection file **only** are available as a separate data set, Nimbus Image Dissector Camera System Remapped Visible Imagery Daily L3, GeoTIFF.

NmIDCS3H data files also include latitude and longitude arrays that specify the geographic center of each grid cell.

1.5 Temporal Coverage

23 April, 1969 – 04 April, 1971

1.5.1 Temporal Resolution

Daily

1.6 Parameter or Variable

Table 2 describes the data fields and corresponding attributes stored in NmIDCS3H data files. Note that the parameter of interest in this data set, **visible brightness**, is stored in the `brightness` Data Field. For details about the criteria used to select the most favorable value for a grid cell when multiple observations were available, see section 3 of this document.

Table 2. NmIDCS3H Data Fields

Data Field	Description	Attributes	Value
latitude	Latitude array, grid cell geographic centers	nav_info	standard navigation
		units	degrees_north
longitude	Longitude array, grid cell geographic centers	nav_info	standard navigation
		units	degrees_east
minimum_brightness	Minimum brightness value from overlapping observations in grid cell. See section 3.2.2.1 of this document for details.	–	–
start_end_time	Image composite date in seconds since 00:00:00, 01 January 1970.	–	–
cosine_view_angle	Cosine view angle of observation used in composite. See section 3.2.2 for details	–	–
brightness	Visible brightness. For multiple observations in grid cell, value with view angle closest to nadir is selected for mosaic. The cosine of this angle is stored in cosine_view_angle.	DOI	10.5067/NIMBUS/NmIDCS3H
		ESDT	NmIDCS3H (data set short name)
		long_ESDT	Image Dissector Camera System Remapped Visible Imagery Daily L3, HDF5 (data set long name)
		units	1

2 SOFTWARE AND TOOLS

HDF-compatible software packages, such as HDFView and Panoply, can be used to read, extract, and display NmIDCS3H data files.

3 DATA ACQUISITION AND PROCESSING

3.1 Data Acquisition Methods

To obtain the along-track scan, the IDCS rotated the sensor counter to the motion of the satellite for 200 seconds (the cross-track scan was acquired by a drift tube sensor). After 200 seconds, the sensor returned to the starting position to begin the next acquisition 210 seconds after the previous image. As a result, successive images overlap each other in space by 50 percent.

The IDCS output was stored as brightness levels on a tape recorder and 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 70 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 IDCS images for the 24 hour period were accumulated from the NmIDCS1H data set. When multiple observations were available in a grid cell, the observation closest to satellite nadir was given preference. The cosine of the selected observation's view angle is stored in the cosine_view_angle data field, for users who wish to make additional corrections based on view angle.

3.2.2.1 Cloud Clearing

As a simple aid to help differentiate cloudy from clear conditions, when multiple views were available in the same grid cell the minimum brightness value was written to a separate data field called minimum_brightness. Viewing consecutive days of this array may help confirm the presence of clouds in areas where clouds typically appear brighter than the surface, by revealing the absence of clouds on subsequent days. While useful for this purpose, the array tends to have more artifacts than the primary composite constructed from best view angles.

3.2.3 Errors Sources

3.2.3.1 Navigation

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.

However, due to ambiguity in the user guide description of the instrument, the navigation has systemic errors that produce noticeable mismatches between images showing the same geographic features. This error may have arisen because the roll, pitch, and yaw of the satellite were not recorded. Based on a review of many images of the Mediterranean, navigation accuracy is better in equatorial regions.

3.2.3.2 Image Quality

The PIs estimate that the actual gray scale resolution is 4 bit, limited by the initial sensitivity of the IDCS 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. Nevertheless, the IDCS represents a considerable improvement compared with the earlier AVCS instrument.

3.3 Quality Assessment

As discussed in the Nimbus Image Dissector Camera System Visible Imagery L1, HDF5 documentation, IDCS 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.

3.4 Sensor or Instrument Description

The Image Dissector Camera System (IDCS) was a shutterless, electronic scan and step tube mounted behind a 108 degree wide-angle, 5.7 mm focal length lens. The camera was installed on the bottom of the satellite sensory ring and pointed vertically down toward the earth at all times.

The optical field of view was 73.6 degree in the direction of flight and 98.2 degree in the plane perpendicular to flight. The instrument optics focused the image on the dissector tube's photosensitive surface, while a line-scanning beam scanned the surface at 4 Hz with a frame period of 200 seconds. At the nominal spacecraft altitude of 1100 km, the resulting pictures covered approximately 1400 km on a side with a ground resolution of 3 km at nadir. Scanning and stepping functions occurred continuously as the satellite progressed along its orbital path. Pictures were either transmitted to ground stations in real time or stored on magnetic tape for subsequent transmission.

For additional information about the Nimbus IDCS, see the National Space Science Data Center's Image Dissector Camera System (IDCS) 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

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6 DOCUMENT INFORMATION

6.1 Publication Date

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6.2 Date Last Updated

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