National Aeronautics and Space Administration Goddard Earth Science Data Information and Services Center (GES DISC)

README Document for Famine Early Warning Systems Network (FEWS NET) Land Data Assimilation System (FLDAS) Products

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Revision History

Revision Date	***Changes***	***Author***
08/05/2015	Initial version based on information from Amy McNally.	Hualan Rui
09/28/2015	Add information for VIC model	Hualan Rui
12/09/2015	Update the Table 2 and Table 3	Hualan Rui
04/12/2016	Add new data products from simulation "C"	Hualan Rui
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10/12/2016	Add daily FLDAS products	Hualan Rui
11/21/2016	Review and revise	Amy McNally
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04/28/2017	Add new variable for Noah simulation "C"	Carlee Loeser
08/02/2017	Update URLs to comply with new GES DISC website	Carlee Loeser
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12/08/2017	Add new climatology and anomaly products	Carlee Loeser
08/08/2018	Remove note about concatenation with GrADS and CDO – known issues resolved	Carlee Loeser
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07/10/2019	Correct variable long names for Rainf_f_tavg	Carlee Loeser
09/12/2019	Remove regional FLDAS monthly "C" data	Carlee Loeser
10/02/2019	Add CHIRPS spatial extent information	Carlee Loeser
11/05/2019	Remove regional FLDAS monthly and daily "A" data	Carlee Loeser
11/18/2020	Add "What's New?" section for post-processing details	Carlee Loeser
04/13/2021	Add new datasets and THREDDS data access	Carlee Loeser
09/14/2021	Review and revise	Xiaohua Pan
07/12/2022	Add new citation to References	Stephanie Stettz

Table of Contents

1 Introduction

This document provides the basic information for using the Famine Early Warning Systems Network (FEWS NET) Land Data Assimilation System (FLDAS) products.

The Famine Early Warning Systems Network (FEWS NET) Land Data Assimilation System (FLDAS) is a custom instance of the NASA Land Information System (LIS; http://lis.gsfc.nasa.gov) that has been adapted to work with domains, data streams, and monitoring and forecast requirements associated with food security assessment in data-sparse, developing country settings. Adopting LIS allows FEWS NET to leverage existing land surface models and generate ensembles of soil moisture, evapotranspiration (ET), and other variables based on multiple meteorological inputs or land surface models. The goal of the FLDAS project is to achieve more effective use of limited available hydroclimatic observations and is designed to be adopted for routine use for FEWS NET decision support.

The FLDAS includes a crop water balance model used operationally by FEWS NET (GeoWRSI: Verdin and Klaver, 2002; Senay and Verdin, 2003), Africa-specific daily rainfall from NOAA Climate Prediction Center (RFE2; Xie and Arkin, 1997), and CHIRPS, a quasi-global rainfall dataset designed for seasonal drought monitoring and trend analysis (Funk et al., 2014). A temporal desegregation scheme is implemented so that daily rainfall inputs can be used in both energy and water balance calculations, an irrigation module, and global irrigation and crop maps. State-of-the-practice land data assimilation methods are available in LIS and will be explored in an associated forecasting project.

1.1 Dataset Description

FLDAS data are produced from the Noah version 3.6.1 Land Surface Model (LSM), with three simulation runs, “C” and “CP” globally, and “G” regionally over Central Asia.

Simulation run “C” refers to the simulation run forced by the Modern-Era Retrospective analysis for Research and Applications version 2 (MERRA-2) data combined with Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS) for precipitation measurements. The spatial extent of CHIRPS rainfall inputs is 50°S-50°N (Funk et al., 2015). For regions beyond the CHIRPS domain, MERRA-2 is used as precipitation inputs. Simulation run “C” was initialized on January 1, 1982 using soil moisture and other state fields from the respective FLDAS model climatology for that day of the year.

Simulation run “CP” refers to the simulation run forced by the Global Data Assimilation System (GDAS) data combined with CHIRPS-PRELIM for precipitation measurements. The CHIRPS-PRELIM data is the preliminary, near-real time version of the CHIRPS data. For regions beyond the CHIRPS domain, GDAS is used for precipitation inputs. Simulation run “CP” was initialized on January 1, 2019.

Simulation run "G" refers to the simulation run in the Asia-LIS system forced by GDAS data, and covers only the central Asia domain from 21-56°N and 30-100°E. A nine-year spin-up of the Asia-LIS system was performed to produce stable snow and soil conditions, and the resulting model states were compared with MODIS Maximum Snow Extent data for the spin-up period and adjusted to produce a climatological model state for October 1. Next, the Asia-LIS model was run from October 1, 2000 to September 30, 2011, producing outputs once per day, and resetting the model states to the climatological state on October 1 of each year so that each hydrologic year begins with a consistent set of surface states (LIS Central Asia Readme).

Table 1. Basic Characteristics of the FLDAS monthly, monthly climatology, and monthly anomaly, global data.

Contents	Forcing data, Noah Land Surface Model output
Format	netCDF
Latitude Extent	-60° to 90°
Longitude Extent	-180° to 180°
Spatial Resolution	0.1° x 0.1°
Temporal Resolution	Monthly
Temporal Coverage	January 1982 to present ("C"); January 2019 to present ("CP")
Dimension (lat x lon)	1500 x 3600
Grid box center points	Lower left: -59.95°, -179.95° Upper right: 89.95°, 179.95°

Table 2. Basic Characteristics of the FLDAS daily, Central Asia data.

Contents	Forcing data, Noah Land Surface Model output
Format	netCDF
Latitude Extent	21° to 56°
Longitude Extent	30° to 100°
Spatial Resolution	0.01° x 0.01°
Temporal Resolution	Daily
Temporal Coverage	October 2000 to present
Dimension (lat x lon)	3500 x 7000
Grid box center points	Lower left: 21.005°, 30.005° Upper right: 55.995°, 99.995°

1.2 Data Disclaimer

Please periodically check the GES DISC website for the latest FLDAS data. FLDAS "C" data is delivered about three weeks after the month concludes. FLDAS "CP" data is delivered within one week after the month concludes. FLDAS "G" daily data is delivered the next day.

1.2.1 Acknowledgment

Please refer to McNally et al. (2017) for more information about the FLDAS project.

McNally, A. *et al.* A land data assimilation system for sub-Saharan Africa food and water security applications. *Sci. Data* 4:170012 doi: 10.1038/sdata.2017.12 (2017)

NASA requests including the following acknowledgment in papers published using these data: "*The data used in this study were acquired as part of the mission of NASA's Earth Science Division and archived and distributed by the Goddard Earth Sciences (GES) Data and Information Services Center (DISC).*"

We would appreciate receiving a copy of your publication, which can be forwarded to the following email address: gsfc-dl-help-disc@mail.nasa.gov

1.2.2 Contact Information

For information about or assistance in using any GES DISC data, please contact the GES DISC Help Desk at:

GES DISC
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For general science questions and comments, please contact:

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1.2.3 Digital Object Identifier (DOI) and Citation

A Digital Object Identifier or DOI is a unique alphanumeric string used to identify a digital object and provide a permanent link online. DOIs are often used in online publications in citations. Table 3 lists DOIs for FLDAS data products.

Table 3. DOIs for FLDAS Version 001 Data Products

Product Name	**DOI**
FLDAS_NOAH01_C_GL_M_001	10.5067/5NHC22T9375G
FLDAS_NOAH01_C_GL_MA_001	10.5067/GNKZZBAYDF4W
FLDAS_NOAH01_C_GL_MC_001	10.5067/9JBLK69HNL3V

FLDAS_NOAH01_CP_GL_M_001	10.5067/L8GPRQWAWHE3
FLDAS_NOAH001_G_CA_D_001	10.5067/VQ4CD3Y9YC0R

Each of the DOIs in Table 3 is linked to the corresponding data product page, and the Data Citation for the data product is located on the page. If you use these data in your research or applications, please include a reference in your publication(s) similar to the following example: Amy McNally, NASA/GSFC/HSL (2018), *FLDAS Noah Land Surface Model L4 Global Monthly 0.1 x 0.1 degree (MERRA-2 and CHIRPS)*, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed [**Data Access Date]**, 10.5067/5NHC22T9375G

1.3 What are the differences between FLDAS Global data and GLDAS data?

The FEWS NET LDAS is optimized for FEWS NET agricultural drought monitoring applications in Africa, Central America, and Central Asia. By using CHIRPS rainfall and MERRA-2 meteorological inputs, the FLDAS produces hydrologic estimates (for the "C" run) from 1982-present, at 10 km resolution, and ~1 month latency, that are consistent with other FEWS NET products that are forced with CHIRPS and MERRA-2. The FLDAS also shares many features with GLDAS: both use NASA LIS 7 as the underlying software framework, as well as FAO soils parameters, and provide similar input and output variables. The main differences are the meteorological inputs, the spatial resolution (10 km), and the LSM model version (Noah-3.6.1). For more information on GLDAS data, please refer to the GLDAS Readme document: https://hydro1.gesdisc.eosdis.nasa.gov/data/GLDAS/README_GLDAS2.pdf.

1.4 What's New?

The regional FLDAS Noah Land Surface Model and VIC Land Surface Model monthly data for the "C" runs were decommissioned on September 16, 2019. The regional FLDAS Noah LSM and VIC LSM daily and monthly data for the "A" runs were decommissioned on November 1, 2019. FLDAS users are encouraged to use the global datasets, which span the same temporal range as the regional datasets and encompass all three of the African regions.

In November 2020, all FLDAS data were post-processed with the MOD44W MODIS land mask. Previously, some grid boxes over inland water had non-missing values where the model considered these as land data, as opposed to open water. The post-processing corrected this issue and masked out all model output data over inland water. This issue only affected model output data variables, and all of the meteorological forcing variables (denoted by a _f_ in their short names) were unchanged. If you have downloaded the FLDAS data prior to November 2020, please download the data again to receive this update. The MOD44W MODIS land mask is available to download from the FLDAS Project site: https://ldas.gsfc.nasa.gov/fldas/vegetation-class.

In April 2021, two new FLDAS datasets were added to the FLDAS mission. They are: FLDAS Noah Land Surface Model L4 Global Monthly 0.1 x 0.1 degree (GDAS and CHIRPS-PRELIM) V001, and FLDAS Noah Land Surface Model L4 Central Asia Daily 0.01 x 0.01 degree V001.

2 Data Organization

The currently released FLDAS data are version 001 monthly, monthly climatology, monthly anomaly, and daily data.

2.1 File Naming Convention

FLDAS data are grouped and named based on LSM, spatial resolution, forcing data, spatial coverage, and temporal resolution as listed below. Each group is referred to as a data product and named in accordance with the following convention:
FLDAS_<Model><Grid spacing>_<Forcing type>_<Region>_<Temporal spacing>

Attribute	Description
<Model>	"NOAH" for the Noah LSM
<Grid spacing>	"01" for 0.1 degree
	"001" for 0.01 degree
<Forcing type>	"C" for forced with MERRA-2 and CHIRPS data
	"CP" for forced with GDAS and CHIRPS-Prelim data
	"G" for forced with GDAS data
<Region>	"GL" for Global
	"CA" for Central Asia
<Temporal Spacing>	"D" for daily data
	"M" for monthly data
	"MA" for monthly anomaly data
	"MC" for monthly climatology data

For example, FLDAS_NOAH01_C_GL_M is the product name for the FLDAS global monthly data from the Noah LSM forced by MERRA-2 and CHIRPS data, at 0.1 x 0.1 degree resolution.

FLDAS data files are named in accordance with the following convention:
Monthly: <Product ID>.A<Date>.<Product version>.nc
Monthly anomaly: <Product ID>.ANOM<Date>.<Product version>.nc
Monthly climatology: <Product ID>.CLIM<Date>.<Product version>.nc

Attribute	Description
<Product ID>	Data Product Short Name (see Table 4)
<Date>	<YYYYMM> for monthly, monthly anomaly, and monthly climatology data products
<Product version>	"001" for Version 1

For example, “FLDAS_NOAH01_C_GL_MA.ANOM201204.001.nc” is the filename for version 1 of the FLDAS monthly anomaly global data from the Noah LSM forced by MERRA-2 and CHIRPS data, at 0.1 x 0.1 degree resolution for April 2012.

2.2 File Format and Structure

The FLDAS data are archived in NetCDF format. NetCDF is a set of software libraries and self-describing, machine-independent data formats that support the creation, access, and sharing of array-oriented scientific data [see more].

3 Data Contents

3.1 Data Products

Based on the data product naming convention listed in Section 2.1, the three FLDAS data products that are currently available at the GES DISC are named in Table 4.

Table 4. FLDAS Data Products

	Model	**Forcing Data**	**Region**	**Data Product Short Name**
Monthly	**Noah**	MERRA-2 and CHIRPS Referred to as "C"	Global (GL)	FLDAS_NOAH01_C_GL_M
Monthly	**Noah**	GDAS and CHIRPS-Prelim Referred to as “CP”	Global (GL)	FLDAS_NOAH01_CP_GL_M
Daily	**Noah**	GDAS Referred to as “G”	Central Asia (CA)	FLDAS_NOAH001_G_CA_D
Monthly Anomaly	**Noah**	MERRA-2 and CHIRPS Referred to as "C"	Global (GL)	FLDAS_NOAH01_C_GL_MA
Monthly Climatology	**Noah**	MERRA-2 and CHIRPS Referred to as "C"	Global (GL)	FLDAS_NOAH01_C_GL_MC

3.2 Data Parameters

3.2.1 FLDAS Global Model Data: Monthly

The FLDAS monthly datasets from the Noah LSM (FLDAS_NOAH01_C_GL_M, FLDAS_NOAH01_CP_GL_M) contain 28 fields, as listed in Table 5a.

Table 5a. Parameters from FLDAS Noah model data for the monthly dataset.

Short Name	**Description**	**Unit**
Evap_tavg	Evapotranspiration	kg m-2 s-1
LWdown_f_tavg	Downward longwave radiation flux	W m-2
Lwnet_tavg	Net longwave radiation flux	W m-2
Psurf_f_tavg	Surface pressure	Pa
Qair_f_tavg	Specific humidity	kg kg-1
Qg_tavg	Soil heat flux	W m-2
Qh_tavg	Sensible heat net flux	W m-2
Qle_tavg	Latent heat net flux	W m-2
Qs_tavg	Storm surface runoff	kg m-2 s-1
Qsb_tavg	Baseflow-groundwater runoff	kg m-2 s-1
RadT_tavg	Surface radiative temperature	K
Rainf_f_tavg	Rainfall flux	kg m-2 s-1
SnowCover_inst	Snow cover	fraction
SnowDepth_inst	Snow depth	m
Snowf_tavg	Snowfall rate	kg m-2 s-1
SoilMoi00_10cm_tavg	Soil moisture (0 - 10 cm underground)	m^3 m-3
SoilMoi10_40cm_tavg	Soil moisture (10 - 40 cm underground)	m^3 m-3
SoilMoi100_200cm_tavg	Soil moisture (100 - 200 cm underground)	m^3 m-3
SoilMoi40_100cm_tavg	Soil moisture (40 - 100 cm underground)	m^3 m-3
SoilTemp00_10cm_tavg	Soil temperature (0 - 10 cm underground)	K
SoilTemp10_40cm_tavg	Soil temperature (10 - 40 cm underground)	K
SoilTemp100_200cm_tavg	Soil temperature (100 - 200 cm underground)	K
SoilTemp40_100cm_tavg	Soil temperature (40 - 100 cm underground)	K
SWdown_f_tavg	Surface downward shortwave radiation	W m-2
SWE_inst	Snow water equivalent	kg m-2
Swnet_tavg	Net shortwave radiation flux	W m-2
Tair_f_tavg	Near surface air temperature	K
Wind_f_tavg	Near surface wind speed	m s-1

The short names with "_f" are forcing variables.

3.2.2 FLDAS Global Model Data: Monthly Anomaly and Monthly Climatology

The FLDAS data for monthly anomaly (FLDAS_NOAH01_C_GL_MA) and monthly climatology (FLDAS_NOAH01_C_GL_MC) products are derived from the monthly data. The monthly climatology data are generated from the monthly data, as a 35-year (1982-2016) monthly average. The monthly anomaly data are generated by taking the difference between the monthly data and monthly climatology data for each grid point. This difference represents how the given month compares to the 35-year climatology. The FLDAS monthly anomaly and monthly climatology data contain eight fields, as listed in Table 5b.

Table 5b. Parameters from FLDAS Noah model data for monthly anomaly and monthly climatology datasets.

Short Name	**Description**	**Unit**
Evap_tavg	Evapotranspiration	kg m-2 s-1
Qtotal_tavg	Total runoff (surface + subsurface)	kg m-2 s-1
Rainf_f_tavg	Rainfall flux	kg m-2 s-1
SoilMoi00_10cm_tavg	Soil moisture (0 – 10 cm underground)	m^3 m-3
SoilMoi10_40cm_tavg	Soil moisture (10 – 40 cm underground)	m^3 m-3
SoilMoi100_200cm_tavg	Soil moisture (100 – 200 cm underground)	m^3 m-3
SoilMoi40_100cm_tavg	Soil moisture (40 – 100 cm underground)	m^3 m-3
Tair_f_tavg	Near surface air temperature	K

The short names with "_f" are forcing variables.

3.2.3 FLDAS Central Asia Model Data: Daily

The FLDAS daily data from the Noah LSM (FLDAS_NOAH001_G_CA_D) contain 23 fields, as listed in Table 5c.

Table 5c. Parameters from FLDAS Noah model data for the monthly dataset.

Short Name	**Description**	**Unit**
Evap_tavg	Evapotranspiration	kg m-2 s-1
Psurf_f_tavg	Surface pressure	Pa
Qair_f_tavg	Specific humidity	kg kg-1
Qs_tavg	Storm surface runoff	W m-2
Qsb_tavg	Baseflow-groundwater runoff	kg m-2 s-1
Qsm_tavg	Snowmelt	kg m-2 s-1
RadT_tavg	Surface radiative temperature	K
Rainf_f_tavg	Rainfall flux	kg m-2 s-1
Rainf_tavg	Total precipitation rate	kg m-2 s-1
SnowDepth_inst	Snow depth	m
Snowf_tavg	Snowfall rate	kg m-2 s-1

SoilMoi00_10cm_tavg	Soil moisture (0 - 10 cm underground)	m^3 m-3
SoilMoi10_40cm_tavg	Soil moisture (10 - 40 cm underground)	m^3 m-3
SoilMoi100_200cm_tavg	Soil moisture (100 - 200 cm underground)	m^3 m-3
SoilMoi40_100cm_tavg	Soil moisture (40 - 100 cm underground)	m^3 m-3
SoilTemp00_10cm_tavg	Soil temperature (0 - 10 cm underground)	K
SoilTemp10_40cm_tavg	Soil temperature (10 - 40 cm underground)	K
SoilTemp100_200cm_tavg	Soil temperature (100 - 200 cm underground)	K
SoilTemp40_100cm_tavg	Soil temperature (40 - 100 cm underground)	K
SWdown_f_tavg	Surface downward shortwave radiation	W m-2
SWE_inst	Snow water equivalent	kg m-2
Swnet_tavg	Net shortwave radiation flux	W m-2
Tair_f_tavg	Near surface air temperature	K

The short names with "_f" are forcing variables.

Soil moisture percentiles are an indicator of growing season conditions in the context of historical observations. More information about the soil moisture percentiles can be found at http://lis.gsfc.nasa.gov/sites/default/files/LIS/docs/SoilMoisturePercentile.pdf.

4 Options for Reading the Data

4.1 Utilities

The FLDAS data are archived in self-describing and machine-independent netCDF format. The Unidata page, http://www.unidata.ucar.edu/software/netcdf/software.html, provides a list of software for manipulating or displaying netCDF Data.

4.2 Panoply

Panoply, https://www.giss.nasa.gov/tools/panoply/, is a cross-platform application that plots geo-referenced and other arrays from netCDF, HDF, GRIB, and other datasets.
The How-To section of NASA GES DISC provides a recipe for Quick View Data with Panoply.

4.3 GrADS

The Grid Analysis and Display System (GrADS) is an interactive desktop tool for easy access, manipulation, and visualization of earth science data. GrADS supports several data formats, such as binary, NetCDF, HDF, and GRIB. The documentation and software for GrADS can be found at: http://cola.gmu.edu/grads/.

Each individual FLDAS NetCDF file can be opened by GrADS sdfopen directly without a data descriptor file (aka ctl file). After calling sdfopen, GrADS commands, such as “q file”, “d [variable_name]”, etc. can be used to query file information, read and display the data. Below is an example showing how to sdfopen a FLDAS NetCDF file and query for the dimensions and variables of the file.

```
hrui@hydro1:~/FLDAS_1.0$ grads

              Welcome to the OpenGrADS Bundle Distribution
              -------------------------------------------

For additional information enter "grads -h".

Starting "/opt/grads-
2.1.a2.oga.1/Linux/Versions/2.1.a2.oga.1/x86_64/grads   " ...


Grid Analysis and Display System (GrADS) Version 2.1.a2.oga.1
Copyright (c) 1988-2013 by the Institute for Global Environment and
Society (IGES)
GrADS comes with ABSOLUTELY NO WARRANTY
See file COPYRIGHT for more information

Config: v2.1.a2.oga.1 little-endian readline grib2 netcdf hdf4-sds
hdf5 opendap-grids,stn athena geotiff shapefile cairo
Issue 'q config' command for more detailed configuration information
Loading User Defined Extensions table </opt/grads-
2.1.a2.oga.1/Linux/Versions/2.1.a2.oga.1/x86_64/gex/udxt> ... ok.
Landscape mode? ('n' for portrait):
GX Package Initialization: Size = 11 8.5
ga-> sdfopen FLDAS_NOAH01_C_GL_M.A200101.001.nc
Scanning self-describing file:  FLDAS_NOAH01_C_GL_M.A200101.001.nc
SDF file FLDAS_NOAH01_C_GL_M.A200101.001.nc is open as file 1
LON set to -179.95 179.95
LAT set to -59.95 59.95
LEV set to 0 0
Time values set: 2001:1:1:0 2001:1:1:0
E set to 1 1
ga-> q file
File 1 : LVT land surface analysis output
  Descriptor: FLDAS_NOAH01_C_GL_M.A200101.001.nc
  Binary: FLDAS_NOAH01_C_GL_M.A200101.001.nc
  Type = Gridded
  Xsize = 3600  Ysize = 1500  Zsize = 1  Tsize = 1  Esize = 1
  Number of Variables = 28
     evap_tavg  0  t,y,x  total evapotranspiration
     lwdown_f_tavg  0  t,y,x  surface downward longwave radiation
     lwnet_tavg  0  t,y,x  net downward longwave radiation
     psurf_f_tavg  0  t,y,x  surface pressure
     qair_f_tavg  0  t,y,x  specific humidity
     qg_tavg  0  t,y,x  soil heat flux
     qh_tavg  0  t,y,x  sensible heat flux
     qle_tavg  0  t,y,x  latent heat flux
     qs_tavg  0  t,y,x  surface runoff
     qsb_tavg  0  t,y,x  subsurface runoff amount
```

```
     radt_tavg  0  t,y,x  surface radiative temperature
     rainf_f_tavg  0  t,y,x  rainfall flux
     snowcover_inst  0  t,y,x snow cover
     snowdepth_inst  0  t,y,x snow depth
     snowf_tavg  0  t,y,x snowfall rate
     soilmoi00_10cm_  0  t,y,x  soil moisture content
     soilmoi10_40cm_  0  t,y,x  soil moisture content
     soilmoi40_100cm  0  t,y,x  soil moisture content
     soilmoi100_200c  0  t,y,x  soil moisture content
     soiltemp00_10cm  0  t,y,x  soil temperature
     soiltemp10_40cm  0  t,y,x  soil temperature
     soiltemp40_100c  0  t,y,x  soil temperature
     soiltemp100_200  0  t,y,x  soil temperature
     swdown_f_tavg  0  t,y,x  surface downward shortwave radiation
     swe_inst  0  t,y,x snow water equivalent
     swnet_tavg  0  t,y,x  net downward shortwave radiation
     tair_f_avg  0  t,y,x  air temperature
     wind_f_avg  0  t,y,x  wind speed
ga->
```

With a GrADS descriptor file, by using GrADS command xdfopen, multiple FLDAS NetCDF files can be opened, therefore, time aggregation related visualization and data analysis can be done by GrADS. Below is a GrADS sample descriptor file for monthly 0.1 x 0.1 degree Noah model data product FLDAS_NOAH01_C_GL_M.001.

FLDAS_NOAH01_C_GL_M.001.xdf, a sample data descriptor file

```
DSET FLDAS_NOAH01_C_GL_M.A%y4%m2.001.nc
OPTIONS template
TDEF time   411  LINEAR      Jan2001  1mo
*** variable name may not appear completely (max 15 characters)
```

An example for using xdfopen to open **FLDAS_NOAH01_C_GL_M.001.XDF**

```
ga-> xdfopen FLDAS_NOAH01_C_GL_M.001.XDF
Scanning Descriptor File:  FLDAS_NOAH01_C_GL_M.001.XDF
SDF file /var/tmp/hrui/FLDAS/FLDAS_NOAH01_C_GL_M.A%y4%m2.001.nc is
open as file 1
LON set to -179.95 179.95
LAT set to -59.95 59.95
LEV set to 0 0
Time values set: 2001:1:1:0 2001:1:1:0
E set to 1 1
ga-> q file
File 1 : LIS land surface model output
  Descriptor: FLDAS_NOAH01_C_GL_M.001.XDF
  Binary: /var/tmp/hrui/FLDAS/FLDAS_NOAH01_C_GL_M.A%y4%m2.001.nc
  Type = Gridded
  Xsize = 3600  Ysize = 1500  Zsize = 1  Tsize = 411  Esize = 1
  Number of Variables = 28
     evap_tavg  0  t,y,x  total evapotranspiration
     lwdown_f_tavg  0  t,y,x  surface downward longwave radiation
     lwnet_tavg  0  t,y,x  net downward longwave radiation
     psurf_f_tavg  0  t,y,x  surface pressure
     qair_f_tavg  0  t,y,x  specific humidity
     qg_tavg  0  t,y,x  soil heat flux
```

```
     qh_tavg  0  t,y,x  sensible heat flux
     qle_tavg  0  t,y,x  latent heat flux
     qs_tavg  0  t,y,x  surface runoff
     qsb_tavg  0  t,y,x  subsurface runoff amount
     radt_tavg  0  t,y,x  surface radiative temperature
     rainf_f_tavg  0  t,y,x  rainfall flux
     snowcover_inst  0  t,y,x snow cover
     snowdepth_inst  0  t,y,x snow depth
     snowf_tavg  0  t,y,x snowfall rate
     soilmoi00_10cm_  0  t,y,x  soil moisture content
     soilmoi10_40cm_  0  t,y,x  soil moisture content
     soilmoi40_100cm  0  t,y,x  soil moisture content
     soilmoi100_200c  0  t,y,x  soil moisture content
     soiltemp00_10cm  0  t,y,x  soil temperature
     soiltemp10_40cm  0  t,y,x  soil temperature
     soiltemp40_100c  0  t,y,x  soil temperature
     soiltemp100_200  0  t,y,x  soil temperature
     swdown_f_tavg  0  t,y,x  surface downward shortwave radiation
     swe_inst  0  t,y,x snow water equivalent
     swnet_tavg  0  t,y,x  net downward shortwave radiation
     tair_f_avg  0  t,y,x  air temperature
     wind_f_avg  0  t,y,x  wind speed
ga->
```

5 Data Services

The NASA GES DISC maintains archives of all FLDAS data products and many other Hydrology data sets. The archived data can be accessed via HTTPS network transfer. FLDAS data can be accessed via the GES DISC Unified User Interface (UUI) at https://disc.gsfc.nasa.gov/datasets?keywords=FLDAS.

5.1 HTTPS Access

The FLDAS data can be downloaded directly via the GES DISC HTTPS server: https://hydro1.gesdisc.eosdis.nasa.gov/data/FLDAS/.

5.2 EOSDIS Earthdata Search System

The EarthData Search can be used to find and retrieve datasets across multiple data centers: https://search.earthdata.nasa.gov/search?q=FLDAS&ok=FLDAS.

5.3 OPeNDAP Access

The FLDAS data can be accessed via OPeNDAP for variable and spatial subsetting: https://hydro1.gesdisc.eosdis.nasa.gov/opendap/hyrax/FLDAS/.

5.4 Giovanni

The GES-DISC Interactive Online Visualization ANd aNalysis Interface (Giovanni) is a web-based tool that allows users to interactively visualize and analyze data: https://giovanni.gsfc.nasa.gov/giovanni/#dataKeyword=FLDAS.

5.5 THREDDS (TDS)

The THREDDS Data Server for this mission provides data access to aggregated datasets through OPeNDAP, WCS, WMS, and various others. The datasets are aggregated to one file, where the spatial extent and variables can be subsetted and retrieved.
Monthly data:
https://hydro1.gesdisc.eosdis.nasa.gov/thredds/catalog/FLDAS_aggregation/FLDAS_NOAH01_C_GL_M.001/catalog.html?dataset=fldas_aggregation/FLDAS_NOAH01_C_GL_M.001/FLDAS_NOAH01_C_GL_M.001_Aggregation.ncml
Monthly anomaly data:
https://hydro1.gesdisc.eosdis.nasa.gov/thredds/catalog/FLDAS_aggregation/FLDAS_NOAH01_C_GL_MA.001/catalog.html?dataset=fldas_aggregation/FLDAS_NOAH01_C_GL_MA.001/FLDAS_NOAH01_C_GL_MA.001_Aggregation.ncml
Monthly climatology data:
https://hydro1.gesdisc.eosdis.nasa.gov/thredds/catalog/FLDAS_aggregation/FLDAS_NOAH01_C_GL_MC.001/catalog.html?dataset=fldas_aggregation/FLDAS_NOAH01_C_GL_MC.001/FLDAS_NOAH01_C_GL_MC.001_Aggregation.ncml
There are published How-To articles to walk users through accessing aggregated data through TDS:
How to Obtain a Time Series at a Single Point using TDS
How to Obtain a Spatially Subsetted Time Series using TDS

If you need assistance with data services or wish to report a problem:

Email: gsfc-dl-help-disc@mail.nasa.gov
Voice: 301-614-5224
Fax: 301-614-5268
Address:
Goddard Earth Sciences Data and Information Services Center NASA Goddard Space Flight Center Code 610.2 Greenbelt, MD 20771 USA

6 More Information

6.1 Data Volume

Product	Average File Size	Average Volume per year
FLDAS_NOAH01_C_GL_M	117 MB	1.4 GB
FLDAS_NOAH01_CP_GL_M	117 MB	1.4 GB
FLDAS_NOAH01_C_GL_MA	38 MB	456 MB
FLDAS_NOAH01_C_GL_MC	36 MB	432 MB
FLDAS_NOAH001_G_CA_D	1.2 GB	439 GB

The table will be updated as data volume information for other products become available.

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Appendix

The following acronyms and abbreviations are used in this document.

CHIRPS	Climate Hazards Group InfraRed Precipitation with Station data
FLDAS	Famine Early Warning Systems Network (FEWS NET) Land Data Assimilation System
GDAS	Global Data Assimilation System
GDS	GrADS Data Server
GES DISC	Goddard Earth Sciences Data and Information Services Center
Giovanni	GES-DISC Interactive Online Visualization and Analysis Infrastructure
GrADS	Grid Analysis and Display System
GRIB	GRIdded Binary
HDF	Hierarchical Data Format
HDISC	Hydrology Data and Information Services Center
LDAS	Land Data Assimilation System
LIS	Land Information System
LSM	Land Surface Model
MERRA	Modern Era Retrospective-analysis for Research and Applications
MERRA-2	MERRA Version 2
MODIS	Moderate Resolution Imaging Spectrometer
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
NetCDF	network Common Data Form
NIDIS	National Integrated Drought Information System
Noah	National Centers for Environmental Prediction/Oregon State University/ Air Force/Hydrologic Research Lab (Noah)
VIC	Variable Infiltration Capacity macroscale model