

Hydrological land surface data at the NASA GES DISC is open access, including forcing variables, land surface states, stores, and flux fields from land surface models. The hydrological land surface data are also cloud-enabled accessible via direct S3 access (AWS us-west-2).

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Introduction

The NASA Goddard Earth Sciences Data and Information Services Center (GES DISC) is one of 12 NASA Earth Observing System data centers that document, process, archive, and distribute data from Earth science missions and related projects. The GES DISC hosts many hydrological land surface data products and provides reliable, robust data access and services to users worldwide. This presentation, focusing on hydrological land surface data, provides a summary table of the hydrological data holdings and a list of variables from the forcing and model outputs, along with information about our data and services and our move to the AWS cloud.

Variables

Type	Variable	Unit
Meteorological Forcing	Windspeed	m
	Total precipitation rate	kg/m ² /s
	Near surface air temperature	K
	Near surface specific humidity	kg/kg
	Surface pressure	Pa
	Downward shortwave radiation	W/m ²
Energy Balance	Downward longwave radiation	W/m ²
	Net shortwave radiation flux	W/m ²
	Net longwave radiation flux	W/m ²
	Latent heat flux	W/m ²
	Sensible heat flux	W/m ²
	Ground heat flux	W/m ²
Water Balance	Rain rate	kg/m ² /s
	Snow rate	kg/m ² /s
	Evaporation	kg/m ² /s
	Transpiration	kg/m ² /s
	Evapotranspiration	kg/m ² /s
	Surface runoff	kg/m ² /s
Land Surface Model (LSM) Output	Baseflow runoff	kg/m ² /s
	Snow melt	kg/m ² /s
	Surface temperature	K
	Albedo	~
	Snow depth water equivalent	kg/m ²
	Soil moisture	kg/m ²
State	Soil temperature	K
	Streamflow	m ³ /s
	Flooded Fraction	~
	Flooded Area	m ²
	Irrigated water rate	kg/m ² /s
	Terrestrial water storage	mm
Others	Groundwater storage	mm

Table 1: Variables available from the hydrological model and observational datasets available from the GES DISC.

Earthdata Login system
 Access to GES DISC data requires an Earthdata account. Data continue to be free of charge. Registration is free and easy:
<https://disc.gsfc.nasa.gov/data-access>

Data Access and Services

Search / Access

Data at the GES DISC is searchable and accessible

- GES DISC webpage, <https://disc.gsfc.nasa.gov/>
- EarthData Search, <https://search.earthdata.nasa.gov/search>
- HTTPS: Navigate by data product & date/time
- OPeNDAP: Search, subset, and download data
- Direct S3 Access

Visualize

Geospatial Interactive Online Visualization and Analysis Infrastructure (GIOVANNI)

- GIOVANNI provides a simple way to visualize, analyze, and access vast amounts of Earth science data without having to download the data.

Figure A shows the average groundwater storage percentile for June, July, and August from Groundwater and Soil Moisture Conditions from the Gravity Recovery and Climate Experiment (GRACE) and GRACE-Follow On (GRACE-FO) Data Assimilation L4 7-days 0.25° x 0.25° Global V3.0, visualized using GIOVANNI.

Subset / Regrid

The GES DISC has tools to subset and regrid data

- GES DISC Subsetter: Create variable and spatial subsets, and download data in various data formats
- GrADS Data Server (GDS): Subset, analyze, and download data
- OPeNDAP

Figure B shows the time series for NLDAS_FORA0125_H.002 total hourly precipitation for January 2019 to December 2022.

Aggregate

- Datarods/Timeseries: View and download long time series of a single latitude/longitude specified location.
- Thematic Real-time Environmental Distributed Data Services (THREDDS) Data Server (TDS)

Hydrology Data Products

GES DISC maintains an archive of several hydrology datasets (Table 2)

- Global, North American, and Famine Early Warning System (FEWS) Land Data Assimilation System (GLDAS, NLDAS, FLDAS)
- Gravity Recovery and Climate Experiment (GRACE) Data Assimilation for Drought Monitoring (GRACE-DA-DM)
- Land Parameter Retrieval Model (LPRM)
- The temporal resolution of the data at the GES DISC ranges from hourly to monthly
- The spatial resolution ranges from 0.1° to 1.0°

Land Surface Model	Coverage	Temporal							Spatial			
		Latency in Days	Climatology	Anomaly	1-hour	3-hour	1 day	7 days	North America	Global Land	Asia	
NLDAS-2*	Forcing A	1979-01-01 ~ present	-4	X	X	X	X	X	X	X	X	X
	Forcing B	1979-01-01 ~ present	-4	X	X	X	X	X	X	X	X	X
	Noah	1979-01-02 ~ present	-4	X	X	X	X	X	X	X	X	X
	Mosaic	1979-01-02 ~ present	-4	X	X	X	X	X	X	X	X	X
	VIC	1979-01-02 ~ present	-4	X	X	X	X	X	X	X	X	X
GLDAS-2.0*	Catchment	1948-01-01 ~ 2014-12-31	-45			X	X	X	X	X	X	X
	VIC	1948-01-01 ~ 2014-12-31	-45			X	X	X	X	X	X	X
	Noah	2000-01-01 ~ present	-45			X	X	X	X	X	X	X
GLDAS-2.1*	Catchment	2000-01-01 ~ present	-45			X	X	X	X	X	X	X
	VIC	2000-01-01 ~ present	-45			X	X	X	X	X	X	X
FLDAS-1*	Noah	1982-01-01 ~ present	-1	X		X	X	X	X	X	X	X
	Catchment	2003-02-03 ~ present	-45			X	X	X	X	X	X	X
GRACEDADM*	Noah	1979-01-02 ~ 2016-12-31	-45			X	X	X	X	X	X	X
	Catchment	2002-04-01 ~ present	-45			X	X	X	X	X	X	X
NCALDAS-2.0*	Noah	1979-01-02 ~ 2016-12-31	-45			X	X	X	X	X	X	X
	Catchment	2002-04-01 ~ present	-45			X	X	X	X	X	X	X
SMERGE-2.0*	Noah	1979-01-02 ~ 2019-05-10	-45			X	X	X	X	X	X	X
	Catchment	2002-04-01 ~ present	-45			X	X	X	X	X	X	X
LPRM*	AMSR2	2012-07-03 ~ present	-1			X	X	X	X	X	X	X
	AMSR	2002-06-19 ~ 2011-10-03	-45			X	X	X	X	X	X	X
	TMI	1997-12-07 ~ 2015-04-08	-45			X	X	X	X	X	X	X
	WINDSAT	2003-02-01 ~ 2012-08-01	-45			X	X	X	X	X	X	X
	WINDSAT	2003-02-01 ~ 2012-08-01	-45			X	X	X	X	X	X	X

GES DISC Data and the Cloud

Migrating to the Cloud

NASA is currently in the process of migrating its data products and services to the cloud. The hydrological land surface datasets are cloud-enabled. More information can be found here:
<https://disc.gsfc.nasa.gov/information/documents?title=Migrating%20to%20the%20Cloud>

Direct S3 Access

Amazon's Simple Storage Service (S3) is an object storage service that offers scalability, data availability, security, and performance. GES DISC data is in the **AWS us-west-2** region and can only be accessed if users are in that same region.

Sample GES DISC URL for S3 access:
 s3://gesdisc-cumulus-prod-protected/NLDAS/NLDAS_NOAH0125_H.2.0/
 s3://gesdisc-cumulus-prod-protected/FLDAS/FLDAS_NOAH01_C_GL_M.001/

Benefits from data and services available in the cloud include:

- Improved Performance
- Easy Access
- Multidisciplinary data access
- Multiple data access methods
- Analysis next to data
- Improved scientific transparency

How To's, Help Desk, Other information

How-To's and FAQ's

- Examples with step-by-step instructions and screenshots illustrating how to access or download data
 - GES DISC Documentation: Data Access
 - How to Access GES DISC Data Using Python
- Frequently asked questions about the data science content, algorithm, and data processing information, general data information, how to find, download, read and view data

GES DISC cloud migration website link/QR code

- GES DISC Documentation: Migrating to the Cloud
- How to Perform Cross-DAAC S3 Bucket Access Using Python

GES DISC Help Desk
 Contact the GES DISC Help Desk at gsfc-dl-help-disc@mail.nasa.gov with any questions about our data and data access.

Time series Service (Data Rods)

Hydrology Data Rods webpage
<https://disc.gsfc.nasa.gov/information/tools?title=Hydrology%20Data%20Rods>

GLDAS Noah Land Surface Model L4 3-hourly 0.25° x 0.25° V2.1 data on-prem vs. in the cloud time series retrieval speed comparison can be seen on the left.

- 1 year = 2920 timesteps
- 10 years = 29200 timesteps
- 20 years = 58400 timesteps

Time series access from the cloud is consistent for all ranges of timesteps. Accessing a longer time series from the cloud is faster than access from on-prem.