Nimbus Temperature-Humidity Infrared Radiometer 6.7 µm Grayscale Swath Data L1, TIFF, 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. 2020. *Nimbus Temperature-Humidity Infrared Radiometer 6.7 µm Grayscale Swath Data L1, TIFF, Version 1.* [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/ROX6G419O13W. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/NmTHIR67-1T

National Snow and Ice Data Center

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1 DATA DESCRIPTION

This data set is provided as a complement to the Nimbus Temperature-Humidity Infrared Radiometer 6.7 µm Water Vapor Swath L1, HDF5 data set (NmTHIR67-1H). It contains more granules than NmTHIR67-1H due to storage media limitations, but does not contain the brightness temperature values that are included in NmTHIR67-1H. The data are provided only in qualitative form and may be useful for viewing imagery from historic weather events, specifically in the tropical regions.

1.1 Parameters

THIR 6.7 µm grayscale temperature imagery

1.2 File Information

1.2.1 Format

TIFF

1.2.2 File Contents

Each data granule consists of a TIFF (.tif) data file and a corresponding XML (.xml) metadata file. Note, multiple data granules are included in each data directory.

1.2.3 Naming Convention

Files are named according to the following convention and as described in Table 1.

1.2.3.1 File Name Convention

`Nm[pid].[sat].[orb].[yyyy].[ddd].[hh].[mm].[ss].[frbon].[freon].[seq].tif`

Table 1. File Naming Convention

Variable	Description
Nm	Nimbus
pid	Product ID
sat	Satellite (N4 = Nimbus 4, N5 = Nimbus 5, N6 = Nimbus 6)
orb	Orbit (dsc = nighttime, asc = daytime)
yyyy	Year data observed
ddd	Day data observed

Variable	Description
hh	Hour data observed
mm	Minute data observed
ss	Second data observed
frbon	Film reel begin orbit number (1 to 5 digits)
freon	Film reel end orbit number (1 to 5 digits)
seq	Scan process sequence number (1 to 3 digits)
tif	TIFF data format

1.2.3.2 File Name Example

```
NmTHIR67-1T.N5.dsc.1975.169.16.05.41.10252.10439.110.tif
```

1.3 Spatial Information

1.3.1 Coverage

The coverage is global

1.3.2 Resolution

The observed resolution was approximately 5 km at nadir. However, the resolution was degraded during processing and is now estimated to be 16 km.

1.3.3 Geolocation

This data set is not georeferenced; however, most images include latitude and longitude coordinate markers.

1.4 Temporal Information

1.4.1 Coverage

The coverage is intermittent. Data are available within the following date ranges:

Table 2. Temporal Coverage by Satellite

Satellite	Temporal Coverage
Nimbus 4	18 April 1970 to 8 April 1971
Nimbus 5	1 Jan 1970 to 17 March 1971
Nimbus 6	13 June 1975 to 11 Nov 1975

1.4.2 Resolution

Each TIFF file contains approximately 40 minutes of ascending or descending swath data.

NOTE: Granules accessed via Earthdata search show the start date and end date for each granule. The start date and end date should precisely align with the temporal coverage period for the granule. However, for this data set, the data rescue team did not have the resources to determine the exact start time and end time for every granule. Therefore, the start date and end date specify a 2 hour and 12-minute window for all granules. The time written into the granule file name is more precise and should fall within the center of this 2 hour and 12-minute window.

1.5 Sample Data Image

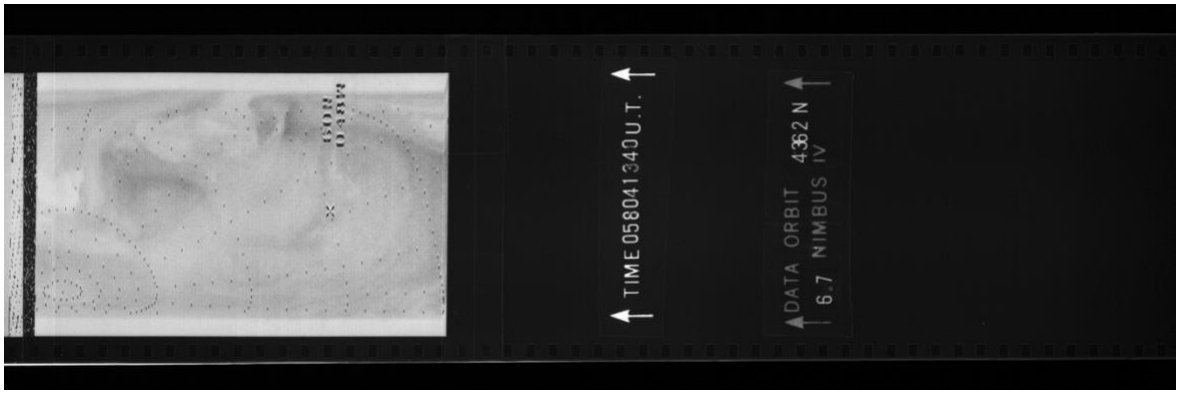

Figure 1. This figure shows grayscale radiative temperatures from Nimbus 4, orbit 4362, acquired on June 18, 1975. The satellite orbit and observation time are burned into the right side of the film and latitude/longitude coordinate pairs are burned into the image. Note, this metadata may not be included in all images.

2 DATA ACQUISITION AND PROCESSING

2.1 Background

The Nimbus Temperature-Humidity Infrared Radiometer (THIR) 6.7 µm channel operated primarily at night to map the water vapor distribution in the upper troposphere and stratosphere. The THIR instruments on-board the Nimbus 4, Nimbus 5, and Nimbus 6 satellites transformed measured radiation into electrical voltages that were recorded on tape and played back when the satellite flew within range of a receiving station. The data were then transmitted to the Goddard Space Flight Center (GSFC), where they were archived as grayscale images on 70 mm black and white film. A subset of orbits, primarily covering North America, were also archived on 7-track, digital magnetic tape. The film and tape were stored in boxes for many years. Over time the quality of both the film

and tape began to degrade. In 2017 an effort to rescue and preserve the grayscale images began. This effort is described in the Processing section below.

2.2 Acquisition

The Nimbus 4, Nimbus 5, and Nimbus 6 satellites were second-generation meteorological research and development spacecraft designed to serve as stabilized, earth-oriented platforms for testing advanced systems designed to sense and collect atmospheric science data. These Nimbus satellites scanned the entire globe every one to two days. As such, most locations on Earth were imaged at least once per day and more frequently where swaths overlap, such as near the poles.

2.3 Processing

In 2017 the U.S. Geological Survey utilized a high-speed camera system to scan reels of 70 mm film. More than 100,000 black and white TIFF formatted images were scanned, with each reel containing approximately 150 orbits of either ascending or descending swaths. Each scanned image was identified using the box number and the film reel numbers. The scanned images and film reel boxes were then sent to NSIDC where the observation date and time for each image was identified. The beginning reel number and ending reel number were used along with the orbit number to estimate the observation date and time for each image. The observation date and time as well as the reel start date and end date are written into the filename for each granule. In addition, the film reel numbers are also embedded in the 'Image Description' tag for each TIFF file. The Nimbus Data Rescue team attempted to reconstruct the geolocation information and calibrated radiance temperatures from the magnetic tape. However, because the film was not developed or scanned consistently, the team was unable to reconstruct this information. Therefore, just the grayscale TIFF images are included with this product.

2.4 Limitations

- The post-processing spatial resolution is estimated to be 16 km. The spatial resolution of the data was degraded as a result of data smoothing introduced when the film was exposed and developed.
- This data set contains gaps in temporal coverage due to missing data.
- This data set is not georeferenced.

2.5 Instrumentation

The Temperature-Humidity Infrared Radiometer (THIR) on-board Nimbus 4, Nimbus 5, and Nimbus 6 was a single scanning radiometer that operated in the 6.7 µm window (6.5 µm - 7.0 µm) and the 11.5 µm window (10.5 µm - 12.5 µm). The instrument consisted of a 12.7-cm Cassegrain system, a

scanning mirror common to both channels, a beam splitter, filters, and two germanium-immersed thermistor bolometers. Incoming radiant energy was collected by a flat scanning mirror inclined at 45 deg to the optical axis. The mirror rotated through 360 deg at 48 rpm and scanned in a plane normal to the spacecraft velocity vector. For additional information see the Nimbus 4, Nimbus 5, and Nimbus 6 user guides.

3 RELATED DATA SETS

See the Nimbus Data Rescue Project | Data Sets page.

4 RELATED WEBSITES

NASA Science | Missions: Nimbus

Temperature-Humidity Infrared Radiometer (THIR) - Nimbus 4

Temperature-Humidity Infrared Radiometer (THIR) - Nimbus 5

Temperature-Humidity Infrared Radiometer (THIR) - Nimbus 6

Nimbus Documentation and Conference Materials

5 CONTACTS AND ACKNOWLEDGMENTS

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6 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.

7 DOCUMENT INFORMATION

7.1 Publication Date

22 January 2020

7.2 Date Last Updated

23 March 2020