Data User Guide

GPM Ground Validation Iowa Flood Center (IFC) NEXRAD Composite IFloodS

Introduction

The GPM Ground Validation Iowa Flood Center (IFC) NEXRAD Composite IFloodS dataset contains rain rate estimates derived using NEXt Generation Weather RADar system (NEXRAD) radars in operation during the Iowa Flood Studies (IFloodS) field campaign, in support of Global Precipitation Measurement (GPM) ground validation. NEXRAD is a network of 160 stationary S-Band radars dispersed throughout the United States and select locations abroad. Data were gathered in the vicinity of the IFloodS field campaign which took place in Iowa and surrounding areas during April 19, 2013 through June 30, 2013. This NEXRAD Composite data product is available in netCDF-4 or ASCII format with associated reflectivity browse imagery available in GIF format.

Citation

Krajewski, Witold F. 2018. GPM Ground Validation Iowa Flood Center (IFC) NEXRAD Composite IFloodS [indicate subset used]. Dataset available online from the NASA EOSDIS Global Hydrology Resource Center Distributed Active Archive Center, Huntsville, Alabama, U.S.A. doi: http://dx.doi.org/10.5067/GPMGV/IFLOODS/NEXRAD/DATA101

Keywords:

NASA, GHRC, IFC, GPM GV, Iowa Flood Center, IFC, IFloodS, Iowa, NEXRAD, rain rate, precipitation rate

Campaign

The Global Precipitation Measurement mission Ground Validation (GPM GV) campaign used a variety of methods for validation of GPM satellite constellation measurements prior to and after launch of the GPM Core Satellite, which launched on February 27, 2014. The instrument validation effort included numerous GPM-specific and joint agency/international external field campaigns, using state of the art cloud and precipitation observational infrastructure (polarimetric radars, profilers, rain gauges, and

disdrometers). These field campaigns accounted for the majority of the effort and resources expended by GPM GV. More information about the GPM mission is at https://pmm.nasa.gov/GPM/.

The Iowa Flood Studies (IFloodS) was a ground measurement campaign that took place throughout Iowa from May 1 to June 15, 2013. The main goal of IFloodS was to evaluate how well the GPM satellite rainfall data can be used for flood forecasting. Specifically, this meant collecting detailed measurements of precipitation at the Earth's surface using ground instruments and advanced weather radars and simultaneously collecting data from satellites passing overhead. The ground instruments characterize precipitation – the size and shape of raindrops, the physics of ice and liquid particles throughout the cloud and below as it falls, temperature, air moisture, and distribution of different size droplets – to improve rainfall estimates from the satellites, and in particular the algorithms that interpret raw data for the GPM mission's Core Observatory satellite, which launched in 2014. More information about IFloodS is available at https://ghrc.nsstc.nasa.gov/home/field-campaigns/ifloods.
Additional information about the Iowa Flood Center is available at http://iowafloodcenter.org/.

Instrument Description

The NEXt generation RADar(NEXRAD) system consists of 160 Weather Surveillance Radar-1988 Doppler (WSR-88D) radar sites located throughout the United States, as well as some select oversea locations (Figure 1). The system is jointly operated and maintained by the Department of Commerce, Department of Defense, and the Department of Transportation; however, the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) is the civilian agency responsible for general operations (OFCM, 2016).

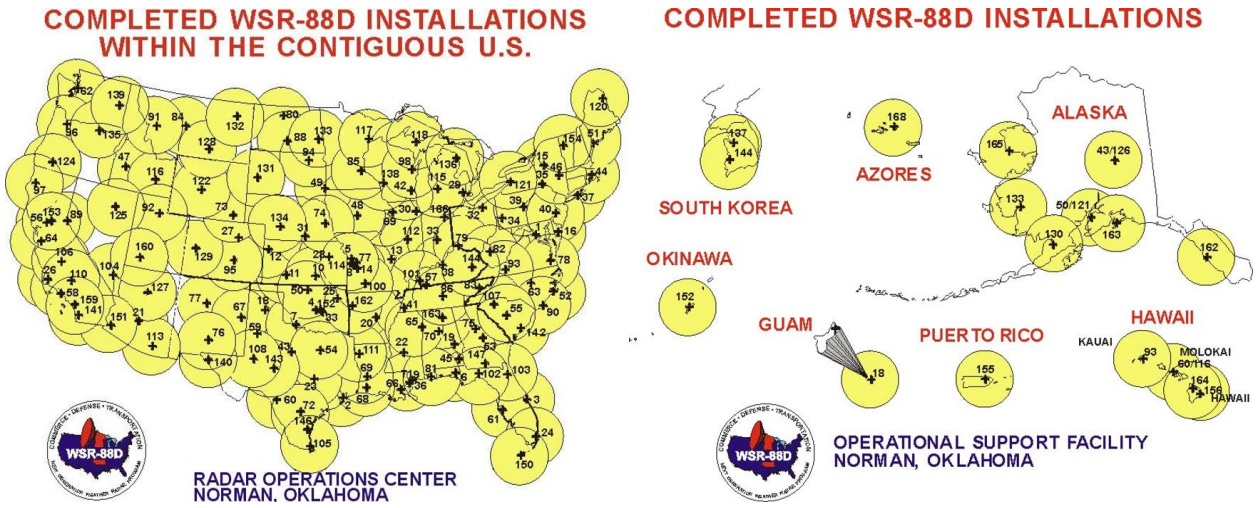

Figure 1: Location of WSR-88D NEXRAD radar stations.
Image source: (https://www.roc.noaa.gov/WSR88D/Maps.aspx)

The NEXRAD WSR-88D radars consist of a 10 cm wavelength (S-Band) Doppler ground station radar with systems that operate within a range of 2,700 - 3,000 MHz (Figure 2). There are two scan modes for each station. Mode A is a fast tracking scan that is designed to detect different types of precipitation during active weather events. Mode B is a slow-scanning mode for clearer weather used for observing air movements when there is little to no precipitation (NOAA National Center for Environmental Information, 2017). The NEXRAD radar stations collect data in a 360 degree swath, with the radar location at the center, at several predetermined elevation angles at specific periods of time. Most data products are generated from radar scan times of 4.5, 5, 6, and 10 minute periods. There are several products generated from NEXRAD, both from base data moments and dual polarization variables. These include base reflectivity, mean radial velocity, and spectrum width. Dual polarization variables include differential reflectivity, correlation coefficient, and differential phase (OFCM, 2016). Data coverage can vary by station but overall NEXRAD data are available from the mid-1990s to the present with nearly continuous archived data.

Figure 2: Image of NEXRAD radar site with antenna tower and radome.
Image Source: (https://www.ll.mit.edu/mission/aviation/faawxsystems/nexrad.html)

More information about the WRS-88D NEXRAD system can be found in the Federal Meteorological Handbooks at the Office of the Federal Coordinator for Meteorological Services and Supporting Research (http://www.ofcm.gov/publications/fmh/allfmh2.htm) as well as from NOAA's Nationa Center for Environmental Information (NCEI) site located at NOAA (https://www.ncdc.noaa.gov/data-access/radar-data/nexrad).

Investigators

Witold F. Krajewski
Iowa Flood Center
Iowa City, Iowa

Data Characteristics

The GPM Ground Validation Iowa Flood Center (IFC) NEXRAD Composite IFloodS dataset is a special product constructed from a composite of NEXRAD data. The dataset contains rain rate estimates in 5-minute intervals throughout Iowa in netCDF-4 or ASCII format with associated reflectivity images provided in GIF format. These data files are considered Level 2 products. More information about the NASA data processing levels are available on the [NASA Data Processing Levels website](#).

Table 1: Data Characteristics

Characteristic	Description
Platform	Ground Stations
Instrument	NEXt generation RADar (NEXRAD) WSR-88D
Projection	n/a
Spatial Coverage	N: 44.534, S: 40.133, E: -89.904, W: -97.154 (Iowa)
Spatial Resolution	1 km
Temporal Coverage	April 19, 2013 - June 30, 2013
Temporal Resolution	5 minutes
Sampling Frequency	<1 second
Parameter	Rain rate
Version	1
Processing Level	2

File Naming Convention

The GPM Ground Validation Iowa Flood Center (IFC) NEXRAD Composite IFloodS dataset is available in both ASCII and netCDF-4 format. The data files consist of rain rate estimates derived from NEXRAD radar data. Associated reflectivity images in GIF format are al. These data files are in the file naming convention as shown below.

netCDF-4 Data Files: ifloods_NEXRAD_IFC_Comp_nx2_G_YYYYMMDD_hhmm_I0007.nc
ASCII Data Files:
ifloods_NEXRAD_IFC_Comp_H99999999_I000#_G_YYYYMMDD_hhmmss.out.gz
Browse Files:
ifloods_NEXRAD_IFC_Comp_H99999999_I000#_G_YYYYMMDD_hhmmss.out.gif

Table 2: File naming convention variables

Variable	Description
YYYY	Four-digit year
MM	Two-digit month
DD	Two-digit day
hh	Two-digit hour in UTC
mm	Two-digit minute in UTC
.nc	netCDF-4 format
I000#	Rainfall intensity product generation using a given '#' of radar

	i.e. I0007 rainfall intensity product is generated by data from 7 radar
ss	Two-digit second in UTC
.gz	Compressed ASCII file
.gif	Graphics Interchange Format

Data Format and Parameters

This dataset consists of rain rate estimates in netCDF-4 and ASCII formats. The ASCII data are considered to be the raw data, while the netCDF-4 files are easier to use for analysis purposes. Browse images showing radar reflectivity are also available in GIF format. Table 3 lists and describes the variables available within the netCDF-4 data files.

Table 3: Data Fields within netCDF-4 files

Field Name	Description	Data Type	Unit
latitude	latitude	float	degrees
longitude	longitude	float	degrees
RainRate	Rain rate estimate	float	mm/hr
time	Time of estimate	int	Seconds since date and time given in file name

Quality Assessment

The Base Reflectivity products within the browse images available in this dataset have undergone data quality assurance by NOAA which results in an intermediate, elevation cut product of 50 km radar range. Further, data processing and product generation for other level 2 data products is generated using the DQA product, including the base reflectivity browse images available in these datasets. For information about the algorithms used, see Part C of the Federal Meteorological Handbook No. 3 (OFCM, 2017).

Software

These data are available in ASCII and netCDF-4 formats, so no software is required to view these data; however, Panoply can be used to easily visualize the netCDF-4 data files.

Known Issues or Missing Data

In the ASCII data files, -99.0 are considered to be missing or no data.

In general for the NEXRAD system, occasional data gaps and missing data are common. Typical causes of missing data include scheduled maintenance of an individual radar, severe weather, communication problems, and data archiving issues.

References

OFCM (2017): Federal Meteorological Handbook Part C: WSR-88D Products and Algorithms. Silver City, MD. Retrieved from http://www.ofcm.gov/publications/fmh/FMH11/fmh11partC.pdf

Related Data

All data from other instruments collected during the IFloodS field campaign are related to this dataset. Other IFloodS campaign data can be located using the GHRC HyDRO 2.0 search tool.

In addition, the following datasets are considered to be related datasets:

GPM Ground Validation NEXRAD Level II KDVN IFloodS
(http://dx.doi.org/10.5067/IFLOODS/NEXRAD/DATA203)

GPM Ground Validation NEXRAD Level II KDMX IFloodS
(http://dx.doi.org/10.5067/IFLOODS/NEXRAD/DATA202)

GPM Ground Validation NEXRAD Level II KARX IFloodS
(http://dx.doi.org/10.5067/IFLOODS/NEXRAD/DATA201)

GPM Ground Validation NEXRAD Level II KMPX IFloodS
(http://dx.doi.org/10.5067/IFLOODS/NEXRAD/DATA204)

GPM Ground Validation NEXRAD Level III KMPX IFloodS
(http://dx.doi.org/10.5067/GPMGV/IFLOODS/NEXRAD/DATA501)

GPM Ground Validation NEXRAD Level III KDVN IFloodS
(http://dx.doi.org/10.5067/GPMGV/IFLOODS/NEXRAD/DATA301)

GPM Ground Validation NEXRAD Level III KDMX IFloodS
(http://dx.doi.org/10.5067/GPMGV/IFLOODS/NEXRAD/DATA401)

GPM Ground Validation NEXRAD Level III KARX IFloodS
(http://dx.doi.org/10.5067/GPMGV/IFLOODS/NEXRAD/DATA201)

Contact Information

To order these data or for further information, please contact:

NASA Global Hydrology Resource Center DAAC
User Services
320 Sparkman Drive
Huntsville, AL 35805
Phone: 256-961-7932

E-mail: support-ghrc@earthdata.nasa.gov
Web: https://ghrc.nsstc.nasa.gov/

Created: March 19, 2018