NASA Giovanni Portals for NLDAS/GLDAS Online Visualization, Analysis, and Intercomparison

Hualan Rui[1], William L Teng[1], Bruce Vollmer[1], David M Mocko[2] , Hiroko Kato Beaudoing[2], Matthew Rodell[2]

1. Goddard Earth Sciences Data and Information Services Center (GES DISC), NASA, Greenbelt, MD, United States
2. Hydrological Sciences Laboratory, NASA, Greenbelt, MD, United States

Hydrology Data and Information Services Center (HDISC)
Data and Information Services Center (DISC)
NASA Goddard Earth Sciences (GES)
Help Desk: gsfc-help-disc@lists.nasa.gov

AGU Fall December 2011
Email: Hualan.Rui@nasa.gov

Introduction

The North American Land Data Assimilation System (NLDAS) and Global Land Data Assimilation System (GLDAS) are generating a series of land surface forcing (e.g., precipitation, surface meteorology, and radiation), state (e.g., soil moisture and temperature, and snow), and flux (e.g., evaporation and sensible heat flux) products, simulated by several land surface models. To date, NLDAS and GLDAS have generated more than 30 (1979 – present) and 60 (1948 – present) years of data, respectively.

To further facilitate data accessibility and utilization, three new portals in the NASA Giovanni system have been made available for NLDAS and GLDAS online visualization, analysis, and intercomparison.

NLDAS and GLDAS Data Access

NLDAS and GLDAS data are accessible from the Hydrology Data and Information Services Center (HDISC) at the NASA GES DISC, http://disc.sci.gsfc.nasa.gov/hydrology.

Data Type (Short Name)	Description	FTP	GDS	Mirador		Giovanni *
				Navigation	Search	(Visualization)
NLDAS-1, 0.125 degree, North America						
NLDAS_FOR0125_H.001	Hourly forcing	✓	✓	✓	✓	✓
NLDAS-2, 0.125 degree, North America						
NLDAS_FORA0125_H.002	Hourly primary forcing	✓	✓	✓	✓	✓
NLDAS_FORB0125_H.002	Hourly secondary forcing	✓	✓	✓	✓	✓
NLDAS_MOS0125_H.002	Hourly Mosaic	✓	✓	✓	✓	✓
GLDAS-2, 1.0 degree, Global						
GLDAS_NOAH10_3H_E1.002	3 hourly Noah experiment 1	✓	✓	✓	✓	✓
GLDAS_NOAH10_M_E1.002	Monthly Noah experiment 1	✓	✓	✓	✓	✓
GLDAS-1, 0.25 degree, Global						
GLDAS_NOAH025SUBP_3H	3 hourly Noah	✓	✓	✓	✓	✓
GLDAS_NOAH025_M	Monthly Noah	✓	✓	✓	✓	
GLDAS-1, 1.0 degree, Global						
GLDAS_CLM10SUBP_3H	3 hourly CLM	✓	✓	✓	✓	✓
GLDAS_CLM10_M	Monthly CLM	✓	✓	✓	✓	✓
GLDAS_MOS10SUBP_3H	3 hourly Mosaic	✓	✓	✓	✓	✓
GLDAS_MOS10_M	Monthly Mosaic	✓	✓	✓	✓	✓
GLDAS_NOAH10SUBP_3H	3 hourly Noah	✓	✓	✓	✓	✓
GLDAS_NOAH10_M	Monthly Noah	✓	✓	✓	✓	✓
GLDAS_VIC10_3H	3 hourly VIC	✓	✓	✓	✓	✓
GLDAS_VIC10_M	Monthly VIC	✓	✓	✓	✓	✓
LPRM/AMSR-E/Aqua L2B Surface Soil Moisture, Ancillary Params, and QC						
LPRM_AMSRE_SOILM2_V001	Hourly global	✓		✓	✓	

Four ways to access the data

- **Mirador searching and downloading**
  - Parameter and spatial subsetting
  - NetCDF conversion for GLDAS and coming soon for NLDAS
- **GrADS Data Server (GDS) accesses**
  - Online visualization and data analysis
  - Parameter and spatial subsetting
  - Output Types: Binary, ASCII, Image
- **FTP downloading**
  - Quick access and batch processing
  - Navigation based on date
- **Giovanni Portals**
  - Online visualization and data analysis
  - Parameter and spatial subsetting
  - Output Types: HDF, NetCDF, ASCII, and Image (GIF/PNG and KMZ)

http://disc.sci.gsfc.nasa.gov/hydrology/data-holdings http://ldas.gsfc.nasa.gov/

NLDAS / GLDAS Parameters:

- Atmospheric Forcing:
  Rainfall, snowfall, humidity, temperature, pressure, radiation, wind, etc.
- Water Balance parameters:
  Soil moisture, snow melt, canopy water storage, runoff, evapotranspiration, etc.
- Energy Balance parameters:
  Net radiation, heat fluxes, soil temperature, etc.

Giovanni

Giovanni is a Web-based application developed by the GES DISC that provides a simple and intuitive way to visualize, analyze, and access vast amounts of Earth science remote sensing data without having to download the data.

Giovanni is comprised of a number of interfaces, called portals, each tailored to meet the needs of different Earth science research communities.

Current Giovanni contains about 40 portals that focus on Hydrology, Atmosphere, Environment, and Ocean.

Giovanni Hydrology Portals

Giovanni Hydrology Portals feature the NLDAS and GLDAS portals, and portals for Tropical Rainfall Measuring Mission (TRMM), Modern Era Retrospective-Analysis for Research and Applications (MERRA), and Northern Eurasia Earth Science Partnership Initiative (NEESPI).

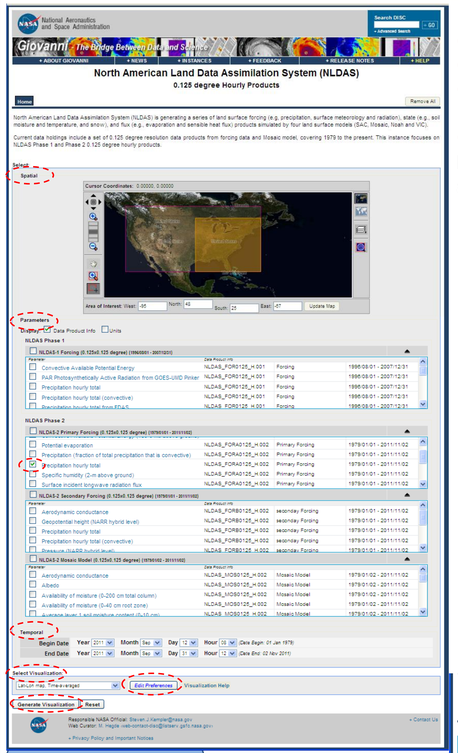
- **NLDAS hourly**: http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=NLDAS0125_H
- **GLDAS 3-hourly**:http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=GLDAS10_3H
- **GLDAS monthly**: http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=GLDAS10_M
- **Daily soil moisture portal**: coming soon ……

NLDAS *is a collaboration project among several groups (NOAA/NCEP/EMC, NASA/GSFC, Princeton University, University of Washington, NOAA/OHD, and NOAA/NCEP/CPC) and is a core project of NOAA/MAPP.*
GLDAS *is supported by the NASA Energy and Water cycle Study (NEWS).*

Giovanni NLDAS Hourly Portal

The Giovanni NLDAS Hourly Portal provides online visualization, analysis, and intercomparision for NLDAS hourly 0.125 x 0.125 data products, including NLDAS Phase 1 (NLDAS-1) forcing data, NLDAS Phase 2 (NLDAS-2) primary forcing data, secondary forcing data, and Mosaic model data. As an example, **2011 Tropical Storm (TS) Lee** is viewed and analyzed below using the Giovanni NLDAS Hourly Portal.

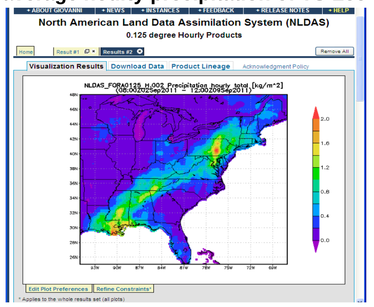
http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=NLDAS0125_H



Format Options for "Download Data"
- HDF
- ASCII
- NetCDF
- KMZ

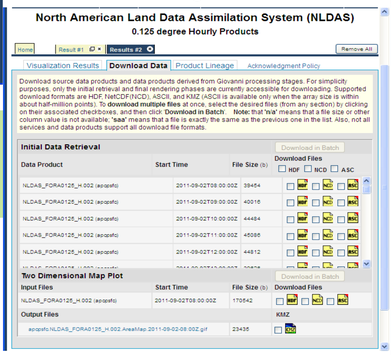
Make selections:
- Spatial: 95W~67W, 25N~48N (for TS Lee)
- Parameter : Precipitation hourly total
- Temporal : 08Z Sept. 02, 2011 to 12Z Sept. 09, 2011
- Visualization: Lat-Lon Map

Lat-Lon Map Result Page shows the average hourly precipitation of TS Lee

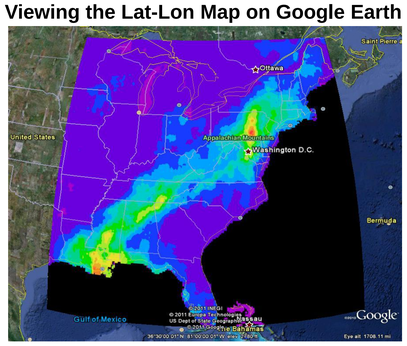


Options on the Result Page:
- Download Data
- Product Lineage
- Acknowledgement Policy
- Edit Plot Preferences
- Refine Constraints

Download Data Page

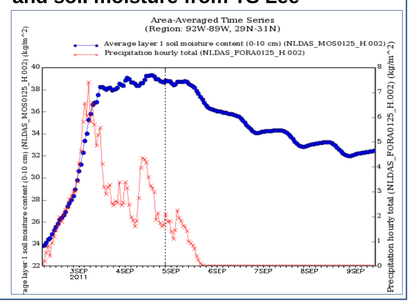


Viewing the Lat-Lon Map on Google Earth



Time series of NLDAS-2 precipitation and soil moisture for the heaviest rain regions of Louisiana/Mississippi. The persistence of high soil moisture content after the heavy rains contributed to flash flooding in many areas.

Time Series of NLDAS-2 precipitation and soil moisture from TS Lee



Giovanni GLDAS Portals

GLDAS products support weather and climate model initialization studies, water and energy cycle investigations water resources applications, and other applications.

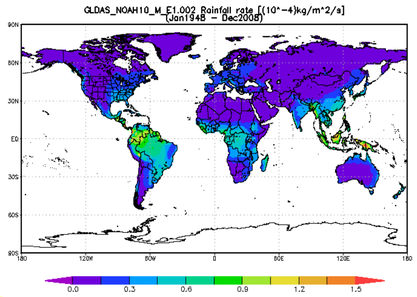
- The 60-year GLDAS-2 Noah data have been added to the Giovanni GLDAS portals.
- Included Models:
  - GLDAS Version 1 (GLDAS-1): CLM, Mosaic, Noah, and VIC
  - GLDAS Version 2 (GLDAS-2): Noah (CLM, Catchment, and VIC model data are coming soon)

Giovanni GLDAS Monthly Portal

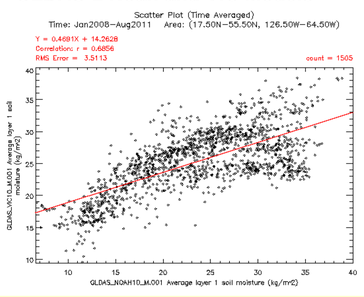
http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=GLDAS10_M

The Giovanni portal makes data access and intercomparison easy and effective.

60-Year Rainfall Climatology from GLDAS-2 Noah Model



Scatter Plot of Soil Moisture from GLDAS-1 Noah and VIC Models

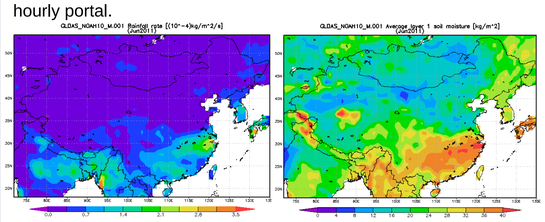


Giovanni GLDAS 3-hourly Portal

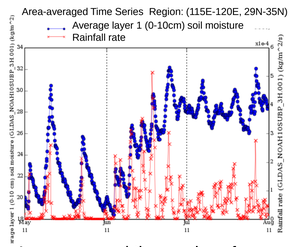
http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=GLDAS10_3H

The portal facilitates studies of flood and drought, other extreme events, and other applications.

From Jun. to Sep. 2011, China experienced a series of floods. In Anhui Province, continuous rain in June 2011 caused over 660 reservoirs to overflow, and damaged hundreds of kilometers of dikes. This severe flood event can be studied via the GLDAS 3-hourly portal.



GLDAS-1 average rain rate (left) and 0-10 cm soil moisture (right) for June 2010 over China, with heavy rain centered in Anhui Province.



Area-averaged time series of GLDAS-1 Noah 3-hourly rain rate (red) and soil moisture (blue) for May – July 2010 over Anhui Province (115E – 120E, 29N-35N).

Possible Future Enhancements

- Add GLDAS 0.25º X 0.25º 3-hourly and monthly data into Giovanni.
- Add new capabilities, such as accumulation, unit conversion, and nonlinear color scales.
- Make climatology and anomaly analysis available for GLDAS/NLDAS data.

Summary

- To date, NLDAS and GLDAS have generated more than 30 years (1979 – present) and 60 years (1948 – present) of data, respectively. These quality-controlled, spatially and temporally consistent terrestrial hydrological data could play an important role in characterizing the spatial and temporal variability of water and energy cycles, and thereby improve our understanding of land-surface-atmosphere interactions and the impact of land surface processes on climate extremes.
- All data are accessible at NASA GES DISC Hydrology Data Holdings via Mirador, ftp, GDS, or Giovanni (http://disc.sci.gsfc.nasa.gov/hydrology/data-holdings).
- Giovanni NLDAS and GLDAS portals further facilitate access and use of the data. The portals provide a simple and intuitive way to visualize, analyze, and access NLDAS/GLDAS data without having to download the data.