

First ISCCP Regional Experiment (FIRE) Cirrus 1 Rawinsonde Langley DAAC Data Set Document



Summary:

The First ISCCP Regional Experiments (FIRE) have been designed to improve data products and cloud/radiation parameterizations used in general circulation models (GCMs). Specifically, the goals of FIRE are (1) to improve basic understanding of the interaction of physical processes in determining life cycles of cirrus and marine stratocumulus systems and the radiative properties of these clouds during their life cycles and (2) to investigate the interrelationships between the ISCCP data, GCM parameterizations, and higher space and time resolution cloud data.

To-date, four intensive field-observation periods were planned and executed: a cirrus IFO (October 13-November 2, 1986); a marine stratocumulus IFO off the southwestern coast of California (June 29-July 20, 1987) a second cirrus IFO in southeastern Kansas (November 13-December 7, 1991); and a second marine stratocumulus IFO in the eastern North Atlantic Ocean (June 1-June 28, 1992). Each mission combined coordinated satellite, airborne, and surface observations with modeling studies to investigate the cloud properties and physical processes of the cloud system.

Rawinsonde data for the 1986 FIRE Cirrus IFO includes data from seven (7) National Weather Service stations at Green Bay, WI; St. Cloud and International Falls, MN; Peoria, IL; Omaha, NE; and Flint and Sault Ste. Marie, MI and three special stations located at Plattville, Fort McCoy, and Wausau, WI.

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1. Data Set Overview:

Data Set Identification:

FIRE_C11_RAWINSONDES:

First ISCCP Regional Experiment (FIRE) Cirrus 1 Rawinsonde Data Set Document (FIRE_C11_RAWINSONDES)



Data Set Introduction:

Project FIRE (First ISCCP Regional Experiment) is a U.S. cloud climatology research program to validate and improve ISCCP (International Satellite Cloud Climatology Project) data products and cloud/radiation parameterizations used in general circulation models (GCMs).

The primary emphasis of FIRE is the study of marine stratocumulus and cirrus cloud systems. These two cloud types were selected because of their recognized importance for global climate and their scientific appeal for many members of the scientific community.

Objective/Purpose:

The objective of FIRE is to investigate the cloud properties and physical processes of the cloud systems using combined and coordinated satellite, airborne, and surface observations with modeling studies.

The goals of FIRE are (1) to improve the basic understanding of the interaction of physical processes in determining life cycles of cirrus and marine stratocumulus systems and the radiative properties of these clouds during their life cycles and (2) to investigate the interrelationships between the ISCCP data, GCM parameterizations, and higher space and time resolution cloud data.

Summary of Parameters:

Dew/Frost Point Temperature
Geopotential Height
Potential Temperature
Pressure
Relative Humidity
Specific Humidity
Temperature
Wind Direction
Wind Speed

Discussion:

The radiosonde is a balloon-borne instrument platform with radio transmitting capabilities. The radiosonde contains instruments capable of making direct in-situ measurements of air temperature, humidity and pressure with height, typically to altitudes of approximately 30 km. These observed data are transmitted immediately to the ground station by a radio transmitter located within the instrument package. The ascent of a radiosonde provides an indirect measure of the wind speed and direction at various levels throughout the troposphere. Ground based radio direction finding antenna equipment track the motion of the radiosonde during its ascent through the air. The recorded elevation and azimuth information are converted to wind speed and direction at various levels of triangulation techniques.

The radiosonde transmits temperature and relative humidity data at each pressure level. Winds aloft are determined from the precision radar tracking of the instrument package. The altitudes of these levels are calculated using an equation (the hypsometric equation) that relates the vertical heights of a layer from the mean layer temperature, the humidity of the layer and the air pressure at top and bottom of the layer. Significant levels where the vertical profiles of the temperature or the dewpoint undergo a change are determined from the sounding. The height of the troposphere and stability indices are calculated. These data are encoded into standardized RAOB messages and transmitted worldwide over standard communications network.

A plot of the vertical variations of observed weather elements made above a station is called a sounding. The plots of the air temperature, dewpoint and wind information as functions of pressure are generally made on a specially prepared thermodynamic diagram. The altitude can be determined from the pressure by evaluating the hydrostatic equation. Mandatory and significant levels are determined. The data are encoded into the standard RAOB messages and transmitted by conventional communications networks to the National Meteorological Center.

Related Data Sets:

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2. Investigator(s):

Investigator(s) Name and Title:

David Starr
NASA Goddard Space Flight Center



Title of Investigation:

First ISCCP Regional Experiment (FIRE)

Contact Information:

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Code 613
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USA
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3. Theory of Measurements:

...

4. Equipment:**Sensor/Instrument Description:****Collection Environment:****Source/Platform:**

Ground Station

Source/Platform Mission Objectives:

...

Key Variables:

Dew/Frost Point Temperature
Geopotential Height
Potential Temperature
Pressure
Relative Humidity
Specific Humidity
Temperature
Wind Direction
Wind Speed

Principles of Operation:

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Sensor/Instrument Measurement Geometry:

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Manufacturer of Sensor/Instrument:

...

Sensor/Instrument:

Rawinsonde

Calibration:**Specifications:**

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Tolerance:

...

Frequency of Calibration:

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Other Calibration Information:

Efforts are currently underway to evaluate the accuracy of the pressure, temperature and humidity observations by the types of sondes used here (GSFC/Wallops Island). In general, the accepted accuracies are RMS errors of 0.7 C for temperature and 6 to 15 105n relative humidity. The humidity errors increase at low humidities and cold temperatures. Wind observations are generally believed to be accurate to within 5 m/s and 5 degrees azimuth.

NOTE: A number of derived parameters are given with the basic observations. Some, e.g., lapse rate and vertical wind speed shear, are useful quality or interest indicators. Other parameters are given for the user's convenience. The derived moisture parameters, e.g., frost point temperatures, preserve the information of the observations to a very high precision.

NOTE: The NWS data was hand entered in order to preserve maximum resolution. Thus, some errors likely remain although a substantial effort was made to find and correct these typos.

NOTE: No attempts to systematically filter the thermodynamic data have been performed here. Thus, seemingly unreasonable lapse rates do occur in the data, e.g., super-adiabatic layers, which often indicate exit of a cloud layer (wet-bulbing).

NOTE: No surface observations were taken at FMC. On some launches, it is obvious that the first data level is well above the surface. On others, the lowest reported level appears reasonable as a surface observation. Thus, this data must be used with caution, especially with respect to the computed geopotential heights.

5. Data Acquisition Methods:

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6. Observations:

Data Notes:

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Field Notes:

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7. Data Description:

Spatial Characteristics:

Spatial Coverage:

<u>Data Set Name</u>	<u>Min Lat</u>	<u>Max Lat</u>	<u>Min Lon</u>	<u>Max Lon</u>
FIRE_C11_RAWI NSONDES	39.00	50.00	-96.20	-81.10

Spatial Coverage Map:

There are no maps available for this data set.

Spatial Resolution:

HORIZONTAL RESOLUTION:

Includes data obtained from seven National Weather Service stations located at: Green BAY, WI (GRB, SITE = 72645 AT 44 29'N, 88 08'W AND 210 M),

St. Cloud, MN (STC, SITE = 72655 AT 45 33'N, 94 04'W AND 315 M),
Peoria, IL (PIA, SITE = 72532 AT 40 40'N, 89 41'W AND 200 m),
International Falls, MN (INL, SITE = 72747 AT 48 34'N, 93 23'W AND 359 M),
Omaha, NE (OMA, SITE = 72553 AT 41 22'N, 96 01'W AND 400 M),
Flint, MI (FNT, SITE = 72637 AT 42 58'N, 83 44'W AND 236 m),
Sault Ste. Marie, MI (SSM, SITE = 72734 AT 46 28'N, 84 22'W AND 221 m).

and three special FIRE Cirrus IFO rawinsonde stations located at:
Plattville, WI (PLA, SITE = 100 AT 42 43'N, 90 22'W AND 311 M),
Fort McCoy, WI (FMC, SITE = 200 AT 43 57'N, 90 44'W AND 256 M),
Wausau, WI (WAU, SITE = 300 AT 44 56'N, 89 38 W AND 366 m).

When available, the actual sonde location is given for each observation level during each ascent. Locations for NWS sondes were derived from the observed azimuth and elevation angles (1 minute resolution) and computed heights (assumed equal to geopotential heights) using a full spherical treatment. Locations for the Vasilala sondes were taken from the LORAN signal (about 1 minute resolution). Linear interpolation in time was used to assign the locations to thermodynamic observation levels given here. It should be noted that LORAN locations are often erroneous at altitudes below about 2 km. Bad values have been removed when obvious. No locations are given for WAU, except the launch site, as the raw LORAN data were not available to me. Locations at FMC also appear to have occasional problems, e.g., uncertainty in the actual release point.

VERTICAL RESOLUTION: The vertical resolution of the NWS sondes is determined by the barometric switch design of the individual sondes. The data was obtained in hard copy prior to application of the standard NWS processor, i.e., the standard filter for significant levels was not applied. Thus, every data point was retained. The vertical resolution of the processed PLA, FMC and WAU data given here is 5 mb below the 450 mb pressure level and 2.5 mb above, i.e., on the order of 50 meters throughout.

Projection:

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Grid Description:

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Temporal Characteristics:

Temporal Coverage:

<u>Data Set Name</u>	<u>Begin Date</u>	<u>End Date</u>
FIRE_C11_RAWINSOND ES	10-13-1986	11-03-1986

Temporal Coverage Map:

There are no maps available for this data set.

Temporal Resolution:

Includes data obtained from seven National Weather Service stations at all routine synoptic times (nominally 0000 and 1200 GMT) and special FIRE Cirrus IFO soundings at these sites between 1200 GMT on 10-13-86 and 0000 GMT on 11-03-86. Special soundings were made on all but four days in one of two operation modes: 1) Enhanced -- an additional 1800 GMT launch at three NWS sites (GRB, STC, and PIA) and 2) Intensive -- additional launches at all seven NWS sites at up to three hour resolution as requested (10-22, 10-24, 10-27, 10-28, and 11-02). Also includes soundings from three special FIRE Cirrus IFO sites (PLA, FMC, WAU).

For the most part, PLA followed the same schedule as the GRB, STC and PIA sites. Unlike PLA, FMC often did not sound at the routine synoptic times but usually did launch at the special times requested for the enhanced and intensive modes. WAU participation was more sporadic and usually launched at different times from the other stations in support of AFGL operations. Actual launch times are given when available. If unknown, the launch time was set to one hour prior to the nominal sounding time in accordance with routine practice at NWS stations and the procedure used at PLA and FMC, i.e., the 0000 and 1200 sondes are here defaulted to 1100 and 2300. It should be noted

that 1115 and 2315 may be more representative of actual NWS operations. The nominal sounding time and date are given in the ASCII header record to each data file while the actual or default launch time and corresponding date are given in each data record, e.g., 0000 GMT on 10-28 and 2315 GMT on 10-27, respectively. Elapsed time since launch is given at all data levels, except for WAU where it was not available to me. Temporal resolution during the profile is determined by the ascent rate and barometric switch design of the sonde for the NWS sondes. For the Vaisala sondes, the raw thermodynamic data were available at about 2 second intervals. This resolution was significantly reduced during data processing as described in (Spatial Characteristics: vertical resolution).

Data Characteristics:

Parameter/Variable:

All records and parameters within this data set have been defined, including their minimum and maximum values, in the header file.

The header file has been modified to reflect the changed record names in each file. However, the same parameters exist for each record. The reason for changing the record names is the external read header file reads a specific record name following by the parameters defined within each record and prior to the change, the file did not possess this information.

The read program has been modified to compute the WIND SPEEDSHEAR parameter in each record. The reason is that if you read the integer value and convert the value to a real value, the new result will always be out of the minimum/maximum range as defined within the header file. The data producer recommended a new formula to convert the integer value that was read in and converted to a real value, the real value must be divided by 2097152.0. Finally, 400.0 must then be subtracted from this new result to get the proper value within the minimum/maximum range. This formula has been implemented in the read program.

The fill value number for this data set is the maximum 4-byte integer word size of 2147483647.

There are two full records of (112*2) ASCII header information in each data record file.

There were no problems with values being out of the minimum/maximum range.

Variable Description/Definition:

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Unit of Measurement:

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Data Source:

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Data Range:

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Sample Data Record:

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8. Data Organization:

Data Granularity:

A general description of data granularity as it applies to the IMS appears in the [EOSDIS Glossary](#).

Data Format:

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9. Data Manipulations:

Formulae:



Derivation Techniques and Algorithms:

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Data Processing Sequence:

Processing Steps:

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Processing Changes:

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Calculations:

Special Corrections/Adjustments:

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Calculated Variables:

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Graphs and Plots:

Images are not available for this data set.

10. Errors:

Sources of Error:

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Quality Assessment:

Data Validation by Source:

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Confidence Level/Accuracy Judgement:

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Measurement Error for Parameters:

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Additional Quality Assessments:

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Data Verification by Data Center:

The Langley DAAC performs an inspection process on this data received by the data producer via ftp. The DAAC checks to see if the transfer of the data completed and were delivered in their entirety. An inspection software was developed by the DAAC to see if the code was able to read every granule. The code also checks to see if every parameter of data falls within the ranges which are included in the granule. This same code extracts the metadata required for ingesting the data into the IMS. If any discrepancies are found, the data producer is contacted. The discrepancies are corrected before the data are archived at the DAAC.

11. Notes:

Limitations of the Data:

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Known Problems with the Data:



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Usage Guidance:

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Any Other Relevant Information about the Study:

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12. Application of the Data Set:

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13. Future Modifications and Plans:

There are no plans for future modifications of these data sets.

14. Software:

Software Description:

Sample read software are available.

Software Access:

The software can be obtained through the Langley DAAC. Please refer to the contact information below. The software can also be obtained at the same time the user is ordering these data sets.

15. Data Access:

Contact Information:

Langley DAAC User and Data Services Office
NASA Langley Research Center
Mail Stop 157D
Hampton, Virginia 23681-2199
USA
Telephone: (757) 864-8656
FAX: (757) 864-8807
E-mail: support-asdc@earthdata.nasa.gov

Data Center Identification:

Langley DAAC User and Data Services Office
NASA Langley Research Center
Mail Stop 157D
Hampton, Virginia 23681-2199
USA
Telephone: (757) 864-8656
FAX: (757) 864-8807
E-mail: support-asdc@earthdata.nasa.gov

Procedures for Obtaining Data:

The data are available from the [Langley Data Center web site](#).

Data Center Status/Plans:

The Langley DAAC will continue to archive this data. There are no plans to reprocess.

16. Output Products and Availability:

There are no output products available at this time for this data set.



17. References:

Sorlie, S., February 1993. "Langley DAAC Handbook." NASA Langley Research Center, Hampton, Virginia.

18. Glossary of Terms:

[EOSDIS Glossary.](#)

19. List of Acronyms:

NASA - National Aeronautics Space Administration

URL - Uniform Resource Locator

[EOSDIS Acronyms.](#)

20. Document Information:

Document Revision Date:

August 15, 1997; November 24, 1997; July 1999

Document Review Date:

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Document ID:

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Citation:

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Document Curator:

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