

SITE AVERAGED AMS DATA: 1989 (BETTS)

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## Site Averaged AMS Data: 1989 (Betts)

### Summary:

The Site Averaged AMS Data: 1989 (Betts) data set contains the site-averaged product of the Portable Automatic Meteorological Station (AMS) data acquired during the 1987-1989 FIFE experiment. Data are in 30-minute time intervals in 1989.

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## 1. Data Set Overview:

### Data Set Identification:

SITE AVERAGED AMS DATA: 1989 (BETTS).

### Data Set Introduction:

This data set is a site-averaged product of the Portable Automatic Meteorological Station (AMS) data acquired during the 1987-1989 FIFE experiment. The raw data have been extensively cleaned and edited before the site average was generated. The center of the FIFE 15x15 km site is close to 39.05°N, 96.53°W.

The 3 years of data were acquired and processed separately over a period of several years; and as a result there are a few differences in the 87 product and in the underlying methodology.

## ORNL DAAC SITE AVERAGED AMS DATA: 1989 (BETTS)

The 1987 data was downloaded piecemeal (by 2400 baud modem!) from the FIFE information center, edited and merged. Subsequently the 1988 data was retrieved from the FIFE CD ROM Volume 1; and the 1989 data was retrieved directly from the Oak Ridge DAAC. As our computers have improved by more than an order of magnitude in speed and disc space during the processing period, the 1989 data received a more uniform processing than the 1987. All the originating data however should correspond to that in the group 8, "Surface Meteorological Measurements (SUR\_MET)" or FIFE CD-ROM Volume 1, dated May 22, 1994, FIS Data Base Table "AMS\_DATA\_8x".

### **Objective/Purpose:**

Information not available.

### **Summary of Parameters:**

Air Temperature, Atmospheric Pressure, Longwave Radiation, Precipitation Rate, Reflectance, Shortwave Radiation, Soil Temperature, Solar Radiation, Surface Temperature, and Surface Wind Speed/Direction.

### **Discussion:**

Information not available.

### **Related Data Sets:**

- [Site Averaged AMS Data: 1987 \(Betts\)](#)
- [Site Averaged AMS Data: 1988 \(Betts\)](#)
- [Site Averaged AMS Data: 1987 - 1989 \(Betts\)](#)

## **2. Investigator(s):**

### **Investigator(s) Name and Title:**

Alan K. Betts and John H. Ball  
Atmospheric Research  
Telephone: (802) 483-2087  
Fax: (802) 483-6167  
Email: akbetts@aol.com

### **Title of Investigation:**

FIFE Follow-On.

### **Contact Information:**

ORNL DAAC User Services Office  
Oak Ridge National Laboratory  
Telephone: 1-(865)-241-3952  
Fax: 1-(865)-574-4665  
Email: ornl\_daac@ornl.gov

## Requested Form of Acknowledgment.

You may use these files freely. Please send Alan Betts ([akbetts@aol.com](mailto:akbetts@aol.com)) an e-mail if you do, so he can notify you of any updates. Please notify both Alan Betts and the ORNL DAAC of any errors you find.

This data processing was supported by NASA under Contract NAS5-32356 to Alan Betts, and an acknowledgment of the years of work that went into the production of these files would be appreciated in publications based substantially on them.

The FIFE CD-ROM can be cited as D. E. Strebel, D. R. Landis, K. F. Huemmrich, and B. W. Meeson (1994), Collected Data of The First ISLSCP Field Experiment, Vol. 1: Surface Observations and Non-Image Data Sets.

## 3. Theory of Measurements:

Information not available.

## 4. Equipment:

### Sensor/Instrument Description:

- ANEMOMETER: An instrument for measuring or indicating the force or speed of wind.
- BAROMETER: An instrument used for determining atmospheric pressure. The two most common barometers are the mercury barometer and the aneroid barometer.
- PYRANOMETER: An instrument that measures shortwave radiation over the whole hemisphere.
- RADIOMETER:
- RAIN GAUGE: An instrument used for measuring the amount of precipitation (rainfall) received. Generally expressed in inches or centimeters.
- THERMOMETER: An instrument for measuring temperature.

### Collection Environment:

Ground-based.

### Source/Platform:

Meteorological Station.

### Source/Platform Mission Objectives:

Information not available.

### Key Variables:

Information not available.

**Principles of Operation:**

Information not available.

**Sensor/Instrument Measurement Geometry:**

Information not available.

**Manufacturer of Sensor/Instrument:**

Information not available.

**Calibration:**

Information not available.

**5. Data Acquisition Methods:**

Information not available.

**6. Observations:**

Information not available.

**7. Data Description:**

**Spatial Characteristics:**

The FIFE site, with areal extent of 15 km by 15 km, is located south of the Tuttle Reservoir and Kansas River, and about 10 km from Manhattan, Kansas, U.S.A. The northwest corner of the area has UTM coordinates of 4,334,000 Northing and 705,000 Easting in UTM Zone 14.

The center of the FIFE 15 x 15 km site is close to 39.05°N, 96.53°W.

**Spatial Coverage:**

The distribution of stations during the data collection period is listed below. Finally, in 1989, 8 sitegrids were instrumented.

SITEGRID STATION ID

0847-SAM	929
4168-SAM	925
6912-PAM	919
2123-SAM	905
4439-PAM	911
8639-SAM	921
2133-PAM	931
6469-PAM	923

**Spatial Coverage Map:**

Not available.

**Spatial Resolution:**

These are point data.

**Projection:**

Information not available.

**Grid Description:**

Information not available.

**Temporal Characteristics:**

**Temporal Coverage:**

This data set contains data from Jan 1, 1989 through Nov 10, 1989.

**Temporal Coverage Map:**

Not available.

**Temporal Resolution:**

The time interval of the year is broken down into 30 minute intervals. There is one variable sample at each 30 minute time interval so in a LEAP (NOTE 1988) there are  $366 \times 48 = 17658$  time intervals. This field in the database is named "YSq#" (Yearly Sequence #) and makes a convenient linear time scale; in addition to day and UTC.

**Data Characteristics:**

- Air temperature,
- Atmospheric pressure,
- Longwave radiation,
- Precipitation rate,
- Reflectance,
- Shortwave radiation,
- Soil temperature,
- Solar radiation,
- Surface temperature, and
- Surface wind speed/direction.

Parameter/Variable Name

- Air Temperature:

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- Atmospheric Pressure: The pressure exerted by the weight of air above a given point. Usually expressed in terms of the height of a column of mercury.
- Longwave Radiation:
- Precipitation Rate:
- Reflectance:
- Shortwave radiation: The radiant energy emitted from the sun, in the visible and near ultraviolet wavelengths.
- Soil Temperature: A measure of the thermal energy of a soil.
- Solar Radiation: A measure of the electromagnetic energy that comes from the sun only.

Table 1. contains a summary of the variables in this data set.

**Table 1.** Variable Description

Variable Name	Long Name	SAS Type	Description
1 Ysq_no broken down into 30-minute intervals"		8	"Time interval of the year
2 date (mm/dd/yyyy) "	OBS_DATE	8	"Observation date
3 Jul_Date 1-366) "		8	"Julian date (day of year
4 utc		8	"Decimal time"
5 P (mbar) "	ATMOSPHERIC_PRESSURE	8	"Average atmospheric pressure
6 P_k atmospheric pressure average"		8	"Number of sites included in
7 P_s deviation (mbar) "		8	"Atmospheric pressure standard
8 T (degrees C) "	DRY_BULB_TEMPERATURE	8	"Average dry bulb temperature
9 T_k average dry bulb temperature (T) "		8	"Number of sites included in
10 T_s deviation"		8	"Dry bulb temperature standard
11 Tw (degrees C) "	WET_BULB_TEMPERATURE	8	"Average wet bulb temperature
12 Tw_k 13 Tw_s deviation"		8	"Number of sites included in average wet bulb te
14 Rain30 30-minutes (Rain30) "	RAINFALL_RATE(*)	8	"Average rainfall rate for
15 Rain30_k average 30-minute rainfall rate (Rain30) "		8	"Number of sites included in
16 Rain30_s 30-minute rainfall rate (Rain30) "		8	"Standard deviation of average
17 U velocity (m/s) "	U_COMPNT_WIND_VELOC	8	"Average U component of wind
18 U_k average U component wind velocity (U) "		8	"Number of sites included in
19 U_s component wind velocity (U) "		8	"Standard deviation of U
20 V velocity (m/s) "	V_COMPNT_WIND_VELOC	8	"Average V component of wind

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21 V_k	8	"Number of sites included in average V component
22 V_s	8	"Standard deviation of V
component wind velocity (V) "		
23 Tsurf SURF_TEMP	8	"Average surface temperature
(degrees C) "		
24 Tsurf_k	8	"Number of sites included in
average surface temperature		
(Tsurf) "		
25 Tsurf_s	8	"Standard deviation of
surface temperature (Tsurf) "		
26 Tsoil10 SOIL_TEMP_10CM	8	"Average soil temperature at
10 cm (degrees C) "		
27 Tsoil10k	8	"Number of sites included in
average soil temperature at		
10 cm (Tsoil10) "		
28 Tsoil10s	8	"Standard deviation of soil
temperature at 10 cm		
(Tsoil10) "		
29 Tsoil50 SOIL_TEMP_50CM	8	"Average soil temperature at
50 cm (degrees C) "		
30 Tsoil50k	8	"Number of sites included in
average soil temperature at		
50 cm (Tsoil50) "		
31 Tsoil50s	8	"Standard deviation of soil
temperature at 50 cm		
(Tsoil50) "		
32 SolDn TOTAL_INCIDENT_RADTN	8	"Average total incident
radiation (W/m2) "		
33 SolDn_k	8	"Number of sites included in
total incident radiation		
average (SolDn) "		
34 SolDn_s	8	"Standard deviation of average
total incident radiation		
(SolDn) "		
35 SolRef SHORTWAVE_SOLAR_REFL	8	"Average shortwave solar
reflectance (W/m2) "		
36 SolRef_k	8	"Number of sites included in
average shortwave solar		
reflectance (SolRef) "		
37 SolRef_s	8	"Standard deviation of average
shortwave solar reflectance		
(SolRef) "		
38 Rnet NET_RADTN	8	"Average net radiation (W/m2) "
39 Rnet_k	8	"Number of sites included in
average net radiation (Rnet) "		
40 Rnet_s	8	"Standard deviation of average
net radiation (Rnet) "		
41 IRDn INCIDENT_LONGWAVE_RADTN	8	"Average incident longwave
radiation (W/m2) "		
42 IRDn_k	8	"Number of sites included in
average incident longwave		
radiation (IRDn) "		
43 IRDn_s	8	"Standard deviation of average
incident longwave radiation		
(IRDn) "		
44 Q	8	"Average mixing ratio"
45 Q_k	8	"Number of sites included in
average mixing ratio (Q) "		
46 Q_s	8	"Standard deviation of average
mixing ratio (Q) "		
47 ToClDoct	8	"Average total cloud cover
(octas) "		

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48 HiCldoct (octas) "	8	"Average high cloud cover
49 TimePhot were taken"	8	"Time of day sky photographs
50 MF_cld10 Marshall Field (tenths) "	8	"Reported cloud cover from
51 obs_time	8	"Observation time (hhmm) "

(\* ) The FIS rainfall rate is in mm/5mins, and was multiplied by 6 to give mm in 30mins.

In 1987 there are also four cloud variables;

ToCld\_octas cloud sky cover in eights.

HiCld\_octas cloud sky cover in eights.

TimePhoto the time of day of sky photograph.

Mf\_cld\_tenths reported cloud cover from Marshall Field, in tenths.

### Unit of Measurement:

Refer to the [Table 1](#) Description.

### Data Source:

Meteorological Station.

### Data Range:

Information not available.

### Sample Data Record:

Ysq_no	date	Jul_Date	utc	P	P_k	P_s	T				
T_k	T_s	Tw	Tw_k	Tw_s	Rain30	Rain30_k	Rain30_s	U			
U_k	U_s	V	V_k	V_s	Tsurf	Tsurf_k	Tsurf_s	Tsoil10			
Tsoil10k	Tsoil10s	Tsoil50	Tsoil50k	Tsoil50s	Soldn	Soldn_k	Soldn_s	SolRef			
IRDn	IRDn_k	IRDn_s	Q	Q_k	Q_s	ToCldoct	HiCldoct	TimePhot	MF_cld		
1	01/01/1989	1	0.25	963.67	8	2.21	1.48				
8	0.83	0.33	7	0.65	0	8	-1.07				
8	0.53	2.87	8	0.53	-0.95	8	1.39	0.43			
5	0.4	3.3	6	1.33	0	3					
2.06	0	8	1.73	-43.63	8	3.99					
236.08	4	4.51	3.58	7	0.13	.	.				
.	.	0015									
2	01/01/1989	1	0.75	963.93	8	2.23	1.14				
8	0.86	0.32	7	0.59	0	8	-1.09				
8	0.64	3.2	8	0.67	-0.77	8	1.34	0.44			
5	0.41	3.29	6	1.34	0	3					
2.02	0	8	1.69	-44.12	8	4.28					
241.67	4	7.02	3.66	7	0.12	.	.				
.	.	0045									
3	01/01/1989	1	1.25	964.26	8	2.25	0.69				
8	0.9	0	7	0.69	0	8	-1.27				
8	0.51	3.3	8	0.87	-0.8	8	1.17	0.48			
5	0.4	3.32	6	1.35	0	3					
1.57	0	8	2.33	-44.56	8	3.98					



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239.09	4	8.76	3.64	7	0.14	.	.
.	.	0115					
4	01/01/1989	1	1.75	964.67	8	2.26	0.01
8	0.71	-0.43	7	0.46	0	8	-1.34
8	0.5	3.57	8	0.88	-1.06	8	0.97
5	0.37	3.34	6	1.35	0	3	0.48
2.31	0	8	2.54	-43.63	8	4.88	
237.87	4	9.51	3.6	7	0.1	.	.
.	.	0145					

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## 8. Data Organization:

### Data Granularity:

<u>File names</u>	<u>size (bytes)</u>
fifams89.dat	3113301

### Data Format:

This data set is a time series of 30 minute average variables for the periods May 1, 1987- Dec 31, 1987 (50 fields; 14 variables (mean , SD, and count; plus 4 cloud fields); date (2), UTC, year sequence #.)

## 9. Data Manipulations:

Information not available.

## 10. Errors:

### Sources of Error:

Information not available.

### Quality Assessment:

#### Data Validation by Source:

Information not available.

#### Confidence Level/Accuracy Judgment:

Most variables are continuous for all but a few short periods. There is no radiation data for an extended period of one month from April 11 through May 10, 1988 because the instruments were being calibrated. However, other than this period, Rnet is available about 99% of the time. IRDn is missing for three extended time intervals and may be of questionable value for much of the time that it is available.

#### Data Filters and Cleaning:

A set of filters was applied to reject bad data points and help to identify lines of bad data (such as produced by electrical noise). Table 2 summarizes these filters. Scanning the data and nulling out obvious erroneous data manually effected further data editing. Some bad values will, however, have slipped through these can often

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be identified by a large value of the standard deviation.

**Table 2. Data filters**

<b>Variable</b>	<b>Max/Min (1988)</b>	<b>Filter Range</b>
P	999.94/938.29	930 to 1000
T	37.94/-23.17	-30 to 45
Tw	36.01/-22.43	-30 to 40 & (Tw-T)0.05
Rain30	7.75/0	
U	31.20/-27.56	
V	22.29/-17.86	
Tsurf	54.76/-39.34	-50 to 60
Tsoil10	39/-2.85	-10 to 50
Tsoil50	26/1.38	-5 to 40
SolDn	1034.71/-4.88	-5 to 1200
SolRef	543,45/-4.93	-5 to 600
Rnet	8.39.52/-87.36	-98 to 1000
IRDn	498.52/143.60	100 to 600
Q	N/A (calculated)	

Each variable (for all sites), together with the site-average and standard deviation were then examined graphically and manually (and iteratively) edited to eliminate bad data; and generate a cleaned-up site average for each variable. Some such as temperature and wet-bulb temperature were examined in pairs. Some bad data has escaped this process; often this is indicated by a solitary extreme standard deviation.

### **Interpolation**

We did not interpolate variables at a site before averaging; but we have interpolated most site-average variables to fill gaps (where these are small <6 hours) to reduce the burden on modelers. Gaps of more than a day have generally not been interpolated; although we have filled a few missing days temperature profiles with a simple and obvious sawtooth patterns (in 1988 and 1989). Some missing Net radiation values at night have been set to -30 Wm<sup>-2</sup>. In 1988 and 1989 SolDn and SolRef have been set to 0 (zero) between sun set and sun rise.

INTERPOLATED DATA IS EASILY IDENTIFIED. If the count on a variable is zero the data has been interpolated.

### **Measurement Error for Parameters:**

Information not available.

### **Additional Quality Assessments:**

Information not available.

### **Data Verification by Data Center:**

Information not available.

## **11. Notes:**

## Limitations of the Data:

Not available.

## Known Problems with the Data:

Information not available.

## Usage Guidance:

Information not available.

## Any Other Relevant Information about the Study:

### Original 1987 AMSDOC.txt

This is the documentation from the original May 26 - Oct 16 1987 site average data set from the FIFE CD-ROM. We include it for its remarks on the cloud data fields; and formula used for mixing ratio  $q$ , as we have not reprocessed this period, except for rain and IRDN.

FIFE-87 compacted surface data set. (Betts and Ball, 1992)  
Rev. Date: December 11, 1992

This data set contains FIFE-site averages derived from (ten) AMS stations (data every 30 minutes), together with cloud data from two sources, from May 26 - Oct 16, 1987.

The raw data for these files came from the FIS Data Base tables AMS\_DATA\_87 and CLOUD\_CAMERA\_DATA. The MF\_Cld field was obtained independently from the hourly cloud observations of Marshall AAF, KS, approximately 12 km west of the FIFE site.

## Data Processing

### Surface Portable Automated Meteorological Stations.

These were PAM-II stations supplied by the National Center for Atmospheric Research (NCAR), with pressure (PS), temperature (T) and wet-bulb (TW) temperature sensors mounted at 2 m and an anemometer at 5.4 m, as well as ground temperature sensors at 10 cm (T1soil) and 50 cm (T2soil) below the surface.

Each station measured surface skin temperature (TSfc) with a downward looking radiometer, net radiation (RNet) with a net radiometer, measured reflected solar radiation (SolRef) and recorded rainrate and accumulation from a tipping bucket raingauge. A subset of stations (2 before August, 10 1987 and then 4) measured incoming solar radiation (SolDn), and longwave radiation (LWDN) (2 before October, 1987, and then 4). The archive data uses NCAR's calibrations of the instruments.

### Data Filters

A set of filters was applied to reject bad data points and identify lines of bad data (such as produced by electrical noise). These are shown in Table 87-1.

Table 87-1

## ORNL DAAC SITE AVERAGED AMS DATA: 1989 (BETTS)

Variable	May 26–Jun 24	Jun 25–Aug21	Aug 22–Oct 16
SolDn	-5 to 1200	-5 to 1200	-5 to 1200
SolRef	-5 to 250	-5 to 250	-5 to 250
RNet	-98 to 1000	-98 to 1000	-98 to 800
TSfc	0 to 55	10 to 55	-10 to 35
TSoil10	9 to 30	19 to 30	9 to 21
TSoil50	11 to 30	19 to 30	11 to 19

T

and **TW** were filtered to eliminate any data where **T** was less than **TW**. The data was scanned for low values of surface pressure.

For both the radiation and thermodynamic data, further data editing was done by scanning the data and nulling out obvious erroneous data manually. Some bad values will however have slipped through.

The mixing ratio (**Q**) was calculated from **TW** and **PS** (surface pressure) as follows:

$$QW = 622 / (0.1631 * PS * \exp(-17.67 * TW / (TW + 243.5)) - 1) \\ Q = QW - (1006 / 2501) * (T - TW)$$

### Data Averaging

All the station data that passed this editing were averaged for each date and time to give a site average, a standard deviation, and a count of stations in the average. The center of the FIFE area is close to 39.05°N, 96.53°W.

The standard deviation is between sites, which are located at different altitudes, on different types and slopes of terrain, different soils etc. Isolated high standard deviations probably indicate an erroneous value that has not been filtered, although in some variables such as SolDn or RNet, they may be caused by more extensive cloud over a few sites. We have not included a standard deviation for LWDN, since there are only 2 sites with this measurement for much of the time.

### Cloud data

Two fields relating to daytime cloud cover for total cloud and high cloud (in octas) are from the archive of digitized photographic data (from Ann Henderson-Sellers). They are not 30 min. averages. The instantaneous digitized mean cloud cover from each single frame was simply assigned to the 30 min. time block in which it was taken. Since photos were typically every 40 min., every fourth time had no photo. A further field indicates the exact time of a photo. The MF\_Cld field was obtained independently from the hourly cloud observations of Marshall AAF, KS, approximately 12 km west of the FIFE site. This data set is in tenths cloud cover, estimated by observer.

## 12. Application of the Data Set:

Information not available.

## 13. Future Modifications and Plans:

There are no plans to revisit this data; but let us know of errors.

## 14. Software:

Information not available.

## 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](mailto:ornldaac@ornl.gov)

### Data Center Identification:

ORNL Distributed Active Archive Center  
Oak Ridge National Laboratory  
Telephone: (865) 241-3952  
FAX: (865) 574-4665  
Email: [ornldaac@ornl.gov](mailto: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:

This data set is available online via the World Wide Web at <http://daac.ornl.gov/>, or telnet ornlms.ornl.gov 6493 (128.219.24.108 6493), or eosims.ornl.gov 12345 (128.219.24.108 12345)

## 17. References:

Betts and Ball, 1996: FIFE surface climate and site-average data set 1987-1989, Submitted to J. Atmos. Sci. (3rd FIFE special issue)

## ORNL DAAC SITE AVERAGED AMS DATA: 1989 (BETTS)

Betts, A.K., J.H. Ball, and A.C.M. Beljaars, 1993: Comparison between the land surface response of the European Centre model and the FIFE-1987 data. Q.J.R.M.S., 119, 975-1001.

Betts, A.K. and J.H. Ball, 1994: Budget analysis of FIFE-1987 sonde data. J.G.R., 99, 3655-3666.

Betts, A.K. and J.H. Ball, 1995: The FIFE surface diurnal cycle climate. J.G.R. 100, 25679-25693.

Betts A. K. And J. H. Ball, 1997: FIFE surface climate and site-average dataset: 1987-1989. (FIFE special issue 3 J.Atmos. Sci. in press)

Strebel, D. E., D. R. Landis, K. F. Huemmrich, and B. W. Meeson, 1994: Collected data of the First ISLSCP Field Experiment, in Surface Observations and Non-Image Data Sets., Vol 1, CD-ROM, NASA GSFC, Greenbelt, MD 20771

### **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 <http://cdiac.esd.ornl.gov/cdiac/glossary.html>.

## **19. List of Acronyms:**

ESD Environmental Sciences Division (Oak Ridge National Laboratory) FTP File Transfer Protocol NASA National Aeronautics and Space Administration ORNL Oak Ridge National Laboratories, Oak Ridge, Tennessee, U.S.A. URL Uniform Resource Locator

A general list of acronyms for the DAAC is available at <http://daac.ornl.gov/acronyms.html>.

## **20. Document Information:**

December 4, 1996 (citation revised on October 1, 2002)

### **Document Review Date:**

April 21, 1997

### **Document ID:**

FIFE\_FFOAMS89

### **Citation:**

Cite this data set as follows (citation revised on October 1, 2002):

## ORNL DAAC SITE AVERAGED AMS DATA: 1989 (BETTS)

Betts, A. K. 1994. Site Averaged AMS Data: 1989 (Betts). Data set. Available on-line [http://www.daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. [doi:10.3334/ORNLDAAC/91](https://doi.org/10.3334/ORNLDAAC/91).

### **Document Curator:**

DAAC Staff  
[ornldaac@ornl.gov](mailto:ornldaac@ornl.gov)

### **Document URL:**

<http://daac.ornl.gov>