Nimbus Temperature-Humidity Infrared Radiometer 6.7 µm Water Vapor Remapped Digital Data 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. 2015. *Nimbus Temperature-Humidity Infrared Radiometer 6.7 µm Water Vapor Remapped Digital Data 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/NmTHIR67-3G. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/NmTHIR67-3G

National Snow and Ice Data Center

TABLE OF CONTENTS

1 DETAILED DATA DESCRIPTION

The THIR detected emitted thermal radiation in two windows: 6.7 µm (6.5 µm — 7.0 µm) and 11.5 µm (10.5 µm — 12.5 µm). This data set contains Nimbus-4 THIR 6.7 µm window data for the region between 60° N and 60° S. The corresponding THIR 11.5 µm window measurements are available as a separate data set here.

WARNING: Simultaneous observations from the 6.7 µm and 11.5 µm windows are typically not available. Although measurements sometimes overlap, most do not.

1.1 Format

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

1.2 File and Directory Structure

Text goes here

1.3 File Naming Convention

This section explains the file naming convention used for NmTHIR67-3G data files. Daily composites are divided into ascending/day (up) and descending/night (down) orbit halves. As such, two GeoTIFF files are available per solar day.

Example File Name: `NmTHIR67-3G.DownWV.1970.05.10.G.tif`

`NmTHIR67-3G.[UpWV/DownWV].[yyyy].[mm].[dd].[p].tif`

Refer to Table 1 for the valid values for the file name variables listed above.

Table 1. File Name Variable Descriptions

Variable	Description
NmTHIR67-3G	Nimbus-4 THIR 6.7 µm window daily composite (GeoTIFF)
UpWV/DownWV	Orbit half: Up (day) or Down (night), water vapor
yyyy	Four-digit year
mm	Month
dd	Day
p	Projection: G (equatorial)
.tif	GeoTIFF file

1.4 File Size

Data files typically about 4 MB.

1.5 Spatial Coverage

Northernmost Latitude: 60° N
Southernmost Latitude: 60° S
Easternmost Longitude: 180° E
Westernmost Longitude: 180° W

1.5.1 Spatial Resolution

Roughly 20 km

1.5.2 Projection and Grid Description

Data are provided in a 20 km cylindrical equidistant projection. The grid was constructed by defining a 2000 east-west by 664 north-south global array at the equator to establish roughly 20 km x 20 km cells. Only the portion of the grid from 60° N to 60° S (2000 X 664) is saved for the final output.

1.6 Temporal Coverage

Intermittent data are available from 10 May 1970 to 25 March 1971

1.6.1 Temporal Resolution

Daily

1.7 Parameter or Variable

1.7.1 Variable Description

The parameter of interest in this data set is infrared brightness temperature in the 6.7 µm water vapor window. See section 3 of this document for details.

2 SOFTWARE AND TOOLS

Any GeoTIFF-compatible software package can be used to read and display this data set's files.

3 DATA ACQUISITION AND PROCESSING

3.1 Data Acquisition Methods

The THIR on the Nimbus 4 satellite transformed measured radiation into electrical voltages that were recorded on tape and played back when the satellite came within range of a receiving station. These data were then transmitted to the Goddard Space Flight Center (GSFC), where they were calibrated, converted to temperatures, and archived on 7-track, digital magnetic tapes. In 2013, the contents of these tapes were recovered and written to a binary tape emulation file format (TAP) for preservation. GES DISC, the NASA Goddard Earth Sciences Data and Information Services Center, maintains a Nimbus Overview page through which users can obtain the TAP files and historical Nimbus documentation such as instrument user guides and mission reports.

3.2 Derivation Techniques and Algorithms

3.2.1 Processing Steps

To construct the daily composites, all reprocessed THIR swaths for each 24-hour period were accumulated from the Nimbus Temperature-Humidity Infrared Radiometer 6.7 µm Water Vapor Swath L1, HDF5 (NmTHIR67-1H) data set. When multiple observations were available in a grid cell, the observation closest to satellite nadir was selected.

The underlying THIR swath data have been corrected to minimize seemingly random alignment errors that caused cloud edges and land features to appear jagged. See section ‘Derivation Techniques and Algorithms’ in the NmTHIR67-1H documentation for details.

3.2.2 Error Sources

This data set was constructed from archival files at GES DISC. As such, they reflect the original THIR calibration and temperature conversion utilized in 1970. Furthermore, most of the mosaics have large areas of missing data because the Nimbus 4 project only captured select data based on operational considerations in the 1970-1971 time frame.

3.3 Quality Assessment

The realignment described in the preceding section improves the visual appearance of the data and better represents the shapes of clouds and coastlines. In regions with very little spatial information, for example where the measurements are very noisy or very uniform, the shifts offer little or no improvement.

3.4 Sensor or Instrument Description

The Nimbus 4 Temperature-Humidity Infrared Radiometer (THIR) was a two-channel scanning radiometer designed to detect emitted thermal radiation in two windows: 6.7 µm (6.5 µm — 7.0 µm) and 11.5 µm (10.5 µm — 12.5 µm). The 6.7 µm window operated primarily at night and was used to map the distribution of water vapor in the upper troposphere and stratosphere. The 11.5 µm channel operated both day and night and measured cloud top or surface temperatures.

The Nimbus 4 instrument utilized a single scan mirror which rotated at 48 rpm and was inclined 45° to the axis of rotation to scan perpendicular to the flight path. The field of view scanned across the earth from east to west in daytime and west to east at night, traveling northward and southward respectively. Incoming energy was collected by the mirror and then focused into a dichromatic beam splitter which divided the energy spectrally and spatially into the two channels. Both channels transformed the received radiation into an electrical (voltage) output with an information bandwidth of 0.5 Hz to 120 Hz for the 6.7 µm channel and 0.5 Hz to 360 Hz for the 11.5 µm channel. The data were recorded on tape and subsequently played back to a ground acquisition station.

The THIR intially operated successfully but failed on January 11, 1971 (orbit 3731). It was restarted several times thereafter for very short periods before finally ceasing all operations in August 1971. For additional information about the Nimbus THIR, see the NASA National Space Science Data Center Temperature-Humidity Infrared Radiometer (THIR) Web page.

3.5 Version History

Table 2. Version History

Version (Date)	Details
V1 (24 November, 2015)	Initial release.

4 REFERENCES AND RELATED PUBLICATIONS

4.1 References

Gallaher D., G. G. Campbell, W. Meier, J. Moses, and D. Wingo. 2015. The process of bringing dark data to light: The rescue of the early Nimbus satellite data. *GeoResJ* 6: 124-134. doi:10.1016/j.grj.2015.02.013.

Gallaher, D., G. G. Campbell, and W. Meier. 2014. 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*. 7(3): 881-887. doi:10.1109/JSTARS.2013.2264391.

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.

Sabatini, R.R. 1970. *Nimbus IV User's Guide*. NASA Goddard Space Flight Center, Geenbelt, MD. https://acdisc.gesdisc.eosdis.nasa.gov/data/s4pa/Nimbus4_THIR_Level2/THIRN4L2CH115.001/doc/NimbusIVUG.pdf. 16 June, 2015.

4.2 Related Data Collections

See the Nimbus Data Rescue Project | Data Sets page.

4.3 Related Websites

NASA Goddard Earth Sciences Data and Information Services Center | Nimbus Overview
NASA Goddard Earth Sciences Data and Information Services Center | Nimbus Documentation
NASA Goddard Earth Sciences Data and Information Services Center | Nimbus 4 THIR
NASA Science | Missions | Nimbus

5 CONTACTS AND ACKNOWLEDGMENTS

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6 DOCUMENT INFORMATION

6.1 Publication Date

November 2015

6.2 Date Last Updated

October 2020