Atmos. Profile: Radiosonde - NCDC (FIFE)

Summary:

The NOAA Radiosonde Observations - 1989 (NCDC) Data Set contains radiosonde data obtained from the National Climatic Data Center (NCDC). These 396 days of data cover 13 months from October 1988 through October 1989. These data were collected using sondes released in Dodge City and Topeka Kansas, 337 km and 68 km, respectively, from the FIFE study area. Radiosonde observations were made to determine the pressure, temperature, and humidity from the surface to the point where the sounding was terminated.

It is assumed that the use of these data is applicable to the FIFE study because these meteorological data are relatively stable in the horizontal domain. These data may be used as input to numerical models, as well as verification data for simulation studies.

Table of Contents:

1. Data Set Overview:

Data Set Identification:

Atmos. Profile: Radiosonde - NCDC (FIFE)
(NOAA Radiosonde Observations - 1989 (NCDC)).

Data Set Introduction:

The NOAA Radiosonde Observations - 1989 (NCDC) Data Set contains atmospheric pressure, geopotential height, atmospheric temperature, relative humidity, wind direction, and wind speed radiosonde data obtained from the National Climatic Data Center (NCDC). These data cover for 13 months from October 1988 through October 1989. There are 396 days of data during this period with data at 12 hour intervals.

Objective/Purpose:

The FIFE Staff Science effort covered those activities which were FIFE community level activities, or required uniform data collection procedures across sites and time. These activities included the acquisition, processing and archiving of meteorological parameters of the atmosphere above the FIFE site. These data may be used as input to numerical models, as well as verification data for simulation studies.

Summary of Parameters:

Atmospheric pressure, geopotential height, atmospheric temperature, relative humidity, wind direction, wind speed.

Discussion:

The radiosonde data was obtained from the National Climatic Data Center (NCDC). These data are available for 13 months from October 1988 through October 1989. There are 396 days of data during this period with data at 12 hour intervals. Unlike the radiosonde data collected at the FIFE study area (see the FIFE Radiosonde Data (Brutsaert)) these data were collected using sondes released in Dodge City and Topeka Kansas, 337 km and 68 km, respectively, from the FIFE study area.

Related Data Sets:

- NOAA Radiosonde Observations.
- NOAA Regional Surface Data.
- NOAA Regional Surface Data - 1989 (NCDC).
- Upper Air Derivative Data from NMC.
- FIFE Radiosonde Data (Brutsaert).
- Automated Meteorological Stations (AMS).

FIS Data Base Table Name:

NCDC_RADIOSONDE_DATA.

2. Investigator(s):

Investigator(s) Name and Title:

Staff science.

Title of Investigation:

Staff Science Meteorological Data Acquisition Program.

Contact Information:

Contact 1:
Dr. Robert J. Lutz
Hughes STX Corp.
301-286-1272

Contact 2:
U.S. Department of Commerce
NOAA/NESDIS
704-259-0682

Requested Form of Acknowledgment.

The NOAA Radiosonde Observations - 1989 (NCDC) was obtained by FIS from NOAA's National Climatic Data Center. The data and documentation were interpreted and put into FIFE formats by Dr. Robert J. Lutz of Hughes STX Corporation. His work is greatly appreciated.

3. Theory of Measurements:

Radiosonde observations are made to determine the pressure, temperature, and humidity from the surface to the point where the sounding is terminated. It is assumed that the use of these data is applicable to the FIFE study because these meteorological data are relatively stable in the horizontal domain.

4. Equipment:

Sensor/Instrument Description:

The radiosonde is a balloon-borne, battery-powered instrument used together with the ground-receiving equipment to delineate the vertical profile of the atmosphere. The radiosonde consists of meteorological measuring elements coupled to a radio transmitter and assembled into a small lightweight box. The device is carried aloft by a balloon filled with hydrogen, natural gas, or helium gas. Included in the train is a small parachute to slow the descent of the instrument after the balloon bursts, thereby minimizing the danger of injury to life and property.

Collection Environment:

Airborne.

Source/Platform:

Balloon filled with hydrogen.

Source/Platform Mission Objectives:

To measure pressure, temperature, and humidity profiles in the atmosphere.

Key Variables:

Pressure, height, temperature, and relative humidity.

Principles of Operation:

Pressure is measured by means of a baroswitch which employs an expanding aneroid pressure cell to move a contact arm across a commutator bar as the pressure decreases. Temperature is measured by a thermistor. The electrical resistance of the thermistor is a function of temperature. Relative humidity is measured by a hygristor, whose electrical resistance is a function of the relative humidity and to some extent, temperature.

As the radiosonde ascends, the thermistor and hygristor are switched sequentially into the modulator circuit by the baroswitch. The amplitude of the received signal, therefore, is alternately a function of temperature or humidity. Because of the translation from amplitude to frequency done by the modulation circuit the signal may be any value from 0 to 200 Hz. Periodically, the thermistor and hygristor are bypassed in the modulator circuit. Reference circuits using fixed resistors are then used to modulate the carrier frequency to known values, 95, 190, or 195 Hz (47.5, 95, or 97.5 recorder divisions). Any changes that may be occurring in the modulator circuit can then be evaluated.

Sensor/Instrument Measurement Geometry:

The radiosonde consists of meteorological measuring elements coupled to a radio transmitter and assembled into a small lightweight box.

Manufacturer of Sensor/Instrument:

Not available at this revision.

Calibration:

Specifications:

Not available at this revision.

Tolerance:

Not available at this revision.

Frequency of Calibration:

Calibration is performed at the beginning of each sounding.

Other Calibration Information:

Calibration charts are provided by the manufacturer of the radiosonde. The serial numbers affixed to the baroswitch assembly are checked to make sure that they agree with those printed on the calibration chart and on the instrument. If the baroswitch numbers disagree, the radiosonde is rejected.

5. Data Acquisition Methods:

The radiosonde transmits meteorological information consisting of pressure obtained from an aneroid cell, temperature, and relative humidity. The telemetered meteorological information from the radiosonde is detected, amplified, and shaped by a receiver, and the processed information is printed in graphic form on a strip chart recorder or stored on computer disc. These discs were then transcribed to magnetic tape and archived at the National Climatic Data Center (NCDC).

FIS staff obtained these data on tape from the NCDC. FIS staff read the tapes, using documentation that was produced by the NCDC.

6. Observations:

None.

7. Data Description:

Spatial Characteristics:

Spatial Coverage:

NOAA radiosonde data were collected from two stations in Kansas. The names, locations, and approximate distance from the FIFE site are listed below.

UTM UTM

LOCATION	NORTHING	EASTING	LATITUDE	LONGITUDE	DISTANCE
Dodge City, KS	4180534	414568	37 46 12	99 58 12	337 km

```
Topeka, KS        4327629    272466    39 04 12    95 37 48      68 km
```

The FIFE STATION_ID and SITEGRID_ID for these locations are:

```
STATION_ID              SITEGRID_ID
-----------------    ------------------
451                     XRSD-RDN
456                     XRST-RDN
```

The horizontal coverage of an individual sonde varies depending upon the track the sonde takes as it ascends. The data were collected 400 km apart.

Spatial Coverage Map:

Not available.

Spatial Resolution:

The horizontal resolution varies with the rate and angle of the ascent. The specific values are not available at this revision.

The vertical resolution will vary as the radiosonde ascends.

Projection:

Not available.

Grid Description:

Not available.

Temporal Characteristics:

Temporal Coverage:

The overall time period of data acquisition was from October 1, 1988 through October 31, 1989.

Temporal Coverage Map:

Not available.

Temporal Resolution:

Observations were made at least twice a day at 0000 GMT and 1200 GMT. On some days observations are available at three hour intervals (i.e. 0300, 0600, 0900, 1200, 1500, 1800, 2100 and 0000 GMT).

Data Characteristics:

The SQL definition for this table is found in the NCDC_SON.TDF file located on CD-ROM Volume 1.

Parameter/Variable Name

Parameter/Variable Description Source	Range	Units

SITEGRID_ID
This is a FIS grid location
code. Site grid codes (SSEE-III)
give the south (SS) and the east
(EE) cell number in a 100 x 100
array of 200 m square cells. The
last 3 characters (III) are an
instrument identifier.

STATION_ID
The FIS site identifier used to
designate this site.

OBS_DATE
The date of the observations, in
the format DD-mmm-YY.

OBS_TIME
The time that the observation was   [GMT]
taken in GMT. The format is (HHMM).

ATMOSPHERIC_PRESS
The atmospheric pressure when the   [millibars]
temperatures and height values were
recorded. [MILLIBARS]

GEOPTNTL_HEIGHT
The measured geopotential height.   [meters]
[METERS]

ATMOSPHERIC_TEMP
The measured atmospheric   [degrees
temperature, at a given pressure.   Celsius]

```
WIND_DIR
The direction of the wind.                          [degrees
from North]
```

```
WIND_SPEED
The wind speed at the measurement                   [meters]
height.                                             [sec^-1]
```

```
REL_HUMID
The relative humidity.                              [percent]
```

```
DATA_TYPE ***
The type of data recorded, ranging
from 0 to 5.
```

```
DATA_QUALITY **
The quality of the data, either
000000 or 404444.
```

```
FIFE_DATA_CRTFCN_CODE *
The FIFE Certification Code for
the data, in the following format:
CPI (Certified by PI), CPI-???
(CPI - questionable data).
```

```
LAST_REVISION_DATE
data, in the format (DD-MMM-YY).
```

Footnotes:

* Valid levels

The primary certification codes are: EXM Example or Test data (not for release) PRE Preliminary (unchecked, use at your own risk) CPI Checked by Principal Investigator (reviewed for quality) CGR Checked by a group and reconciled (data comparisons and cross checks)

The certification code modifiers are: PRE-NFP Preliminary - Not for publication, at the request of investigator. CPI-MRG PAMS data that is "merged" from two separate receiving stations to eliminate transmission errors. CPI-??? Investigator thinks data item may be questionable.

** The Data_Quality parameter must be decoded to interpret this field. Each digit represents a different parameter as listed below.

```
DIGIT              PARAMETER
-----------        ----------------------
1                  Obs_Date/Obs_Time
2                  Atmospheric_Press
3                  Geoptntl_Height
4                  Atmospheric_Temp
5                  Rel_Humid
6                  Wind_Dir/Wind_Speed
```

The range of values for all digits and the interpretation for each is as follows:

```
VALUE OF DIGIT          QUALITY
----------------        -----------------
0               Correct
1               Doubtful
2               In Error
3               Replacement Value
4               Assumed or Estimated Value
9               Element Not Checked
```

*** The Data_Type parameter must be decoded to interpret this field. The valid values for this field are listed below along with their interpretation:

> 0 = Surface
> 1 = Mandatory
> 2 = Significant
> 3 = Generated
> 4 = Tropopause
> 5 = Maximum Wind
> 9 = Other Unspecified

Where:

> Mandatory = Required by World Meteorological Organization as required in coded TEMP report.
> Significant = Level as required to adequately describe a sounding in part B and D of the TEMP message.

Sample Data Record:

SITEGRID_ID	STATION_ID	OBS_DATE	OBS_TIME	ATMOSPHERIC_PRESS
XRSD-RSN	451	01-OCT-89	1200	916
XRSD-RSN	451	01-OCT-89	1201	900
XRSD-RSN	451	01-OCT-89	1201	897
XRSD-RSN	451	01-OCT-89	1202	866
XRSD-RSN	451	01-OCT-89	1202	856
XRSD-RSN	451	01-OCT-89	1203	850
XRSD-RSN	451	01-OCT-89	1204	823
XRSD-RSN	451	01-OCT-89	1205	800
XRSD-RSN	451	01-OCT-89	1207	750

```
XRSD-RSN       451            01-OCT-89    1209             700
XRSD-RSN       451            01-OCT-89    1211             650
XRSD-RSN       451            01-OCT-89    1212             635

GEOPTNTL_HEIGHT   ATMOSPHERIC_TEMP   WIND_DIR    WIND_SPEED   REL_HUMID
---------------   ----------------   --------    ----------   ---------
791               13.9               180         4            67
942               15.5               209         11           57
970               15.9               212         14           55
1273              24.6               233         22           19
1375              25.5               236         21           19
1437              25.1               237         20           19
1719              24.3               234         17           19
1966              22.1               230         16           19
2521              16.9               227         15           21
3102              11.4               235         10           23
3715               6.3               283         7            32
3906               4.6               284         7            36

DATA_TYPE   DATA_QUALITY   FIFE_DATA_CRTFCN_CODE   LAST_REVISION_DATE
---------   ------------   ---------------------   ------------------
0           000000                   PRE               01-OCT-92
3           000000                   PRE               01-OCT-92
2           000000                   PRE               01-OCT-92
2           000000                   PRE               01-OCT-92
2           000000                   PRE               01-OCT-92
1           000000                   PRE               01-OCT-92
2           000000                   PRE               01-OCT-92
3           000000                   PRE               01-OCT-92
3           000000                   PRE               01-OCT-92
1           000000                   PRE               01-OCT-92
3           000000                   PRE               01-OCT-92
2           000000                   PRE               01-OCT-92
```

8. Data Organization:

Data Granularity:

The overall time period of data acquisition was from October 1, 1988 through October 31, 1989. Observations were made at least twice a day at 0000 GMT and 1200 GMT.

A general description of data granularity as it applies to the IMS appears in the EOSDIS Glossary.

Data Format:

The CD-ROM file format consists of numerical and character fields of varying length separated by commas. The character fields are enclosed with a single apostrophe. There are no spaces between the fields. Each file begin with five header records. Header records contain the following information: Record 1 Name of this file, its table name, number of records in this file, and principal investigator name.

Record 2 Path and filename of the previous data set, and path and filename of the next data set. (Path and filenames for files that contain another set of data taken at the same site on the same day.)

Record 3 Path and filename of the previous site, and path and filename of the next site. (Path and filenames for files of the same data set taken on the same day for the previous and next sites, sequentially numbered by SITEGRID.)

Record 4 Path and filename of the previous date, and path and filename of the next date. (Path and filenames for files of the same data set taken at the same site for the previous and next date.)

Record 5 Column names for the data within the file, delimited by commas.

Record 6 Data records begin.

Each field represents one of the attributes listed in the chart in the *Data Characteristics Section* and described in detail in the TDF file. These fields are in the same order as in the chart.

9. Data Manipulations:

Formulae:

Derivation Techniques and Algorithms:

Not available at this revision.

Data Processing Sequence:

Processing Steps:

The data was received from the National Climatic Data Center on 6250 BPI tapes. Data was extracted using software that was supplied in the documentation that came with these data.

Processing Changes:

These data were loaded into the appropriate table in the FIFE data base by the FIS staff. The station identification numbers that NOAA supplied with the data were the internal NOAA numbers, 13985 for Dodge City and 13996 for Topeka. The FIS staff converted these to the FIFE station identification numbers (451 and 456, respectively) and loaded them into the Station-ID column.

Missing values were given a repetitive 9 value, corresponding to the maximum digits allowed in the field.

Calculations:

None performed at this revision.

Special Corrections/Adjustments:

None performed at this revision.

Calculated Variables:

Not applicable.

Graphs and Plots:

None.

10. Errors:

Sources of Error:

The sources of error are as follows:

1. Insufficient recorder sensitivity,
2. Fading or weak signals,
3. Unstable temperature traces,
4. Leaking pressure cell,
5. Sticking contact arm,
6. Electrical leakage in the baseline check box, or
7. Repeated contacts caused by faulty baroswitch assembly.

Quality Assessment:

Data Validation by Source:

When the radiosonde or ground equipment functions abnormally, the accuracy of the observed data will be noted within the data quality parameter.

Confidence Level/Accuracy Judgment:

Not available at this revision.

Measurement Error for Parameters:

Not estimated at this revision.

Additional Quality Assessments:

FIS staff performed a preliminary data quality check, examining minima and maxima of the meteorological parameters. No errors were found in the data set.

Occasionally soundings terminate abnormally, (e.g. balloon burst, leaking or floating balloon, weak or fading signal, radiosonde failure, etc.) When this occurs, if possible, another release is made close to the allotted time.

FIS staff applied a general QA procedure to the data to identify inconsistencies and problems for potential users. As a general procedure, the FIS QA consisted of examining the maximum, minimum, average, and standard deviation for each numerical field in the data table. Inconsistencies and problems found in the QA check are described is the *Known Problems with the Data Section*.

Data Verification by Data Center:

The data verification performed by the ORNL DAAC deals with the quality of the data format, media, and readability. The ORNL DAAC does not make an assessment of the quality of the data itself except during the course of performing other QA procedures as described below.

The FIFE data were transferred to the ORNL DAAC via CD-ROM. These CD-ROMs are distributed by the ORNL DAAC unmodified as a set or in individual volumes, as requested. In addition, the DAAC has incorporated each of the 98 FIFE tabular datasets from the CD-ROMs into its online data holdings. Incorporation of these data involved the following steps:

- Copying the entire FIFE Volume 1, maintaining the directory structure on the CD-ROM.
- Using data files, documentation, and SQL code provided on the CD-ROM to create a database in Statistical Analysis System (SAS).
- Creating transfer files to transfer the SAS metadata database to Sybase tables.

Each distinct type of data (i.e. "data set" on the CD-ROM), is accompanied by a documentation file (i.e., .doc file) and a data format/structure definition file (i.e., .tdf file). The data format files on the CD-ROM are Oracle SQL commands (e.g., "create table") that can be used to set up a relational database table structure. This file provides column/variable names, character/numeric type, length, and format, and labels/comments. These SQL commands were converted to SAS code and were used to create SAS data sets and subsequently to input data files directly from the CD-ROM into a SAS dataset. During this process, file names and directory paths were captured and metadata was extracted to the extent possible electronically. No files were found to be corrupted or unreadable during the conversion process.

Additional Quality Assurance procedures were performed as follows:

- Statistical operations were performed to calculate minimum and maximum values for all numeric fields and to create a listing of all values of the character fields. During this process, it was determined that various conventions were used to represent missing values. (Note: no modifications were made to any data by the DAAC). In most cases, missing value identification conventions were discussed in the accompanying .doc file.

Based on a visual check of the minimum and maximum values, no glaring errors or holes were identified that might indicate errors introduced during CD-ROM mastering by the FIFE project or data ingest by the DAAC.

- Some minor inconsistencies and typographical errors were identified in some of the character fields and column labels, however, no modifications were made to the data by the DAAC.
- Some conversions of ASCII data were necessary to move the data from a DOS platform to a UNIX platform. Standard operating system conversion utilities were used (e.g., dos2unix).
- Much of the metadata required for archival is imbedded in the narrative documentation accompanying the data sets and extracted manually by DAAC staff who have read the .doc files provided on the CD-ROM and have hand entered this information into the metadata database maintained by the DAAC. QA procedures have been performed on these metadata to identify and eliminate typographical errors and inconsistencies in naming conventions, to ensure that all required metadata is present, and to ensure the accuracy of file names and paths for retrieval.
- Data requested for distribution to users are checked to verify that files copied from disk to other media remain uncorrupted.

As errors are discovered in the online tabular data by investigators, users, or DAAC staff, corrections are made in cooperation with the principal investigators. These corrections are then distributed to users. CD-ROM data are corrected when re-mastering occurs for replenishment of CD-ROM stock.

11. Notes:

Limitations of the Data:

Not available.

Known Problems with the Data:

Missing data is reported as 999 for all fields except GEOPTNTL_HEIGHT where it is 99999.

Usage Guidance:

Not available at this revision.

Any Other Relevant Information about the Study:

Not available at this revision.

12. Application of the Data Set:

These data may be used as input to numerical models, as well as verification data for simulation studies.

13. Future Modifications and Plans:

The FIFE field campaigns were held in 1987 and 1989 and there are no plans for new data collection. Field work continues near the FIFE site at the Long-Term Ecological Research (LTER) Network Konza research site (i.e., LTER continues to monitor the site). The FIFE investigators are continuing to analyze and model the data from the field campaigns to produce new data products.

14. Software:

Software to access the data set is available on the all volumes of the FIFE CD-ROM set. For a detailed description of the available software see the *Software Description Document*.

15. Data Access:

Contact Information:

ORNL DAAC User Services
Oak Ridge National Laboratory

Telephone: (865) 241-3952
FAX: (865) 574-4665

Email: ornldaac@ornl.gov

Data Center Identification:

ORNL Distributed Active Archive Center
Oak Ridge National Laboratory
USA

Telephone: (865) 241-3952
FAX: (865) 574-4665

Email: ornldaac@ornl.gov

Procedures for Obtaining Data:

Users may place requests by telephone, electronic mail, or FAX. Data is also available via the World Wide Web at http://daac.ornl.gov.

Data Center Status/Plans:

FIFE data are available from the ORNL DAAC. Please contact the ORNL DAAC User Services Office for the most current information about these data.

16. Output Products and Availability:

NOAA Radiosonde Observations - 1989 (NCDC) are available on FIFE CD-ROM Volume 1. The CD-ROM filename is as follows:

DATA\ATMOST\NCDC_SON\GRIDgrid\YyyMmm\ydddgrid.NCR

Where *xxxx* is the four digit code for the location within the FIFE site grid, *yy* is the last two digits of the year (e.g. Y87 = 1987), *mm* is the month of the year (e.g. M12 = December), and *ddd* is the day of the year, (e.g. 061 = sixty-first day in the year). Note: capital letters indicate fixed values that appear on the CD-ROM exactly as shown here, lower case indicates characters (values) that change for each path and file.

The format used for the filenames is: *ydddgrid.sfx*, where *grid* is the four-number code for the location within the FIFE site grid, *y* is the last digit of the year (e.g. 7 = 1987, and 9 = 1989), and *ddd* is the day of the year. The filename extension (*.sfx*), identifies the data set content for the file (see the *[Data Characteristics Section](#)*) and is equal to .NCR for this data set.

17. References:

Satellite/Instrument/Data Processing Documentation.

The National Climatic Data Center documentation referred to in this report is:

> TD-6200 Series NCDC Upper Air Digital Files. 1990. National Climatic Data Center. Federal Building. Asheville, NC.

> Federal Meteorological Handbook No. 3. Radiosonde Observations. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. Washington, D. C.

> Federal Meteorological Handbook No. 4. Radiosonde Code. Second Edition-1976. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. Washington, D. C.

Journal Articles and Study Reports.

FIS is unaware of any reports using this dataset. Some general publications which discuss radiosondes and/or their application within FIFE are as follows:

Brutsaert, W., M. Sugita, and L.J. Fritschen. 1990. Inner region humidity characteristics of the neutral boundary layer over prairie terrain. Water Resour. Res. 26:2931-2936.

Sugita, M. and W. Brutsaert. 1990. Wind velocity measurements in the neutral boundary layer above hilly prairie. J. Geophys. Res. 95:7617-7624.

Sugita, M. and W. Brutsaert. 1991. Daily evaporation over a region from lower boundary layer profiles measured with radiosondes. Water Resour. Res. 27:747-752.

Sellers, P.J., F.G. Hall, G. Asrar, D.E. Strebel, and R.E. Murphy. 1988. The First ISLSCP Field Experiment (FIFE). Bull. Am. Meteorol. Soc. 69:22-27.

Archive/DBMS Usage Documentation.

Contact the EOS Distributed Active Archive Center (DAAC) at Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee (see the *Data Center Identification Section*). Documentation about using the archive and/or online access to the data at the ORNL DAAC is not available at this revision.

18. Glossary of Terms:

A general glossary for the DAAC is located at Glossary.

19. List of Acronyms:

CCT Computer Compatible Tape CD-ROM Compact Disk Read-Only Memory BPI Byte per inch DAAC Distributed Active Archive Center EOSDIS Earth Observing System Data and Information System FIS FIFE Information System IFOV Instantaneous Field of View ISLSCP International Satellite Cloud Climatology Project Mbps Megabyte per second NCDC National Climatic Data Center NOAA National Oceanic and Atmospheric Administration NESDIS National Environmental Satellite Data and Information Service ORNL Oak Ridge National Laboratory URL Uniform Resource Locator UTM Universal Transverse Mercator

A general list of acronyms for the DAAC is available at Acronyms.

20. Document Information:

April 28, 1994.

This document has been reviewed by the FIFE Information Scientist to eliminate technical and editorial inaccuracies. Previous versions of this document have been reviewed by the Principal Investigator, the person who transmitted the data to FIS, a FIS staff member, or a FIFE scientist generally familiar with the data. It is believed that the document accurately describes the data as collected and archived on the FIFE CD-ROM series.

Document Review Date:

September 2, 1996 (citation revised on October 3, 2002).

Document ID:

ORNL- FIFE_NCDC_SON.

Citation:

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Document Curator:

DAAC Staff

Document URL:

http://daac.ornl.gov