

30 Minute Rainfall Data (FIFE)

Summary:

The FIFE Thirty Minute Rainfall Data Data Set contains data from thirty rain gauges located in the Kings Creek basin in the northwest corner of the FIFE study area during 1987. Reliability of the gauges were such that at any particular time, data from approximately 20 were recovered. The high temperatures and humidity, plus software problems in the loggers, resulted in data losses. The collected data were of high quality and sufficiently many gauges were working that the structure of the raincells can be observed from the gauge data.

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1. Data Set Overview:

Data Set Identification:

30 Minute Rainfall Data (FIFE).
(Kings Creek Watershed 30 Minute Precipitation).

Data Set Introduction:

The FIFE Thirty Minute Rainfall Data Data Set contains data from thirty rain gauges located in the Kings Creek basin in the northwest corner of the FIFE study area during 1987. Reliability of the gauges were such that at any particular time, data from approximately 20 were recovered.

Objective/Purpose:

The purpose of collecting the rainfall data was to provide an accurate estimation of areal storm rainfall for the terrestrial water balance model for the Kings Creek area of the FIFE study area. Using the distributed water balance model, the spatial characteristics of the land surface hydrology (infiltration, evaporation and runoff) can be estimated.

Summary of Parameters:

Rainfall.

Discussion:

Thirty rain gauges were put out in June 1987 within the 11.7 sq km Kings Creek basin which was in the northwest corner of the FIFE study area. These gauges measured rainfall until October 1987. Reliability of the gauges were such that at any particular time, data from approximately 20 were recovered. The high temperatures and humidity, plus software problems in the loggers, resulted in the described data losses. The collected data were of high quality and sufficiently many gauges were working that the structure of the raincells can be observed from the gauge data.

Related Data Sets:

- [Daily Rainfall Amounts in the Konza Research Area.](#)
- [Automatic Micrometeorological Observations.](#)
- [NOAA Regional Surface Data.](#)
- [NOAA Regional Surface Data - 1989 \(NCDC\).](#)
- [Historical Daily Rainfall and Temperature Data for Manhattan, Kansas.](#)
- [Historical Monthly Rainfall Data for Manhattan, Kansas.](#)
- [Daily Stream Flow Amounts.](#)
- [Storm Event Stream Flow.](#)
- [Fifteen-minute Stream Flow Rates from USGS.](#)

FIS Data Base Table Name:

RAIN_30MIN_DATA.

2. Investigator(s):

Investigator(s) Name and Title:

Professor Eric F. Wood
Princeton University

Title of Investigation:

A Terrestrial Water Balance Model for FIFE.

Contact Information:

Contact 1:

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Requested Form of Acknowledgment.

The Kings Creek Watershed 30 Minute Precipitation data were collected by A. Volkmann, P.C.D. Milly, and E.F. Wood.

3. Theory of Measurements:

The University of Princeton used tipping bucket rain gauges in which a 0.2 mm tip connected to a data logger (that recorded the date and time to within 1 min of the tip) was used to record rainfall. The 1 minute rainfall readings were aggregated into 30 minute intervals.

4. Equipment:

Sensor/Instrument Description:

Collection Environment:

Ground-based.

Source/Platform:

Tipping bucket rain gauges were placed on the ground at multiple locations throughout the Kings Creek Watershed.

Source/Platform Mission Objectives:

Not applicable.

Key Variables:

Rainfall depth at gauge locations.

Principles of Operation:

Tipping bucket rain gauge, with a 0.2 mm tip, connected to a data logger that recorded the date and time (to within 1 min) of the tip.

Sensor/Instrument Measurement Geometry:

Rain gauge was leveled and placed approximately 6 inches above the ground. Vegetation was kept clear so as not to influence the rain capture.

Manufacturer of Sensor/Instrument:

Manufacturer: Environmental Measurements (UK).

Calibration:

Carried out by the manufacturer for each instrument.

Specifications:

ARG100 Aerodynamic Rain gauge with a 0.2 mm tip sensitivity, funnel dia 254 mm, overall height 340 mm. L2000 single channel data logger with 4k memory.

Tolerance:

Not available at this revision.

Frequency of Calibration:

Not available at this revision.

Other Calibration Information:

Not available at this revision.

5. Data Acquisition Methods:

The rain gauges were deployed in the field and loggers initialized for the date and time. Periodically, the loggers were interrogated and the data downloaded.

6. Observations:

Data Notes:

Not available.

Field Notes:

Not available at this revision.

7. Data Description:

Spatial Characteristics:

The FIFE study area, 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, USA. The northwest corner of the area has UTM coordinates of 4,334,000 Northing and 705,000 Easting in UTM Zone 14.

Spatial Coverage:

Thirty-one rain gauges were placed throughout the Kings Creek Basin within the FIFE study area. The exact location of each gauge follows:

SITEGRID	STN	NORTHING	EASTING	LATITUDE	LONGITUDE	ELEV
1318-RGP	301	4331360	708524	39 06 30	-96 35 18	375
1621-RGP	30	34330732	709244	39 06 09	-96 34 49	355
1626-RGP	30	44330841	710152	39 06 12	-96 34 11	385
1824-RGP	30	64330366	709866	39 05 57	-96 34 24	370
1829-RGP	30	74330427	710750	39 05 58	-96 33 47	415
1917-RGP	30	54330256	708498	39 05 54	-96 35 21	340
2020-RGP	30	94329924	709063	39 05 43	-96 34 57	400
2026-RGP	311	4329933	710158	39 05 42	-96 34 12	375
2123-RGP	310	4329811	709640	39 05 39	-96 34 34	405
2132-RGP	312	4329723	711329	39 05 35	-96 33 23	435
2316-RGP	308	4329376	708140	39 05 26	-96 35 36	395
2316-RGP	332	4329354	708156	39 05 25	-96 35 36	395
2321-RGP	314	4329309	709212	39 05 23	-96 34 52	365
2326-RGP	316	4329457	710188	39 05 27	-96 34 11	410
2329-RGP	317	4329500	710876	39 05 28	-96 33 42	415
2418-RGP	313	4329146	708577	39 05 18	-96 35 18	365
2424-RGP	315	4329256	709754	39 05 21	-96 34 29	380
2433-RGP	318	4329113	711634	39 05 15	-96 33 11	440
2521-RGP	320	4328921	709272	39 05 10	-96 34 50	400
2525-RGP	322	4328909	709961	39 05 09	-96 34 21	410
2616-RGP	319	4328884	708195	39 05 10	-96 35 35	380
2629-RGP	323	4328823	710821	39 05 06	-96 33 46	435
2723-RGP	321	4328671	709549	39 05 02	-96 34 39	405
2814-RGP	324	4328488	707878	39 04 57	-96 35 48	405
2819-RGP	325	4328335	708701	39 04 52	-96 35 14	410
2822-RGP	334	4328327	709498	39 04 51	-96 34 41	410
2929-RGP	327	4328244	710726	39 04 47	-96 33 50	440
2930-RGP	328	4328128	711091	39 04 43	-96 33 35	440
3120-RGP	329	4327746	708927	39 04 33	-96 35 05	430

3121-RGP	326	4327854	709293	39 04 36	-96 34 50	430
3121-RGP	330	4327805	709276	39 04 34	-96 34 51	425

Spatial Coverage Map:

Not available.

Spatial Resolution:

Approximately 0.6 [km²][gauge⁻¹].

Projection:

Not available.

Grid Description:

Not available.

Temporal Characteristics:

Temporal Coverage:

June 1, 1987 through October 15, 1987.

Temporal Coverage Map:

Not available.

Temporal Resolution:

Thirty minute rainfall depths.

Data Characteristics:

The SQL definition found in this table for the RAIN_30M.TDF file located on FIFE CD-ROM Volume 1.

Parameter/Variable Name

Parameter/Variable Source	Description	Range	Units
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SITEGRID_ID	This is a FIS grid location code. Site grid codes(SSEE-III) give the south (SS) and east (EE) cell number in a 100 x 100 array of 200 m square cells. The last 3 characters (III) are an instrument identifier.			FIS
STATION_ID	The Station ID of the location of PRINCETON the observation. See FIFE_SITE_REF UNIVERSITY for more information.	min = 301, max = 334		
OBS_DATE	The FIFE standard date of the observation.	min = 29-MAY-87, max = 26-OCT-87	[GMT]	FIS
OBS_TIME	The FIFE standard time of the observation. It is the midpoint time of the half hour period reported.	min = 15, max = 2345	[GMT]	FIS
LOCAL_OBS_DATE	The local date of the PRINCETON observations. UNIVERSITY	29-MAY-87, max = 26-OCT-87	[CDT]	
LOCAL_OBS_TIME	The local time of the PRINCETON observation. The midpoint time UNIVERSITY of the half hour period reported.	min = 15, max = 2345	[CDT]	
RAINFALL	The amount of rain recorded in GAUGE this 30 minute period.	min = .199, max = 89.948	[mm]	RAIN
FIFE_DATA_CRTFCN_CODE	The FIFE Certification Code for the data, in the following format: CPI (Certified by PI), CPI-??? (CPI - questionable data).	* CPI=checked by principal investigator, CPI-MRG=merged		FIS

data

LAST_REVISION_DATE
data, in the format (DD-MMM-YY). max = 30-MAY-88

Footnote:

* Decode the FIFE_DATA_CRTFCN_CODE field as follows:

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 are "merged" from two separate receiving stations to eliminate transmission errors. CPI-???
Investigator thinks data item may be questionable.

Sample Data Record:

SITEGRID_ID	STATION_ID	OBS_DATE	OBS_TIME	LOCAL_OBS_DATE	LOCAL_OBS_TIME
1917-RGP	305	29-MAY-87	715	29-MAY-87	215
2316-RGP	308	29-MAY-87	715	29-MAY-87	215
2321-RGP	314	29-MAY-87	715	29-MAY-87	215
3121-RGP	330	29-MAY-87	945	29-MAY-87	445
RAINFALL	FIFE_DATA_CRTFCN_CODE	LAST_REVISION_DATE			
.8120	CPI	30-MAY-88			
.4060	CPI	30-MAY-88			
.8120	CPI	30-MAY-88			
.2000	CPI	30-MAY-88			

8. Data Organization:

Data Granularity:

Thirty minute rainfall depths.

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 begins 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, path and name of the document that describes the data in this file, and name of principal investigator for these data.
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_ID)).
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:

None.

Derivation Techniques and Algorithms:

None.

Data Processing Sequence:

The rainfall was collected at 1 minute intervals, using tipping bucket rain gauges and automatic data loggers. The 1 minute data were then aggregated into 30 minute intervals.

All rainfall values of 0 were removed from the data by FIS staff, so that only observations during times in which rainfall was recorded are in the data set.

Processing Steps:

Not available at this revision.

Processing Changes:

Not available at this revision.

Calculations:**Special Corrections/Adjustments:**

Not available at this revision.

Calculated Variables:

None.

Graphs and Plots:

None.

10. Errors:**Sources of Error:**

The investigators did not provide information or specific sources of error. The FIFE Information Scientist obtained information on instrument placement and operations from A. Volkmann during a field visit. The following suggested sources of error are based on observations during that field visit.

Quality Assessment:

The rain gauge units were well constructed, but not totally suited for the Kansas environment. As noted in the [Discussion Section](#), as many as 10 of the 31 gauges might have problems at a given time. Two of the units were replaced completely during the course of the 1987 field season. Basic sources of error would include contamination of the buckets and tipping mechanism by evaporates or insects. Rainfall amounts less than the size of the bucket (0.2 mm), of course, could be lost due to evaporation. The bigger problem was corruption or loss of data in the logging unit. Although sealed, the units did not withstand the Kansas temperature and humidity ranges well. Problems included loss of seal, internal condensation or entry of water, corrosions of contacts, loss of power (battery), and inability to read data from the logging unit memory. While complete loss of data is obvious, it seems likely that some portion of the recovered data may have been corrupted when the above mentioned problems were intermittent and not sufficient to cause complete failure. Constant attention to the gauge units by A. Volkmann caught many of these problems and resulted in generally good quality for the recovered data.

Data Validation by Source:

Not available at this revision.

Confidence Level/Accuracy Judgment:

The collected data were generally of high quality and a sufficient number of gauges were working most of the time that the structure of raincells during rain events can be recovered from the data.

Measurement Error for Parameters:

Not available at this revision.

Additional Quality Assessments:

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 in 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); and
- 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:

As of the revision data of this document, the following discrepancies or errors in the data have been reported:

On July 5, 1987 a rainfall value of 89.948 mm was reported at site 317(2329-RGP) at 1815 GMT.

Site 302(1718-RGP) malfunctioned, therefore no rainfall data exists for this location.

Usage Guidance:

Only observations times in which rainfall was recorded are reported.

Two instruments existed at both the 2316 and 3121 sitegrid_id's. Therefore, two station id's exist for each of these sitegrid_id's (308 and 332 for 2316, and 326 and 330 for 3121). On dates when of the duplicate instruments, malfunctioned rainfall data can usually be obtained from the other instrument at the site.

Any Other Relevant Information about the Study:

A theoretical analysis determined that 20 - 30 rain gauges should be able to estimate storm rainfall volume in the Kings Creek Watershed to within 10% with a reliability of 15%.

12. Application of the Data Set:

This data set provides an estimation of areal storm rainfall for the terrestrial water balance model for the Kings Creek area of the FIFE study area. Using the distributed water balance model, the spatial characteristics of the land surface hydrology (infiltration, evaporation and runoff) can be estimated.

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: ornl daac@ornl.gov

Data Center Identification:

ORNL Distributed Active Archive Center
Oak Ridge National Laboratory
USA

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

Email: ornl_daac@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:

The Kings Creek Watershed 30 Minute Precipitation data are available on FIFE CD-ROM Volume 1. The CD-ROM filename is as follows:

```
\DATA\SUR_MET\RAIN_30M\GRIDxxxx\yddgrid.R30
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Where *xxxx* is the four digit code for the location within the FIFE site grid. 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 (e.g. 061 = sixty-first day in the year). The filename extension (*.sfx*), identifies the data set content for the file (see the [Data Characteristics Section](#)) and is equal to *.R30* for this data set.

17. References:

Satellite/Instrument/Data Processing Documentation.

Not available at this revision.

Journal Articles and Study Reports.

Blain, C.A., and P.C.D. Milly. 1991. Development and application of a hillslope hydrologic model. *Adv. Water Res.* (In press).

Wood, E.F., M. Sivapalan, and K. Beven. 1990. Similarity and scale in catchment storm response. *Rev. in Geophy.* 28(1).

Wood, E.F. 1990. Water balance model for Kings Creek. *Proc. of the Symposium on FIFE. Am. Meteorol. Soc.* February 7-9. Anaheim, CA, pp. 163-167.

Wood, E.F., and J.S. Famiglietti. 1991. Comparison of passive microwave and model derived estimates for soil moisture fields. *Fifth Int. Colloquium on Physical Measurements and Signatures in Remote Sensing.* Courcheval. Jan 14-18. European Space Agency. Noordwijk. The Netherlands.

Famiglietti J.S., E.F. Wood, M. Sivapalan, and D.J. Thongs. 1992. Acatchment scale water balance model for FIFE. *J. of Geophys. Res.* 97(17):18,997-19,007.

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:

AMS Automated Meteorological Station CD-ROM Compact Disk, Read-Only Memory DAAC
Distributive Active Archive Center EOSDIS Earth Observing System Data and Information
System FIS FIFE Information System URL Uniform Resource Locator

A general list of acronyms for the DAAC is available at [Acronyms](#).

20. Document Information:

May 4, 1994 (citation revised on October 15, 2002).

Warning: This document has not been checked for technical or editorial accuracy by the FIFE Information Scientist. There may be inconsistencies with other documents, technical or editorial errors that were inadvertently introduced when the document was compiled or references to preliminary data that were not included on the final CD-ROM.

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.

Document Review Date:

January 9, 1996.

Document ID:

ORNL-FIFE_RAIN_30M.

Citation:

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Wood, E. F. 1994. 30 Minute Rainfall Data (FIFE). 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. Also published in D. E. Strelbel, D. R. Landis, K. F. Huemrich, and B. W. Meeson (eds.), Collected Data of the First ISLSCP Field Experiment, Vol. 1: Surface Observations and Non-Image Data Sets. CD-ROM. National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Maryland, U.S.A. (available from http://www.daac.ornl.gov).

Document Curator:

[DAAC Staff](#)

Document URL:

<http://daac.ornl.gov>