National Climatic Data Center

DATA DOCUMENTATION

FOR

DATASET 3641

Hurricane Satellite (HURSAT-AVHRR): AVHRR observations of tropical cyclones worldwide

Version 5

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Table of Contents

1. Abstract

The “Hurricane Satellite (HURSAT-AVHRR): AVHRR observations of tropical cyclones worldwide” data consist of raw satellite observations derived from the NOAA/AVHRR data centered on historical tropical cyclones (TC). The data derive from NOAA POES constellation of AVHRRs flying since 1978 through 2009. The data are available at irregular temporal intervals (pending orbit and number of operational satellites) that are gridded to roughly 4km resolution. The data include infrared window, visible and other channels available from the AVHRR.

IBTrACS data were temporally-interpolated to match the satellite data resolution. The satellite data were then gridded to 4km, with grid centers fixed on the tropical cyclone center of circulation. Data include hurricanes from the Atlantic, Pacific and Indian Ocean Basins. Data are provided in a convenient NetCDF format which is self-documenting and follows standard storage and meta-data conventions. This data set will be updated on an as needed basis.

This dataset is related to other HURSAT data (e.g., HURSAT-B1 which derived from geostationary imagers).

2. Element Names and Definitions

2.1 File Storage Format and Conventions

File storage format:
NetCDF version 3

File storage format URL:
http://www.unidata.ucar.edu/software/netcdf/

File storage convention:
CF

File storage convention URL:

File metadata convention:
http://www.unidata.ucar.edu/software/netcdf-java/formats/DataDiscoveryAttConvention.html

2.2 File naming convention:

(Note: All times referenced in the naming convention are to the Universal Time Code, UTC)

YyysJjjHLtLon.<Name>.Yyyn.Mm.Dd.Hhmm.Vv.Sat-Nn.Www.hursat-avhrr.Ver.nc

YyysJjjHLtLon = IBTrACS Serial Number

Where:

- Yyys = The year the tropical cyclone began (this may be different than Yyyn).
- Jjj = The day of the year the tropical cyclone began.
- H = Hemisphere:
  - S = Southern Hemisphere
  - N = Northern Hemisphere
- Lt = The latitude (absolute value and rounded to the nearest integer) of the first observation of the cyclone (units=degrees)
- Lon = The longitude (rounded to the nearest integer) of the first observation of the cyclone (units=degrees East of the Prime Meridian ranging from 0-359).
- <Name> = The storm name (Variable number of characters). 'MISSING' means that the storm was not named.
- Yyyn = Year of acquisition of the satellite image
- Mm = Integer representing the month of the image acquisition 01=Jan., 02=Feb., … , 12=Dec.
- Dd = Day of month of the image acquisition (Range=01-31)
- Hhmm = Optimal time of the satellite acquisition where Hhmm is Hh:mm UTC. (Generally rounded to the nearest synoptic hour: 0000, 0300, …, 2100)
- Vv = View zenith angle (degrees) from the satellite to the tropical cyclone center of circulation.
- Sat-Nn = ISCCP Satellite ID where:
  - NOAA-5 through 18
  - METEOSAT-2 [bug: This refers to EUMETSAT polar orbiter METOP-2 **not** geostationary Meteosat]
- Www = Representative IBTrACS wind speed (knots). Not to be used in calculations, but for qualitative analysis (to aid in identifying
- hursat-b1 = file suffix that identifies the data file and the file format
- Ver = file version. Current version = v05.
- nc = file suffix for a NetCDF file.

Example:

2002359S03089.MISSING.2002.12.31.0052.18.NOAA-15.018.hursat-avhrr.v05.nc

Means:

Year storm began	= 2002
Day of Year storm began	= 359
Hemisphere	= S (Southern Henisphere)
Latitude where storm began	= 03 (3 deg South)
Longitude where storm began	= 089E
Storm name	= Missing (i.e., not named)
Image obtained – Year	= 2002
Image obtained – Month	= 12 (December)
Image obtained – Day of Month	= 31
Image obtained – Time	= 0052 = 00:52 UTC
Satellite view zenith angle	= 18 deg
Satellite	= NOAA-15
Tropical Cyclone Wind Speed	= 18 knots
Dataset id	= hursat-avhrr
Version	= 5
File type	= nc (NetCDF file)

2.3 Global Attributes:

Note: Information on the Global Attributes can be obtained using the netCDF utility: ncdump

The bulk of the global attributes derive from the "Unidata Dataset Discovery v1.0" which is described at:

http://www.unidata.ucar.edu/software/netcdf-java/formats/DataDiscoveryAttConvention.html

or the COARDS convention described at:
http://ferret.wrc.noaa.gov/noaa_coop/coop_cdf_profile.html

A description of the attributes not listed in these conventions follows:

Attribute: **serial_number**
Description: The purpose of a storm serial number is an identifier which is unlikely to change given changes to storm intensity, begin or end dates, or position. The format of the serial number is provided above as the first 13 digits of the filename.

Attribute: **TC_name**
Description: The tropical cyclone name (if available).

Attribute: **IBTrACS_Version**
Description: IBTrACS version of the data used for the tracks.

Attribute: **base_date**

Description: This is the year/month/day_of_month of the satellite image.

Attribute: **Conventions**
Description: The convention used in storing the netCDF data.

Attribute: **created**
Description: The date the netCDF file was created by the IDL routine.

Attribute: **Projection**
Description: Lists the projection “Mercator” of the gridded data.

Attribute: **Satellite_Name**
Description: The name of the satellite making the observation.

Attribute: **Sensor_Name**
Description: Name of the satellite instrument making the observation.

2.4 Variables:

Note: Information on the variables can be obtained using he netCDF utility: ncdump

Again, COARDS conventions define the add_offset, scale_factor, long_name and units attributes. We only describe that which can not be obtained from *ncdump* and an understanding of the COARDS convention.

Element Name: sat_time
Definition: Time of the satellite observations when the satellite scanned the cyclone center (position interpolated from BT)

Element Name: lat
Definition: Latitude dimension vector of the corresponding satellite observation grids.

Element Name: lon
Definition: Longitude dimension vector of the corresponding satellite observation grids.

Element Name: CentLat
Definition: Cyclone latitude interpolated (using splines) from the best track data.

Element Name: CentLon
Definition: Cyclone longitude interpolated (using splines) from the best track data.

Element Name: BT_*
Definition: Entries from the Best track data that bound the satellite observation. That is, the observations (generally 6-hourly) that precede and follow the satellite overpass time (sat_time).

Element Name: BT_Time
Definition: Time of the two best track reports.

Element Name: BT_CentLat
Definition: Cyclone latitude at BT_Time

Element Name: BT_CentLon
Definition: Cyclone longitude at BT_Time

Element Name: BT_WindSpd
Definition: Cyclone maximum sustained wind speed at BT_Time

Element Name: BT_CentPrs
Definition: Cyclone minimum central pressure at BT_Time

Element Name: VZA
Definition: Satellite view zenith angle.

Element Name: SZA
Definition: Solar zenith angle.

Element Name: RELAZ
Definition: Relative azimuth angle at the point for the view angle between the ray to the satellite and the ray to the Sun.

Element Name: SFCTYPE
Definition: Surface type as defined by PATMOS

Element Name: SFCELEV
Definition: Surface elevation as defined by PATMOS

Element Name: CH1_REF
Definition: Channel 1 Reflectance

Element Name: CH2_REF
Definition: Channel 2 Reflectance

Element Name: CH3_REF
Definition: Channel 3 Reflectance

Element Name: CH3_TEMP
Definition: Channel 3 Brightness Temperature

Element Name: CH4_TEMP
Definition: Channel 4 Brightness Temperature

Element Name: CH5_TEMP
Definition: Channel 5 Brightness Temperature

2.4.1 IBTrACS information

IBTrACS information is stored in the remaining variables. See IBTrACS documentation for further information. The IBTrACS variables were appended to the HURSAT file using the netCDF Operators command:

ncks -a -A <ibtracs_file> <hursat_file>

By appending the IBTrACS file within the HURSAT file, matchups between satellite observations and IBTrACS parameters are simplified.

3. Start Date

19781105

4. Stop Date

Ongoing.

5. Coverage

a. Southernmost Latitude: 90S
b. Northernmost Latitude: 90N
c. Westernmost Longitude: 180W
d. Easternmost Longitude: 180E

6. How to Order Data

Ask NCDC's Climate Services about costs of obtaining this dataset.

Phone 828-271-4800
Fax 828-271-4876
e-mail NCDC.Orders@noaa.gov

7. Archiving Data Center

a. Name: National Climatic Data Center/NCDC
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151 Patton Ave.
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8. Technical Contact

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Address: National Climatic Data Center
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Fax: 828-271-4328
Email:

9. Known Uncorrected Problems

None.

10. Quality Statement

Disclaimer: While every effort has been made to ensure that these data are accurate and reliable within the limits of the current state of the art, NOAA cannot assume liability for any damages caused by any errors or omissions in the data, nor as a result of the failure of the data to function on a particular system. NOAA makes no warranty, expressed or implied, nor does the fact of distribution constitute such a warranty.

This dataset has undergone extensive quality checks on all parameters, including range checks and elimination of reporting sites with extensive missing data.

11. Essential Companion Datasets

None.

12. References

Knapp, K. R. (2008). "Calibration of long-term geostationary infrared observations using HIRS." Journal of Atmospheric and Oceanic Technology **25**(2): 183-195.

Knapp, K. R. and J. P. Kossin (2007). "New global tropical cyclone data from ISCCP B1 geostationary satellite observations." Journal of Applied Remote Sensing **1**: 013505

Kossin, J. P., K. R. Knapp, D. J. Vimont, R. J. Murnane and B. A. Harper (2007). "A globally consistent reanalysis of hurricane variability and trends." Geophysical Research Letters **34**: L04815.