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

README Document for North American Land Data Assimilation System Phase 2 (NLDAS-2) Products

Last Revised July 23, 2021

Goddard Earth Sciences Data and Information Services Center (GES DISC)
http://disc.gsfc.nasa.gov
NASA Goddard Space Flight Center
Code 610.2
Greenbelt, MD 20771 USA

Prepared By:

Hualan Rui

Name
GES DISC
GSFC Code 610.2

August 2, 2017

Date

David Mocko

Name
Hydrological Sciences Laboratory (HSL)
GSFC Code 617

Reviewed By:

Carlee Loeser

Reviewer Name
GES DISC
GSFC Code 613.2

October 15, 2019

Date

Goddard Space Flight Center
Greenbelt, Maryland

Revision History

Revision Date	***Changes***	***Author***
03/09/2009	Initial version	Hongliang Fang
10/03/2011	Add parameter and spatial subsetting service	Hualan Rui
10/03/2011	Add Giovanni Online Visualization and Analysis	Hualan Rui
11/21/2011	Update GES DISC Helpdesk email address	Hualan Rui
03/06/2012	Add information for Noah hourly data	Hualan Rui
03/06/2012	Add new publications to the References	Hualan Rui
03/14/2012	Review and revise	David Mocko
10/18/2012	Add information for monthly data	Hualan Rui
11/02/2012	Review and revise	David Mocko
01/18/2013	Add information for monthly climatology data	Hualan Rui
03/14/2013	Review and revise	David Mocko
01/28/2014	Add information for VIC hourly data	Hualan Rui
02/28/2014	Add information for VIC monthly and monthly climatology data	Hualan Rui
03/12/2014	Review and revise	David Mocko
08/02/2017	Convert to comply with newer README template, updated URLs to comply with new GES DISC website	Carlee Loeser
03/12/2018	Update Table 5a to read EVP: Total evapotranspiration	Carlee Loeser
07/02/2019	Add Section 1.2: Digital Object Identifier (DOI) and Citation	Carlee Loeser
10/15/2019	Add new reference	Carlee Loeser
03/01/2021	Update the email address of GES DISC Help Desk	Hualan Rui
07/23/2021	Update the ctl file links on page 26	Hualan Rui

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1.0 Introduction

This document provides basic information on the precipitation, land-surface states (e.g., soil moisture and surface temperature), and fluxes (e.g., radiation and latent and sensible heat fluxes) generated by the North American Land Data Assimilation System (NLDAS). This document specifically describes Phase 2 of NLDAS (hereafter, NLDAS-2) which comprises data from January 1979 to present.

NLDAS (Mitchell et al., 2004; Xia et al., 2012) integrates a large quantity of observation-based and model reanalysis data to drive offline (not coupled to the atmosphere) land-surface models (LSMs), and executes at 1/8th-degree grid spacing over central North America, enabled by the Land Information System (LIS) (Kumar et al., 2006; Peters-Lidard et al., 2007). NLDAS forcing drives four land-surface models: NASA's Mosaic, NOAA's Noah, the NWS Office of Hydrological Development's (OHD) SAC, and Princeton's implementation of VIC. More information is available at NASA's Land Data Assimilation Systems (LDAS) and Land Information System (LIS) websites, as well as NCEP/EMC's NLDAS and drought websites. NLDAS drought monitoring products support the National Integrated Drought Information System (NIDIS).

NLDAS-2 is a collaboration project among several groups: NCEP's Environmental Modeling Center (EMC), NASA's Goddard Space Flight Center (GSFC), Princeton University, the NWS Office of Hydrological Development (OHD), the University of Washington, and NCEP's Climate Prediction Center (CPC). NLDAS is a core project with support from NOAA's Modeling, Analysis, Predictions, and Projections (MAPP) Program. The NASA/GSFC group led the development of the algorithm to generate the forcing data and produced this data for the retrospective period (January 1979 - December 2007), as well as generated the retrospective Mosaic model simulation. The University of Washington and Princeton University developed the VIC model, and the Princeton group generated the retrospective period VIC model simulation. NCEP/EMC, in collaboration with the University of Washington, made improvements to the Noah model. NCEP/EMC also generated retrospective period model simulations for Noah and OHD's SAC model. NLDAS-2 forcing data and Mosaic, Noah, and VIC model output is available via HTTPS access, through the GrADS Data Server (GDS), and via Giovanni services – all through the GES DISC. Currently, NLDAS-2 SAC model output are only available from NCEP/EMC's NLDAS website.

1.1 Dataset Description

The temporal resolutions for NLDAS products are hourly and monthly. NLDAS-2 primary and secondary forcing data files and Mosaic, Noah, and VIC LSM output files are briefly described here. Descriptions of the output files from the SAC LSM will be added when this dataset is made available via the GES DISC. Table 1 lists some basic characteristics of the NLDAS-2 data.

Table 1. Basic characteristics of the NLDAS-2 data.

Contents	Forcing data, land-surface model output
Latitude extent	25° to 53°
Longitude extent	-125° to -67°
Spatial resolution	$1/8^{th}$ degree
Temporal resolution	Hourly and monthly
Temporal coverage	1 January 1979 to present
Dimension	464 (lon) x 224 (lat)
Grid box center points	Lower left: -124.9375, 25.0625 Upper right: -67.0625, 52.9375
Land surface models	Mosaic, Noah, and VIC

1.2 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 2 lists the DOIs for the NLDAS-2 data products.

Table 2. DOIs for NLDAS-2 Data Products

Dataset Name	**DOI**
NLDAS_FORA0125_H.002	10.5067/6J5LHHOHZHN4
NLDAS_FORA0125_M.002	10.5067/Z62LT6J96R4F
NLDAS_FORA0125_MC.002	10.5067/DWQUXYFP9O99
NLDAS_FORB0125_H.002	10.5067/KCHJL8HHDP40
NLDAS_FORB0125_M.002	10.5067/OCLG3PX8QDFL
NLDAS_FORB0125_MC.002	10.5067/1D81ROXYF340
NLDAS_MOS0125_H.002	10.5067/EN4MBWTCENE5
NLDAS_MOS0125_M.002	10.5067/FYHMG8SQX19M
NLDAS_MOS0125_MC.002	10.5067/SSXWLJNDWXYP
NLDAS_NOAH0125_H.002	10.5067/47Z13FNQODKV
NLDAS_NOAH0125_M.002	10.5067/NOXZSD0Z6JGD

NLDAS_NOAH0125_MC.002	10.5067/U5BAYF8R76IK
NLDAS_VIC0125_H.002	10.5067/ELBDAPAKNGJ9
NLDAS_VIC0125_M.002	10.5067/ZO0X4QAX5WTD
NLDAS_VIC0125_MC.002	10.5067/B0L38R609B0R

Each of the DOIs in Table 2 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 the corresponding citations in your publication(s). The following is a citation example for NLDAS_NOAH0125_H.002:

Xia, Y., et al., NCEP/EMC (2012), NLDAS Noah Land Surface Model L4 Hourly 0.125 x 0.125 degree V002, Edited by David Mocko, NASA/GSFC/HSL, Greenbelt, Maryland, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: [**Data Access Date**], 10.5067/47Z13FNQODKV

1.3 Data Disclaimer

Currently, users can access the data by searching and downloading via HTTPS access. The NLDAS data are also provided to GrADS Data Server (GDS) users via https://hydro1.gesdisc.eosdis.nasa.gov/dods/. GDS users can access the data and perform subsetting and analysis operations online. Recently, more advanced tools are now provided, such as spatial and parameter subsetting, and an online visualization and analysis tool (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.

Please check periodically the GES DISC web site for the latest NLDAS data. NLDAS-2 data are available at the GES DISC in “near real-time,” with about a four day latency. Please consider signing up for the LDAS mailing list to receive updates and revisions of the datasets.

1.3.1 Acknowledgement

Please refer to Mitchell et al. (2004) for more information about the NLDAS project. Details about the NLDAS-2 configuration and datasets can be found in Xia et al. (2012). Along with the dataset DOI(s), NASA requests that you include 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 address:

GES DISC Help Desk
Code 610.2
NASA/Goddard Space Flight Center
Greenbelt, MD 20771
Phone: 301-614-5224
Fax: 301-614-5268
Email: gsfc-dl-help-disc@mail.nasa.gov

1.3.2 Contact Information

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

GES DISC
Code 610.2
NASA Goddard Space Flight Center
Greenbelt, Maryland 20771
Email: gsfc-dl-help-disc@mail.nasa.gov
301-614-5224 (voice)
301-614-5268 (fax)

For general science questions and comments, please contact:

David M. Mocko
Hydrological Sciences Laboratory, Code 617
NASA Goddard Space Flight Center
Greenbelt, Maryland 20771
Email: David.Mocko@nasa.gov
301-614-6222 (voice)
301-614-6246 (fax)

1.4 What's New?

The most significant difference between NLDAS-1 and NLDAS-2 is the time frames of the datasets. NLDAS-1 is available from mid-1996 to the end of December 2007. NLDAS-2 is available from January 1979 to present. Another major difference between the two phases of NLDAS is the sources of model data and observations used to create the respective forcing datasets. NLDAS-1 uses the 40-km NCEP Eta model-based Data Assimilation System (EDAS) for the surface meteorology, while NLDAS-2 uses the 32-km NARR system. For downward shortwave radiation at the surface, NLDAS-1 uses GOES-based satellite retrievals, with EDAS data used when/where not available; NLDAS-2 uses GOES data to bias-correct the NARR shortwave radiation. For more information about the differences between NLDAS-1 and NLDAS-2, please visit LDAS FAQ at: https://ldas.gsfc.nasa.gov/faq/#NLDAS_1vs2.

2.0 Data Organization

2.1 File Naming Convention

2.1.1 Hourly Data Sets

NLDAS-2 hourly data files are named in accordance with following convention:

NLDAS_FORA0125_H.A<YYYYMMDD>.<HH>00.002.grb
NLDAS_FORB0125_H.A<YYYYMMDD>.<HH>00.002.grb
NLDAS_MOS0125_H.A<YYYYMMDD>.<HH>00.002.grb
NLDAS_NOAH0125_H.A<YYYYMMDD>.<HH>00.002.grb
NLDAS_VIC0125_H.A<YYYYMMDD>.<HH>00.002.grb

"FORA," "FORB," "MOS," "NOAH", and "VIC" denote primary forcing data set "File A," secondary forcing data set "File B," Mosaic model, Noah model, and VIC model, respectively.
"0125" is an indication for $1/8^{th}$ degree grid spacing.
"H" is an indication for hourly.
"<YYYYMMDD>" is a date format for year, month, and day.
"<HH>" is GMT hour of the day.
"002" indicates NLDAS Phase 2.
"grb" indicates the file is in GRIB format.

2.1.2 Monthly Data Sets

NLDAS-2 monthly data files are named similarly as follows:

NLDAS_FORA0125_M.A<YYYYMM>.002.grb
NLDAS_FORB0125_M.A<YYYYMM>.002.grb
NLDAS_MOS0125_M.A<YYYYMM>.002.grb
NLDAS_NOAH0125_M.A<YYYYMM>.002.grb
NLDAS_VIC0125_M.A<YYYYMM>.002.grb

"M" is an indication for monthly.
"<YYYYMM>" is a date format for year and month.

2.1.3 Monthly Climatology Data Sets

NLDAS-2 monthly climatology data files are named as follows:

NLDAS_FORA0125_MC.ACLIM<MM>.002.grb
NLDAS_FORB0125_MC.ACLIM<MM>.002.grb
NLDAS_MOS0125_MC.ACLIM<MM>.002.grb
NLDAS_NOAH0125_MC.ACLIM<MM>.002.grb
NLDAS_VIC0125_MC.ACLIM<MM>.002.grb

"MC" is an indication for monthly climatology.
"CLIM<MM>" is a date format for month.

2.2 File Format and Structure

The NLDAS LSM data are created using the GRIdded Binary (GRIB) format, WMO GRIB-1. For more details about the GRIB format, please see: http://www.nco.ncep.noaa.gov/pmb/docs/on388/.

GRIB parameter tables for NLDAS-2 data are provided in Appendix B. WGRIB or other GRIB reader (grib2ctl.pl) is required to read the files. The NLDAS-2 land surface forcing files and land model output files utilizes GRIB-1 Parameter Table 130, which is oriented toward land/hydrology modeling and land/hydrology physics. The parameter IDs for Part 2 of Table 130 are available online here. The parameter IDs for Part 1 of Table 130 are identical to those of Table 2, online here.

3.0 Data Contents

3.1 Forcing Data

The NLDAS-2 hourly and monthly land surface forcing fields are grouped into two sets of GRIB files, "File A" and "File B". "File A" (named "FORA") is the primary (default) forcing file and contains eleven fields. "File B" (named "FORB") is the secondary (optional) forcing file and contains ten fields.

The non-precipitation land-surface forcing fields for NLDAS-2 are derived from the analysis fields of the NCEP North American Regional Reanalysis (NARR). NARR analysis fields are 32-km spatial resolution and 3-hourly temporal frequency. Those NARR fields that are utilized to generate NLDAS-2 forcing fields are spatially interpolated to the finer resolution of the NLDAS 1/8th-degree grid and then temporally disaggregated to the NLDAS hourly frequency. Additionally, the fields of surface pressure, surface downward longwave radiation, near-surface air temperature, and near-surface specific humidity are adjusted vertically to account for the vertical difference between the NARR and NLDAS fields of terrain height. This vertical adjustment applies the traditional vertical lapse rate of 6.5 K/km for air temperature. The details of the spatial interpolation, temporal disaggregation, and vertical adjustment are those employed in NLDAS-1, as presented by Cosgrove et al. (2003).

3.1.1 Primary Forcing Data

The surface downward shortwave radiation field in “File A” is a bias-corrected field wherein a bias-correction algorithm was applied to the NARR surface downward shortwave radiation. This bias correction utilizes five years (1996-2000) of the hourly 1/8th-degree GOES-based surface downward shortwave radiation fields derived by Pinker et al. (2003). The potential evaporation field in “File A” is that computed in NARR using the modified Penman scheme of Mahrt and Ek (1984).

The precipitation field in “File A” is not the NARR precipitation forcing, but is rather (over CONUS) a product of a temporal disaggregation of a gauge-only CPC analysis of daily precipitation, performed directly on the NLDAS grid and including an orographic adjustment based on the widely-applied PRISM climatology. The precipitation is temporally disaggregated into hourly fields by deriving hourly disaggregation weights from either WSR-88D Doppler radar-based precipitation estimates, 8-km CMORPH hourly precipitation analyses, or NARR-simulated precipitation (based on availability, in order). The latter fields from radar, CMORPH, and NARR are used only to derive disaggregation weights and do not change the daily total precipitation. For details on the precipitation data used over Mexico and Canada (as well as a further explanation of the data over CONUS), please see the NLDAS-2 forcing webpage. The field in “File A” that gives the fraction of total precipitation that is convective is an estimate derived from the following two NARR precipitation fields (which are provided in “File B”): NARR total precipitation and NARR convective precipitation (the latter is less than or equal to the NARR total precipitation and can be zero). The Convective Available Potential Energy (CAPE) is the final variable in the “File A” dataset, also interpolated from NARR.

Table 3a shows a list of parameters provided in the NLDAS-2 **hourly forcing “File A”** GRIB files. This table shows the GRIB Product Definition Section (PDS) ID and the corresponding parameter name and unit, as well as if the variable is instantaneous or backward-accumulated (over the entire previous hour before the time listed in the dataset).

Table 3a. Parameters in the NLDAS-2 hourly primary forcing “File A” data.

PDS IDs	Full Name	Unit	Time
61	Precipitation hourly total	kg/m^2	Hourly backward-accumulated
157	180-0 mb above ground Convective Available Potential Energy	J/kg	Hourly instantaneous

153	Fraction of total precipitation that is convective	unitless	Hourly backward-accumulated
205	LW radiation flux downwards (surface)*	W/m^2	Hourly instantaneous
204	SW radiation flux downwards (surface)	W/m^2	Hourly instantaneous
228	Potential evaporation	kg/m^2	Hourly backward-accumulated
1	Surface pressure*	Pa	Hourly instantaneous
51	2-m above ground Specific humidity*	kg/kg	Hourly instantaneous
11	2-m above ground Temperature*	K	Hourly instantaneous
33	10-m above ground Zonal wind speed	m/s	Hourly instantaneous
34	10-m above ground Meridional wind speed	m/s	Hourly instantaneous

* indicates a field to which the aforementioned vertical adjustment is applied.

The NLDAS-2 **monthly primary forcing "File A"** GRIB files are generated from NLDAS-2 hourly forcing "File A" GRIB files, as monthly accumulation for total precipitation, convective precipitation, and potential evaporation, and monthly average for other variables. The convective precipitation monthly total is the hourly convective fraction multiplied by the hourly precipitation (both from the NLDAS-2 "File A" files), and then summed over all hours of the month. Monthly period of each month is from 00Z at the start of the month to 23:59Z at the end of the month. The one exception to this is the first month (Jan. 1979) that starts from 00Z 02 Jan 1979, except for the monthly accumulated precipitation, convective precipitation, and potential evaporation that start from 12Z 01 Jan 1979. Table 3b shows a list of parameters provided in the NLDAS-2 monthly forcing "File A" GRIB files.

Table 3b. Parameters in the NLDAS-2 monthly primary forcing "File A" data.

PDS IDs	**Full Name**	**Unit**	**Time**
61	Precipitation monthly total	kg/m^2	Monthly accumulated
157	180-0 mb above ground Convective Available Potential Energy	J/kg	Monthly averaged
153	Convective precipitation monthly total	kg/m^2	Monthly accumulated
205	LW radiation flux downwards (surface)*	W/m^2	Monthly averaged
204	SW radiation flux downwards (surface)	W/m^2	Monthly averaged
228	Potential evaporation	kg/m^2	Monthly accumulated
1	Surface pressure	Pa	Monthly averaged
51	2-m above ground Specific humidity*	kg/kg	Monthly averaged
11	2-m above ground Temperature*	K	Monthly averaged
33	10-m above ground Zonal wind speed	m/s	Monthly averaged
34	10-m above ground Meridional wind speed	m/s	Monthly averaged

The NLDAS-2 **monthly climatology primary forcing** data are generated from the NLDAS-2 monthly primary forcing data, as a 30-year (1980 – 2009) monthly average, and contain the same 11 parameters as listed in the Table 3b.

More information can be found from the NLDAS-2 Forcing Dataset Information page at: http://ldas.gsfc.nasa.gov/nldas/NLDAS2forcing.php.

3.1.2 Secondary Forcing Data

NLDAS-2 provides the secondary forcing "File B" files, in which the surface temperature, humidity, and wind fields are represented not at 2-meters and 10-meters above the height of the NLDAS terrain, but rather at the same height above the NLDAS terrain as the height above the NARR terrain of the lowest prognostic level of the NARR assimilation system (namely, the same height above the model terrain as the lowest prognostic level of the mesoscale Eta model, which is the assimilating model in NARR). The height is denoted as a NARR hybrid level and varies spatially.

The surface downward surface radiation field in "File B" is taken directly from NARR, without any bias correction. The precipitation and convective precipitation fields in "File B" are also taken directly from NARR, and are used to calculate the convective fraction provided in "File A". The aerodynamic conductance in "File B" is also taken from NARR.

Table 4a shows a list of parameters provided in the NLDAS-2 **hourly forcing "File B"** GRIB files. This table shows the GRIB Product Definition Section (PDS) ID and the corresponding parameter name and unit, as well as if the variable is instantaneous or backward-accumulated (over the entire previous hour before the time listed in the dataset).

Table 4a. Parameters in the NLDAS-2 hourly secondary forcing "File B" data.

PDS IDs	**Full Name**	**Unit**	**Time**
179	Aerodynamic conductance	m/s	Hourly instantaneous
63	Convective precipitation hourly total	kg/m^2	Hourly backward-accumulated
61	Precipitation hourly total	kg/m^2	Hourly backward-accumulated
204	SW radiation flux downwards (surface)	W/m^2	Hourly instantaneous
7	NARR hybrid level Geopotential height	gpm	Hourly instantaneous
1	NARR hybrid level Pressure	Pa	Hourly instantaneous
51	NARR hybrid level Specific humidity	kg/kg	Hourly instantaneous
11	NARR hybrid level Temperature	K	Hourly instantaneous
33	NARR hybrid level Zonal wind speed	m/s	Hourly instantaneous

34	NARR hybrid level Meridional wind speed	m/s	Hourly instantaneous

The NLDAS-2 **monthly secondary forcing data** are generated from the NLDAS-2 hourly secondary forcing data, as monthly accumulation for precipitation and convective precipitation and monthly average for the other variables. The monthly period of each month is from 00Z at start of the month to 23:59Z at end of the month. The one exception to this is the first month (Jan. 1979) that starts from 00Z 02 Jan 1979, except for the monthly accumulated precipitation and convective precipitation that both start from 12Z 01 Jan 1979. Table 4b shows a list of parameters provided in the NLDAS-2 monthly forcing "File B" GRIB files.

Table 4b. Parameters in the NLDAS-2 monthly secondary forcing "File B" data.

PDS IDs	Full Name	Unit	Time
179	Aerodynamic conductance	m/s	Monthly averaged
63	Convective precipitation monthly total	kg/m^2	Monthly accumulated
61	Precipitation monthly total	kg/m^2	Monthly accumulated
204	SW radiation flux downwards (surface)	W/m^2	Monthly averaged
7	NARR hybrid level Geopotential height	gpm	Monthly averaged
1	NARR hybrid level Pressure	Pa	Monthly averaged
51	NARR hybrid level Specific humidity	kg/kg	Monthly averaged
11	NARR hybrid level Temperature	K	Monthly averaged
33	NARR hybrid level Zonal wind speed	m/s	Monthly averaged
34	NARR hybrid level Meridional wind speed	m/s	Monthly averaged

The NLDAS-2 **monthly climatology secondary forcing data** are generated from the NLDAS-2 monthly secondary forcing data, as a 30-year (1980 – 2009) monthly average, and contain the 10 parameters same as listed in the Table 4b.

More information can be found from the NLDAS-2 Forcing Dataset Information page at: http://ldas.gsfc.nasa.gov/nldas/NLDAS2forcing.php.

3.2 LSM Output Data

3.2.1 Mosaic Model Data

The NLDAS-2 **hourly Mosaic data set** contains a series of land surface parameters simulated from the Mosaic land-surface model (LSM) for NLDAS-2. Mosaic was developed by Koster and Suarez (1994, 1996) to account for subgrid vegetation variability with a tile approach. Each vegetation tile carries its own energy and water balance and soil moisture and temperature. Each tile has three soil layers, with the first two in the root zone. In NLDAS, Mosaic is configured to support a maximum of 10 tiles per grid cell with a 5% cutoff that ignores vegetation classes covering less than 5% of the cell. Additionally, in NLDAS, all tiles of Mosaic in a grid cell have a predominant soil type and three soil layers with fixed thickness values of 10, 30, and 160 cm (hence constant rooting depth of 40 cm and constant total column depth of 200 cm). The Mosaic LSM was forced by the hourly NLDAS-2 forcing “File A” files, and contains thirty-seven fields (see Table 5a). The vertical layers and time are described in Table 5b and Table 5c, respectively.

The NLDAS-2 **monthly Mosaic model data** are generated from the NLDAS-2 hourly Mosaic model data, as monthly accumulation for rainfall, snowfall, subsurface runoff, surface runoff, total evapotranspiration, and snow melt, and monthly average for the other variables. Monthly period of each month is from 00Z at start of the month to 23:59Z at end of the month, except the first month (Jan. 1979) that starts from 00Z 02 Jan 1979. The monthly data set also contains the same set of parameters listed in the Table 5a, except that time is defined differently (see Table 5c).

The NLDAS-2 **monthly climatology Mosaic model data** are generated from the NLDAS-2 monthly Mosaic model data, as a 30-year (1980 – 2009) monthly average, and contain the same set of parameters listed in Table 5a, except that time is defined differently (see Table 5c).

More information can be found from the NLDAS-2 Model Dataset Information page at: http://ldas.gsfc.nasa.gov/nldas/NLDAS2model.php.

3.2.2 Noah Model Data

The NLDAS-2 **hourly Noah data set** contains a series of land surface parameters simulated from the Noah land-surface model (LSM) for NLDAS-2. The Noah model was developed as the land component of the NOAA NCEP mesoscale Eta model [Betts et al. (1997); Chen et al. (1997); Ek et al. (2003)]. As used in NLDAS-2, recent modifications were made to Noah's cold-season [Livneh et al. (2010)] and warm-season [Wei et al. (2012)] parameterizations. Noah-2.8 is the version used for NLDAS-2; code, parameters, and a README file for Noah-2.8 is available from the NCEP ftp server. Noah serves as the land component in the evolving Weather Research and Forecasting (WRF) regional atmospheric model, the NOAA NCEP coupled Climate Forecast System (CFS), and the Global Forecast System (GFS). The model simulates the soil freeze-thaw process and its impact on soil heating/cooling and transpiration, following Koren et al. (1999). The model has four soil layers with spatially invariant thicknesses of 10, 30, 60, and 100 cm. The first three layers form the root zone in non-forested regions, with the fourth layer included in forested regions. The Noah LSM was forced by the hourly NLDAS-2 forcing "File A" files, and contains fifty-two fields (see Table 5a). The vertical layers and time are described in Table 5b and Table 5c, respectively.

The NLDAS-2 **monthly Noah model data** are generated from the NLDAS-2 hourly Noah model data, as monthly accumulation for rainfall, snowfall, subsurface runoff, surface runoff, total evapotranspiration, and snow melt, and monthly average for the other variables. Monthly period of each month is from 00Z at start of the month to 23:59Z at end of the month, except the first month (Jan. 1979) that starts from 00Z 02 Jan 1979. Also, because the first month (Jan. 1979) does not have valid data exactly on 00Z 02 Jan 1979, this one hour is not included in the average for the instantaneous variables for this month only. The monthly data set also contains the same set of parameters listed in the Table 5a, except that the time is defined differently (see Table 5c).

The NLDAS-2 **monthly climatology Noah model data** are generated from the NLDAS-2 monthly Noah model data, as a 30-year (1980 – 2009) monthly average, and contain the same set of parameters listed in the Table 5a, except that time is defined differently (see Table 5c).

More information can be found from the NLDAS-2 Model Dataset Information page at: http://ldas.gsfc.nasa.gov/nldas/NLDAS2model.php.

3.2.3 VIC Model Data

The NLDAS-2 **hourly VIC data set** contains a series of land surface parameters simulated from the VIC land-surface model (LSM) for NLDAS-2. The VIC model was developed at the University of Washington and Princeton University as a macroscale, semi-distributed, grid-based, hydrologic model [Liang et al., 1994; Wood et al., 1997]. The full water and energy balance models of VIC were used for NLDAS-2. VIC uses three soil layers, with thicknesses that vary spatially. The root zone depends on the vegetation type and its root distribution, and can span all three soil layers. The VIC model includes a two-layer energy balance snow model [Cherkauer et al., 2003]. The version of the VIC model available from the NASA GES DISC used for NLDAS-2 is VIC-4.0.3; this version of the VIC model is the same as used in Sheffield et al. (2003). The VIC LSM is forced by the hourly NLDAS-2 forcing “File A” files, and contains forty-three fields (see Table 5a). The vertical layers and time are described in Table 5b and Table 5c, respectively.

The NLDAS-2 **monthly VIC model data** are generated from the NLDAS-2 hourly VIC model data, as monthly accumulation for rainfall, snowfall, subsurface runoff, surface runoff, total evapotranspiration, and snow melt, and monthly average for the other variables. The monthly period of each month is from 00Z at start of the month to 23:59Z at end of the month, except the first month (Jan. 1979) that starts from 00Z 02 Jan 1979. Also, because the first month (Jan. 1979) does not have valid data exactly on 00Z 02 Jan 1979, this one hour is not included in the average for the instantaneous variables for this month only. The monthly data set also contains the same set of parameters listed in the Table 5a, except that the time is defined differently (see Table 5c).

The NLDAS-2 **monthly climatology VIC model data** are generated from the NLDAS-2 monthly VIC model data, as a 30-year (1980 – 2009) monthly average, and contain the same set of parameters listed in the Table 5a, except that time is defined differently (see Table 5c).

More information can be found from the NLDAS-2 Model Dataset Information page at:
http://ldas.gsfc.nasa.gov/nldas/NLDAS2model.php.

Table 5a shows a list of parameters provided in the NLDAS-2 hourly Mosaic, Noah, and VIC GRIB files, including the GRIB Product Definition Section (PDS) ID, Short Name, the corresponding parameter name and unit, as well as if the variable is instantaneous, backward-averaged, or backward-accumulated (over the entire previous hour before the time listed in the dataset).

Table 5a. Parameters in the NLDAS-2 LSM Mosaic, Noah, and VIC data.

*The ”x” indicates if a model contains the parameter.

MOS	**NOAH**	**VIC**	**PDs IDs**	**Short Name**	**Name**	**Unit**	**Time**
x	x	x	179	ACOND	Aerodynamic conductance	m/s	Instantaneous
x	x	x	84	ALBDO	Albedo	%	Instantaneous
x	x	x	162	ARAIN	Liquid precipitation (rainfall)	kg/m^2	Accumulated
x	x	x	161	ASNOW	Frozen precipitation (snowfall)	kg/m^2	Accumulated
x	x	x	148	AVSFT	Average surface skin temperature	K	Instantaneous
x	x	x	234	BGRUN	Subsurface runoff (baseflow)	kg/m^2	Accumulated
x	x		181	CCOND	Canopy conductance	m/s	Instantaneous
x	x	x	223	CNWAT	Plant canopy surface water	kg/m^2	Instantaneous
x	x	x	205	DLWRF	Downward longwave radiation flux	W/m^2	Averaged
x	x	x	204	DSWRF	Downward shortwave radiation flux	W/m^2	Averaged
x	x	x	199	EVBS	Direct evaporation from bare soil	W/m^2	Averaged
x	x	x	200	EVCW	Canopy water evaporation	W/m^2	Averaged
x	x	x	57	EVP	Total evapotranspiration	kg/m^2	Accumulated
x	x	x	155	GFLUX	Ground heat flux	W/m^2	Averaged
x	x	x	182	LAI	Leaf area index (0-9)	unitless	Instantaneous
x	x	x	121	LHTFL	Latent heat flux	W/m^2	Averaged
	x	x	151	LSOIL	Liquid soil moisture content (non-frozen)	kg/m^2	Instantaneous
x	x	x	207	MSTAV	Moisture availability	%	Instantaneous
		x	159	MXSALB	Maximum snow albedo	%	Instantaneous
x	x	x	112	NLWRS	Net longwave radiation flux (surface)	W/m^2	Averaged

x	x	x	111	NSWRS	Net shortwave radiation flux (surface)	W/m^2	Averaged
	x		145	PEVPR	Potential latent heat flux (potential evaporation)	W/m^2	Averaged
		x	139	RADT	Surface radiative temperature	K	Instantaneous
	x		248	RCQ	Humidity parameter in canopy conductance	fraction	Instantaneous
	x		246	RCS	Solar parameter in canopy conductance	fraction	Instantaneous
	x		249	RCSOL	Soil moisture parameter in canopy conductance	fraction	Instantaneous
	x		247	RCT	Temperature parameter in canopy conductance	fraction	Instantaneous
	x		255	RSMACR	Relative soil moisture availability control factor (0-1)	unitless	Instantaneous
	x		203	RSMIN	Minimal stomatal resistance	s/m	Instantaneous
	x	x	250	RZS	Root zone soil moisture content	kg/m^2	Instantaneous
x	x	x	198	SBSNO	Sublimation (evaporation from snow)	W/m^2	Averaged
x	x	x	122	SHTFL	Sensible heat flux	W/m^2	Averaged
x	x	x	66	SNOD	Snow depth	m	Instantaneous
x	x	x	229	SNOHF	Snow phase-change heat flux	W/m^2	Averaged
x	x	x	99	SNOM	Snow melt	kg/m^2	Accumulated
		x	239	SNOT	Snow temperature	K	Instantaneous
x	x	x	238	SNOWC	Snow cover	fraction	Instantaneous
x	x	x	86	SOILM	Soil moisture content	kg/m^2	Instantaneous
x	x	x	235	SSRUN	Surface runoff (non-infiltrating)	kg/m^2	Accumulated
x	x	x	210	TRANS	Transpiration	W/m^2	Averaged
x	x	x	85	TSOIL	Soil temperature	K	Instantaneous
x	x		87	VEG	Vegetation	fraction	Instantaneous
x	x	x	65	WEASD	Water equivalent of accumulated snow depth	kg/m^2	Instantaneous

Table 5b. Definition of NLDAS-2 LSM vertical layers

Model	**PDS ID**	**Name**	**Layer Description**
M	85	Soil temperature	Deep soil

	86	Soil moisture content	0-10 cm, 0-40 cm, 0-100cm, 0-200cm, 10-40 cm, 40-200 cm
	207	Moisture availability	0-40 cm, 0-200 cm
Noah	85	Soil temperature	0-10 cm, 10-40 cm, 40-100 cm, 100-200 cm
	86	Soil moisture content	0-10 cm, 0-100cm, 0-200cm, 10-40 cm, 40-100 cm, 100-200cm
	151	Liquid soil moisture content (non-frozen)	0-10 cm, 10-40 cm, 40-100 cm, 100-200 cm
	207	Moisture availability	0-100 cm, 0-200 cm
VIC	85	Soil temperature	VIC soil layer 1, VIC soil layer 2, VIC soil layer 3
	86	Soil moisture content	VIC soil layer 1, 0-100 cm, Total column, VIC soil layer 2, VIC soil layer 3
	151	Liquid soil moisture content (non-frozen)	VIC soil layer 1, VIC soil layer 2, VIC soil layer 3
	207	Moisture availability	0-100 cm, Total column

Table 5c. Time definitions of the NLDAS-2 LSMs

Data Set	Definition of "Instantaneous", "Averaged", and "Accumulated"
Hourly	"Instantaneous" means the data values are "at exactly 00 minute of every hour".
	"Averaged" means the data values are the average over the previous hour of the time listed in the file. For example, for the 03Z files, the data values are the average over the time from 02Z to 03Z.
	"Accumulated" means the data values are the accumulation over the previous hour of the time listed in the file. For example, for the 03Z files, the data values are the accumulation over the time from 02Z to 03Z.
Monthly	"Accumulated" means the data values are the monthly accumulation of the hourly data over the month. Monthly period of each month is from 00Z at start of the month to 23:59Z at end of the month, except the first month (Jan. 1979) that starts from 00Z 02 Jan 1979.
	The data for all other variables ("Instantaneous" and "Averaged") are the average of the hourly data over the month. Monthly period of each month is from 00Z at start of the month to 23:59Z at end of the month, except the first month (Jan. 1979) that starts from 00Z 02 Jan 1979.

Important Note for Table 5a: The following five variables: 1) Direct evaporation from bare soil (PDS ID 199), 2) Canopy water evaporation (PDS ID 200), 3) Sublimation (evaporation from snow) (PDS ID 198), 4) Transpiration (PDS ID 210), and 5) Snow phase-change heat flux (PDS ID 229) have different signs between Mosaic and Noah. For the Mosaic data, these fluxes were incorrectly defined as positive in the *downward* direction. Please reverse the sign of these five variables in the Mosaic output (such as when comparing against Noah output). For more information on these variables and the evaporation components, please see this question/answer in the NLDAS FAQ.

4.0 Reading the Data

WGRIB, GrADS, or other GRIB readers are required for reading the NLDAS data. WGRIB is a program to manipulate, inventory, and decode GRIB files; version 1.7.X (or later) is recommended to avoid any possible discrepancies caused by different WGRIB versions. The source code and installation instructions for WGRIB are available from:

http://www.cpc.ncep.noaa.gov/products/wesley/wgrib.html.

4.1 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, GRIB, NetCDF, and HDF. The documentation and software for GrADS can be found at:

http://cola.gmu.edu/grads/.

4.1.1 Set NLDAS-specific GRIB Parameter Table

GRIB files identify the contents (e.g., soil moisture, temperature) by parameter numbers. These numbers are linked to their respective parameter names in a parameter table. The parameter tables used for NLDAS data are shown in Appendix B, for the forcing datasets and each land surface model, as indicated. The name of the user-defined table is searched for in the following order:

1. Environment variable “GRIBTAB”
2. Environment variable “gribtab”
3. File gribtab

Defining an environment variable depends on the operating system and on the shell.

Example:

set GRIBTAB=~/data/gribtab	(MS-DOS or Windows)
export GRIBTAB=~/data/gribtab	(bash)
setenv GRIBTAB ~/data/gribtab	(csh)
GRIBTAB=$HOME/data/gribtab; export GRIBTAB	(sh)

4.1.2 Sample WGRIB Usage

Download the GRIBTAB and set the environmental variables (See Appendix B) first before using WGRIB.

1. GRIB data verbose inventory

Usage: ./wgrib grib file [options]

Examples:

wgrib –v NLDAS_FORA0125_H.20010101.1800.002.grb

```
1:0:D=2001010118:TMP:2 m above gnd:kpds=11,105,2:anl:"Temperature [K]
2:143796:D=2001010118:SPFH:2 m above gnd:kpds=51,105,2:anl:"Specific
humidity [kg/kg]
3:317756:D=2001010118:PRES:sfc:kpds=1,1,0:anl:"Pressure [Pa]
4:491716:D=2001010118:UGRD:10 m above gnd:kpds=33,105,10:anl:"Zonal
wind speed [m/s]
5:615402:D=2001010118:VGRD:10 m above
gnd:kpds=34,105,10:anl:"Meridional wind speed [m/s]
6:739088:D=2001010118:DLWRF:sfc:kpds=205,1,0:anl:"LW radiation flux
downwards (surface) [W/m^2]
7:902994:D=2001010117:CONVfrac:sfc:kpds=153,1,0:0-1hr acc:"Fraction of
total precipitation that is convective [unitless]
8:1006570:D=2001010118:CAPE:180-0 mb above
gnd:kpds=157,116,46080:anl:"Convective Available Potential Energy
[J/kg]
9:1180530:D=2001010117:PEVAP:sfc:kpds=228,1,0:0-1hr acc:"Potential
evaporation [kg/m^2]
10:1324326:D=2001010117:APCP:sfc:kpds=61,1,0:0-1hr acc:"Precipitation
hourly total [kg/m^2]
11:1498286:D=2001010118:DSWRF:sfc:kpds=204,1,0:anl:"SW radiation flux
downwards (surface) [W/m^2]
```

wgrib –v NLDAS_FORB0125_H.20010101.1800.002.grb

```
1:0:D=2001010118:DSWRF:sfc:kpds=204,1,0:anl:"SW radiation flux
downwards (surface) [W/m^2]
2:173960:D=2001010117:APCP:sfc:kpds=61,1,0:0-1hr acc:"Precipitation
hourly total [kg/m^2]
3:307700:D=2001010117:ACPCP:sfc:kpds=63,1,0:0-1hr acc:"Convective
precipitation hourly total [kg/m^2]
4:401220:D=2001010118:ACOND:sfc:kpds=179,1,0:anl:"Aerodynamic
conductance [m/s]
5:504796:D=2001010118:TMP:hybrid lev 1:kpds=11,109,1:anl:"Temperature
[K]
6:648592:D=2001010118:SPFH:hybrid lev 1:kpds=51,109,1:anl:"Specific
humidity [kg/kg]
7:822552:D=2001010118:PRES:hybrid lev 1:kpds=1,109,1:anl:"Pressure
[Pa]
8:996512:D=2001010118:UGRD:hybrid lev 1:kpds=33,109,1:anl:"Zonal wind
speed [m/s]
9:1130252:D=2001010118:VGRD:hybrid lev 1:kpds=34,109,1:anl:"Meridional
wind speed [m/s]
10:1253938:D=2001010118:HGT:hybrid lev
1:kpds=7,109,1:anl:"Geopotential height [gpm]
```

wgrib –v NLDAS_MOS0125_H.20010101.1800.002.grb

```
1:4:D=2001010118:NSWRS:sfc:kpds=111,1,0:-1 to 0 hr ave:"SW radiation
flux net (surface) [W/m^2]
2:174784:D=2001010118:NLWRS:sfc:kpds=112,1,0:-1 to 0 hr ave:"LW
radiation flux net (surface) [W/m^2]
3:330540:D=2001010118:DSWRF:sfc:kpds=204,1,0:-1 to 0 hr ave:"SW
radiation flux downwards (surface) [W/m^2]
4:467276:D=2001010118:DLWRF:sfc:kpds=205,1,0:-1 to 0 hr ave:"LW
radiation flux downwards (surface) [W/m^2]
5:594500:D=2001010118:LHTFL:sfc:kpds=121,1,0:-1 to 0 hr ave:"Latent
heat flux [W/m^2]
6:750256:D=2001010118:SHTFL:sfc:kpds=122,1,0:-1 to 0 hr ave:"Sensible
heat flux [W/m^2]
7:925036:D=2001010118:GFLUX:sfc:kpds=155,1,0:-1 to 0 hr ave:"Ground
heat flux [W/m^2]
8:1080792:D=2001010118:SNOHF:sfc:kpds=229,1,0:-1 to 0 hr ave:"Snow
phase-change heat flux [W/m^2]
9:1236548:D=2001010118:ASNOW:sfc:kpds=161,1,0:-1 to 0 hr ave:"
Snowfall (frozen precipitation) [kg/m^2]
10:1401816:D=2001010118:ARAIN:sfc:kpds=162,1,0:-1 to 0 hr ave:"
Rainfall (unfrozen precipitation) [kg/m^2]
11:1548064:D=2001010118:EVP:sfc:kpds=57,1,0:-1 to 0 hr
ave:"Evaporation [kg/m^2]
```

```
12:1684800:D=2001010118:SSRUN:sfc:kpds=235,1,0:-1 to 0 hr ave:"Surface
runoff (non-infiltrating) [kg/m^2]
13:1840556:D=2001010118:BGRUN:sfc:kpds=234,1,0:-1 to 0 hr
ave:"Subsurface runoff (baseflow) [kg/m^2]
14:1977292:D=2001010118:SNOM:sfc:kpds=99,1,0:-1 to 0 hr ave:"Snow melt
[kg/m^2]
15:2133048:D=2001010118:AVSFT:sfc:kpds=148,1,0:anl:"Average surface
skin temperature [K]
16:2269784:D=2001010118:ALBDO:sfc:kpds=84,1,0:anl:"Albedo [%]
17:2406520:D=2001010118:WEASD:sfc:kpds=65,1,0:anl:"Accumulated snow
water-equivalent [kg/m^2]
18:2666900:D=2001010118:SNOWC:sfc:kpds=238,1,0:anl:"Snow cover [%]
19:2746568:D=2001010118:SNOD:sfc:kpds=66,1,0:anl:"Snow depth [m]
20:2911836:D=2001010118:TSOIL:0-0 cm down:kpds=85,112,0:anl:"Deep soil
temperature [K]
21:3077104:D=2001010118:SOILM:0-10 cm down:kpds=86,112,10:anl:"Soil
moisture content [kg/m^2]
22:3242372:D=2001010118:SOILM:10-40 cm down:kpds=86,112,2600:anl:"Soil
moisture content [kg/m^2]
23:3426664:D=2001010118:SOILM:40-200 cm
down:kpds=86,112,10440:anl:"Soil moisture content [kg/m^2]
24:3629976:D=2001010118:SOILM:0-100 cm down:kpds=86,112,100:anl:"Soil
moisture content [kg/m^2]
25:3823776:D=2001010118:SOILM:0-200 cm down:kpds=86,112,200:anl:"Soil
moisture content [kg/m^2]
26:4027088:D=2001010118:MSTAV:0-200 cm
down:kpds=207,112,200:anl:"Moisture availability [%]
27:4201868:D=2001010118:MSTAV:0-40 cm
down:kpds=207,112,40:anl:"Moisture availability [%]
28:4386160:D=2001010118:SOILM:0-40 cm down:kpds=86,112,40:anl:"Soil
moisture content [kg/m^2]
29:4570452:D=2001010118:EVCW:sfc:kpds=200,1,0:-1 to 0 hr ave:"Canopy
water evaporation [W/m^2]
30:4726208:D=2001010118:TRANS:sfc:kpds=210,1,0:-1 to 0 hr
ave:"Transpiration [W/m^2]
31:4881964:D=2001010118:EVBS:sfc:kpds=199,1,0:-1 to 0 hr ave:"Direct
evaporation from bare soil [W/m^2]
32:5037720:D=2001010118:SBSNO:sfc:kpds=198,1,0:-1 to 0 hr
ave:"Sublimation (evaporation from snow) [W/m^2]
33:5183968:D=2001010118:CNWAT:sfc:kpds=223,1,0:anl:"Plant canopy
surface water [kg/m^2]
34:5358748:D=2001010118:ACOND:sfc:kpds=179,1,0:anl:"Aerodynamic
conductance [m/s]
35:5476460:D=2001010118:CCOND:sfc:kpds=181,1,0:anl:"Canopy conductance
[m/s]
36:5632216:D=2001010118:LAI:sfc:kpds=182,1,0:anl:"Leaf area index (0-
9) [non-dim]
37:5778464:D=2001010118:VEG:sfc:kpds=87,1,0:anl:"Vegetation [%]
```

The above inventories consist of several fields separated by colons. The contents of the fields are as follows:

1. Record number
2. Position in bytes
3. Date (YYYYMMDDHH)
4. Parameter name

5. Type of level/layer (grib PDS octet 10)
6. KPDS5, KPDS6, KPDS7 (grib PDS octets 9, 10, 11-12)
7. Forecasts, analysis, etc.
8. Description of parameter type

Users are suggested to refer to the metadata associated with the GRIB-1 files for more details about the type of level/layer information.

2. Extract a specific field from GRIB data

Usage: wgrib -s infile | grep ":TMP:" | wgrib -i infile -o outfile

To convert a specific GRIB field, e.g., 2-meter surface temperature, to binary:
wgrib –s NLDAS_FORA0125_H.20010101.1800.002.grb | grep ":TMP:" | wgrib –i NLDAS_FORA0125_H.20010101.1800.002.grb -o tmp2m.2001010118.gdat

To convert it into a text file:
wgrib –s NLDAS_FORA0125_H.20010101.1800.002.grb | grep ":TMP:" | wgrib –i –text NLDAS_FORA0125_H.20010101.1800.002.grb -o tmp2m.2001010118.txt

A sample tmp2m.2001010118.txt file looks like:

```
464 224
9.999e+20
9.999e+20
…
294.49
295.2
296.3
297.27
297.69
```

The first line shows there are 224 (lines) by 464 (columns) grids, globally from south to north. The real values are listed in one column. The undefined value is 9.999e+20.

4.1.3 Preparation of GrADS Control Files

Set the environmental variables first before starting GrADS (See Set NLDAS-specific GRIB Parameter Table above). For more information, please visit grib2ctl home page.

1. Make a GrADS control file for GRIB files

Usage: grib2ctl [options] [grib file] [optional index file] >[control file]

Example:

grib2ctl.pl NLDAS_FORA0125_H.20010101.1800.002.grb > NLDAS_FORA0125_H.002.ctl

2. Create the "map" file for using GRIB data in GrADS

Usage: gribmap [options] [control file]

Example:

gribmap –E –i NLDAS_FORA0125_H.002.ctl

Here is an example of a control file (NLDAS_FORA0125_H.002.ctl):

```
dset ^NLDAS_FORA0125_H.20010101.1800.002.grb
index ^NLDAS_FORA0125_H.20010101.1800.002.grb idx
undef 9.999E+20
title NLDAS_FORA0125_H.20010101.1800.002.grb
*  produced by grib2ctl v0.9.12.5p45
dtype grib 110
ydef 224 linear 25.0625 0.125
xdef 464 linear -124.9375 0.125
tdef 1 linear 18Z01jan2001 1hr
zdef 1 linear 1 1
vars 11
APCPsfc  0 61,1,0  ** surface Precipitation hourly total [kg/m^2]
CAPE180_0mb  0 157,116,46080 ** 180-0 mb above gnd Convective Available
Potential Energy [J/kg]
CONVfracsfc  0 153,1,0  ** surface Fraction of total precipitation that
is convective [unitless]
DLWRFsfc  0 205,1,0  ** surface LW radiation flux downwards (surface)
[W/m^2]
DSWRFsfc  0 204,1,0  ** surface SW radiation flux downwards (surface)
[W/m^2]
PEVAPsfc  0 228,1,0  ** surface Potential evaporation [kg/m^2]
PRESsfc  0 1,1,0  ** surface Surface pressure [Pa]
SPFH2m  0 51,105,2 ** 2 m above ground Specific humidity [kg/kg]
TMP2m  0 11,105,2 ** 2 m above ground Temperature [K]
UGRD10m  0 33,105,10 ** 10 m above ground Zonal wind speed [m/s]
VGRD10m  0 34,105,10 ** 10 m above ground Meridional wind speed [m/s]
ENDVARS
```

Notes:

- Be sure to use a proper option with the gribmap:

  gribmap –E –i NLDAS_FORA0125_H.002.ctl
  gribmap –E –i NLDAS_FORB0125_H.002.ctl
  gribmap –0 –i NLDAS_MOS0125_H.002.ctl
  gribmap –0 –i NLDAS_NOAH0125_H.002.ctl
  gribmap –0 –i NLDAS_VIC0125_H.002.ctl

  gribmap –0 –i NLDAS_FORA0125_M.002.ctl

gribmap –0 –i NLDAS_FORB0125_M.002.ctl
gribmap –0 –i NLDAS_MOS0125_M.002.ctl
gribmap –0 –i NLDAS_NOAH0125_M.002.ctl
gribmap –0 –i NLDAS_VIC0125_M.002.ctl

gribmap –0 –i NLDAS_FORA0125_MC.002.ctl
gribmap –0 –i NLDAS_FORB0125_MC.002.ctl
gribmap –0 –i NLDAS_MOS0125_MC.002.ctl
gribmap –0 –i NLDAS_NOAH0125_MC.002.ctl
gribmap –0 –i NLDAS_VIC0125_MC.002.ctl

- Note that gribmap rounds off the last significant digit for the center of the grid box of the lower-left hand grid box. Before running gribmap, please edit the xdef line so it reads "-124.9375" and the ydef line so it reads "25.0625".
- The output from grib2ctl.pl (step #1 above) may list the "tdef" line with 2 times instead of 1, and the start time with one hour before the time of the file. If so, before step #2, edit the "ctl" file to change "tdef 2" to "tdef 1" and change the hour of the file, OR leave the "ctl" file as is, and then after step #2 and opening GrADS, be sure to "set t 2" before plotting the data. Or use the "template" option within the GrADS control file to open multiple time periods of the data.
- GrADS ctl files for NLDAS-2 data sets:
  https://hydro1.gesdisc.eosdis.nasa.gov/gds/NLDAS/NLDAS_FORA0125_H.002.ctl
  https://hydro1.gesdisc.eosdis.nasa.gov/gds/NLDAS/NLDAS_FORB0125_H.002.ctl
  https://hydro1.gesdisc.eosdis.nasa.gov/gds/NLDAS/NLDAS_MOS0125_H.002.ctl
  https://hydro1.gesdisc.eosdis.nasa.gov/gds/NLDAS/NLDAS_NOAH0125_H.002.ctl
  https://hydro1.gesdisc.eosdis.nasa.gov/gds/NLDAS/NLDAS_VIC0125_H.002.ctl

  https://hydro1.gesdisc.eosdis.nasa.gov/gds/NLDAS/NLDAS_FORA0125_M.002.ctl
  https://hydro1.gesdisc.eosdis.nasa.gov/gds/NLDAS/NLDAS_FORB0125_M.002.ctl
  https://hydro1.gesdisc.eosdis.nasa.gov/gds/NLDAS/NLDAS_MOS0125_M.002.ctl
  https://hydro1.gesdisc.eosdis.nasa.gov/gds/NLDAS/NLDAS_NOAH0125_M.002.ctl
  https://hydro1.gesdisc.eosdis.nasa.gov/gds/NLDAS/NLDAS_VIC0125_M.002.ctl

  https://hydro1.gesdisc.eosdis.nasa.gov/gds/NLDAS/NLDAS_FORA0125_MC.002.ctl
  https://hydro1.gesdisc.eosdis.nasa.gov/gds/NLDAS/NLDAS_FORB0125_MC.002.ctl
  https://hydro1.gesdisc.eosdis.nasa.gov/gds/NLDAS/NLDAS_MOS0125_MC.002.ctl
  https://hydro1.gesdisc.eosdis.nasa.gov/gds/NLDAS/NLDAS_NOAH0125_MC.002.ctl
  https://hydro1.gesdisc.eosdis.nasa.gov/gds/NLDAS/NLDAS_VIC0125_MC.002.ctl

4.1.4 Retrieve Data through the GrADS Data Server (GDS)

Users can retrieve NLDAS data from a GDS server using analysis tools such as GrADS, Ferret, Matlab, or IDL. Here is an example of the GrADS script to access the GDS server and draw the total hourly precipitation in the primary forcing data.

```
'reinit'
'sdfopen https://hydro1.gesdisc.eosdis.nasa.gov/dods/NLDAS_FORA0125_H.002'
'set lon -124.9375 -67.0625'
'set lat 25.0625 52.9375'
'set gxout grfill'
'set grads off'
'set time 18Z01Jul2007'
'd apcpsfc'
'set rbcols'
'run cbarn'
'draw title NLDAS-2 Primary Forcing Daily 0.125 degree \ Precipitation
Hourly Total at 18Z on July 01, 2007 [kg/m^2]'
'printim NLDAS_FORA0125_H.002_apcpsfc.A20070701.1800.gif white'
```

Users can convert the NLDAS-2 data to ASCII or binary format on the fly, using a standard web browser through a constructed URL. Here is an example for "How to retrieve NLDAS data via GDS as ASCII text?

https://hydro1.gesdisc.eosdis.nasa.gov/dods/NLDAS_NOAH0125_H.002.ascii?soilm0_100cm[2844:2848][78:80][300:305]

The output looks like:

```
soilm0_100cm, [5][3][6]
[0][0], 288.7323, 289.2955, 291.1259, 291.6955, 310.1147, 309.9419
[0][1], 289.1547, 289.4107, 289.5899, 289.8075, 308.8475, 309.1035
[0][2], 289.6795, 289.4171, 290.7099, 290.6971, 295.9259, 296.6619

[1][0], 288.6267, 289.1963, 291.0203, 291.5835, 310.0155, 309.8235
[1][1], 289.0491, 289.3115, 289.4907, 289.7019, 308.7483, 309.0171
[1][2], 289.5739, 289.3243, 290.6107, 290.5979, 295.8139, 296.5563

[2][0], 288.4832, 289.0464, 290.864, 291.4272, 309.8656, 309.6224
[2][1], 288.9056, 289.168, 289.3472, 289.552, 308.6112, 308.8736
[2][2], 289.4304, 289.1808, 290.4736, 290.4608, 295.6704, 296.4128

[3][0], 288.2985, 288.8617, 290.6729, 291.2361, 309.6745, 309.3545
[3][1], 288.7209, 288.9833, 289.1625, 289.3737, 308.4329, 308.6953
[3][2], 289.2585, 289.0025, 290.3081, 290.3017, 295.4921, 296.2281

[4][0], 288.0877, 288.6509, 290.4493, 291.0125, 309.4573, 309.04132
[4][1], 288.52292, 288.7789, 288.9581, 289.1629, 308.22852, 308.4845
[4][2], 289.06052, 288.8109, 290.1293, 290.1229, 295.28772, 296.0237


time, [5]
```

```
722570.5416666666, 722570.5833333334, 722570.625, 722570.6666666666,
722570.7083333334
lat, [3]
34.8125, 34.9375, 35.0625
lon, [6]
-87.4375, -87.3125, -87.1875, -87.0625, -86.9375, -86.8125
```

5.0 Data Services

The NASA GES DISC maintains archives of the NLDAS-2 data products and many other Hydrology data sets. The archived data can be accessed via HTTPS network transfer. NLDAS can be accessed via the GES DISC Unified User Interface at https://disc.gsfc.nasa.gov/uui/datasets?keywords=NLDAS

5.1 HTTPS Access

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

5.2 EOSDIS Earthdata Search System

The EarthData Search Client (EDSC) can be used to find and retrieve datsets across multiple data centers:
https://search.earthdata.nasa.gov/search?q=NLDAS&ok=NLDAS

5.3 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 data sets.

The How-To section of NASA GES DISC provides a recipe for Quick View Data with Panoply.

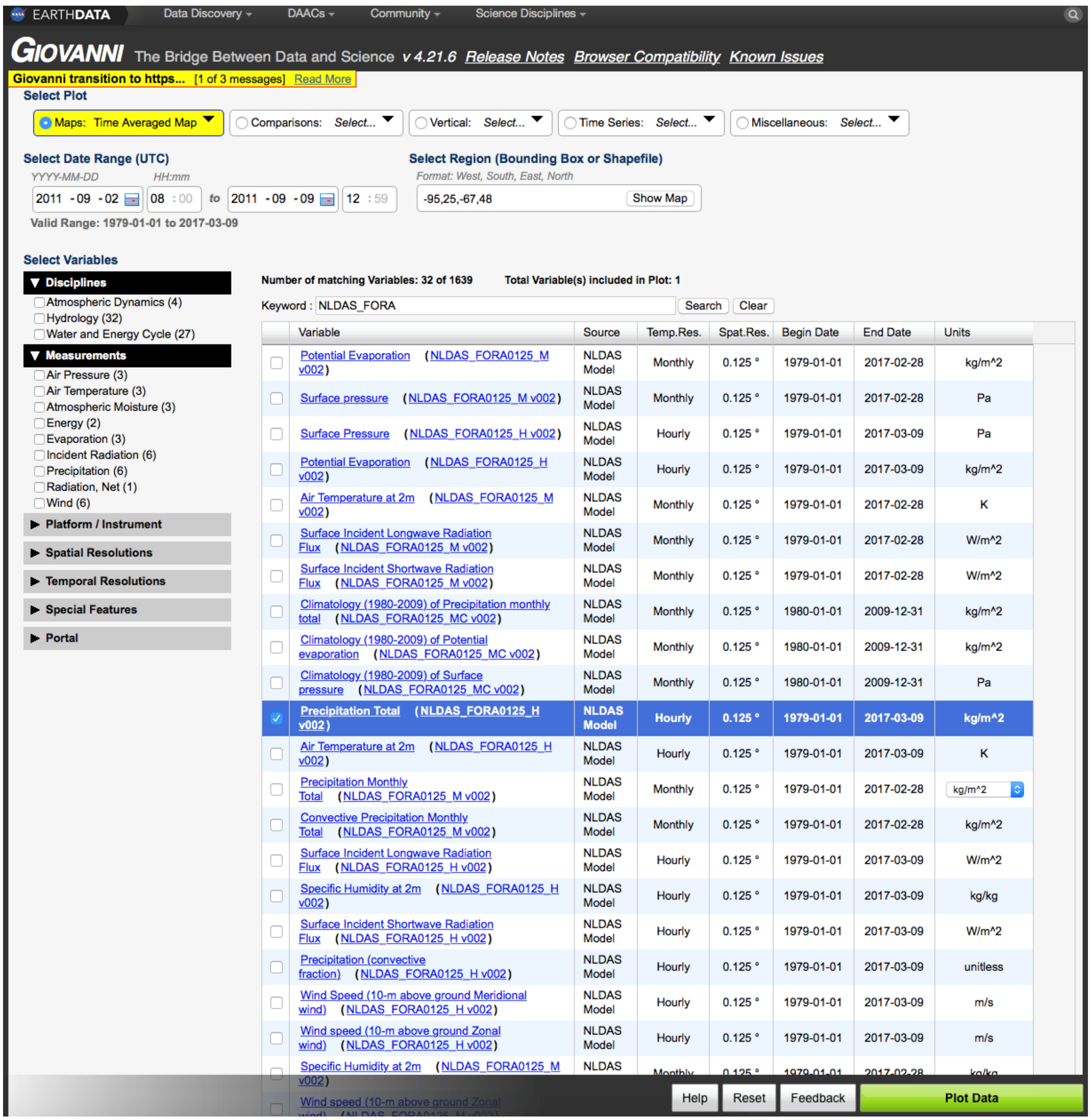
5.4 GrADS Data Server (GDS)

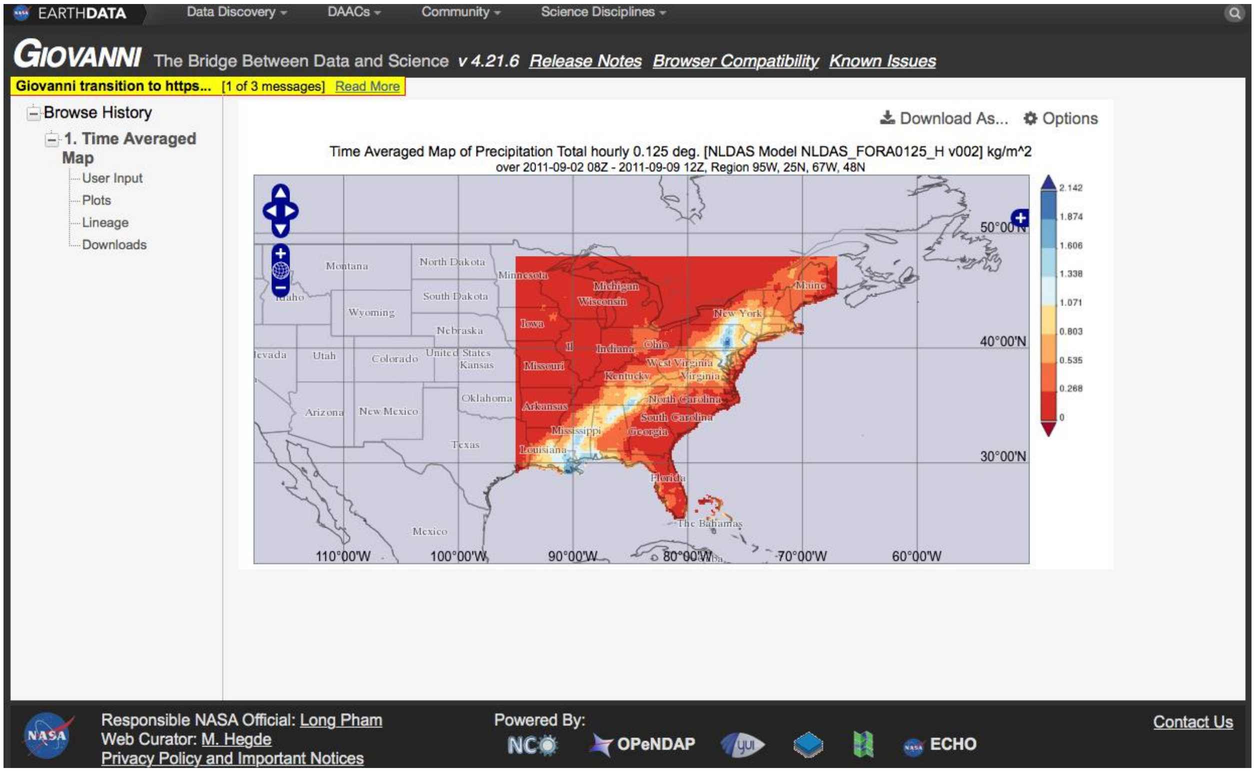
The NLDAS products are provided to the GrADS Data Server (GDS) users via https://hydro1.gesdisc.eosdis.nasa.gov/dods/. The GDS is a stable, secure data server that provides subsetting and analysis services. The GDS supports any operation that can be expressed in a single GrADS expression, including basic math functions, averages, smoothing, differencing, correlation, and regression.

5.5 Giovanni

The GES-DISC Interactive Online Visualization ANd aNalysis Interface (Giovanni) is a Web-based application developed by the NASA 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:
https://giovanni.gsfc.nasa.gov/giovanni/#dataKeyword=NLDAS
Users simply select one or more parameters, spatial and temporal ranges, and the visualization function, and then click on "Plot Data" button to get a result. Several visualization and analysis functions are available in the current instance, including time averaged maps, correlation maps, and area-averaged time series.

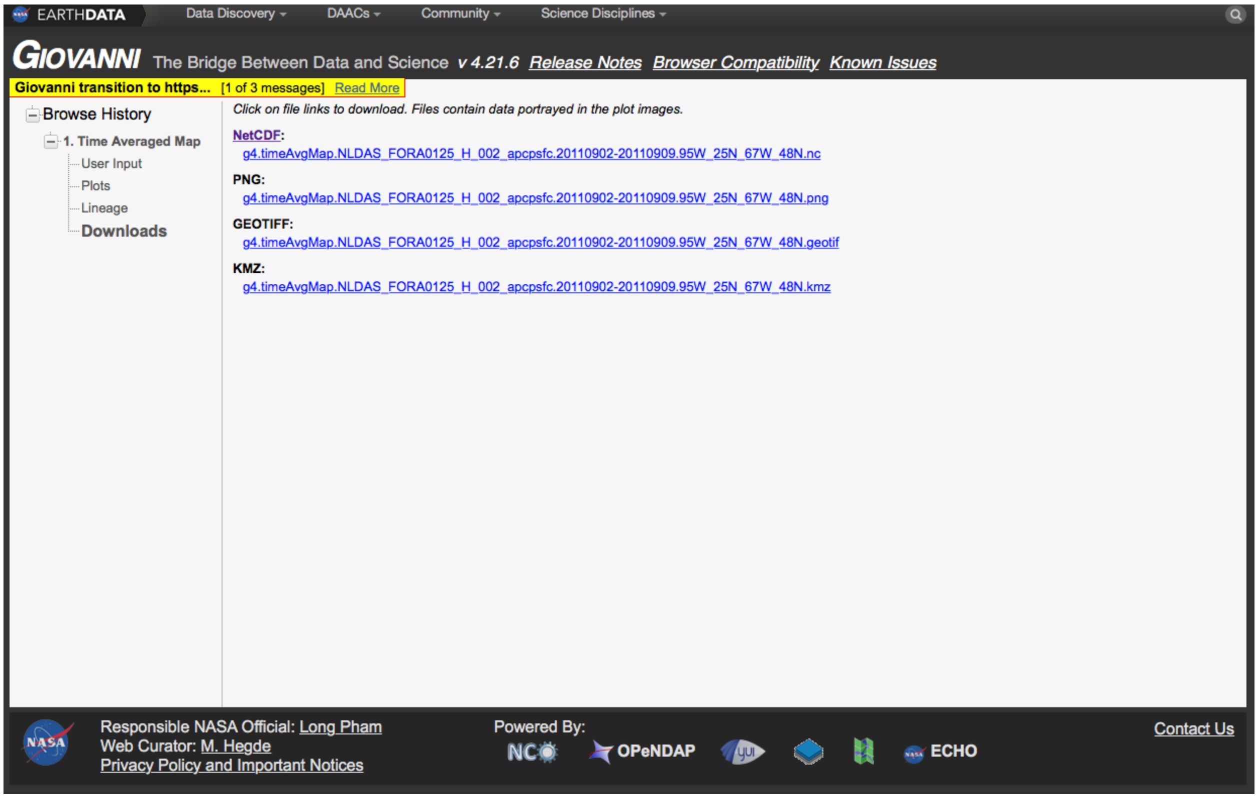
In the example below, a user selects the parameter Precipitation Total for the NLDAS-2 Primary forcing hourly product (NLDAS_FORA0125_H_v002). The area bounding box as 95W ~ 67W, 25N ~ 48N, and time range as 08Z Sept 2, 2011 to 12Z Sept 9, 2011 are selected for a Time Averaged Map to examine the average precipitation rate of 2011 Tropical Storm Lee. Then the user clicks on the "Plot Data" button and sees a resultant Lat-Lon Map of hourly average precipitation between September 2 and September 9, 2011, shown below:



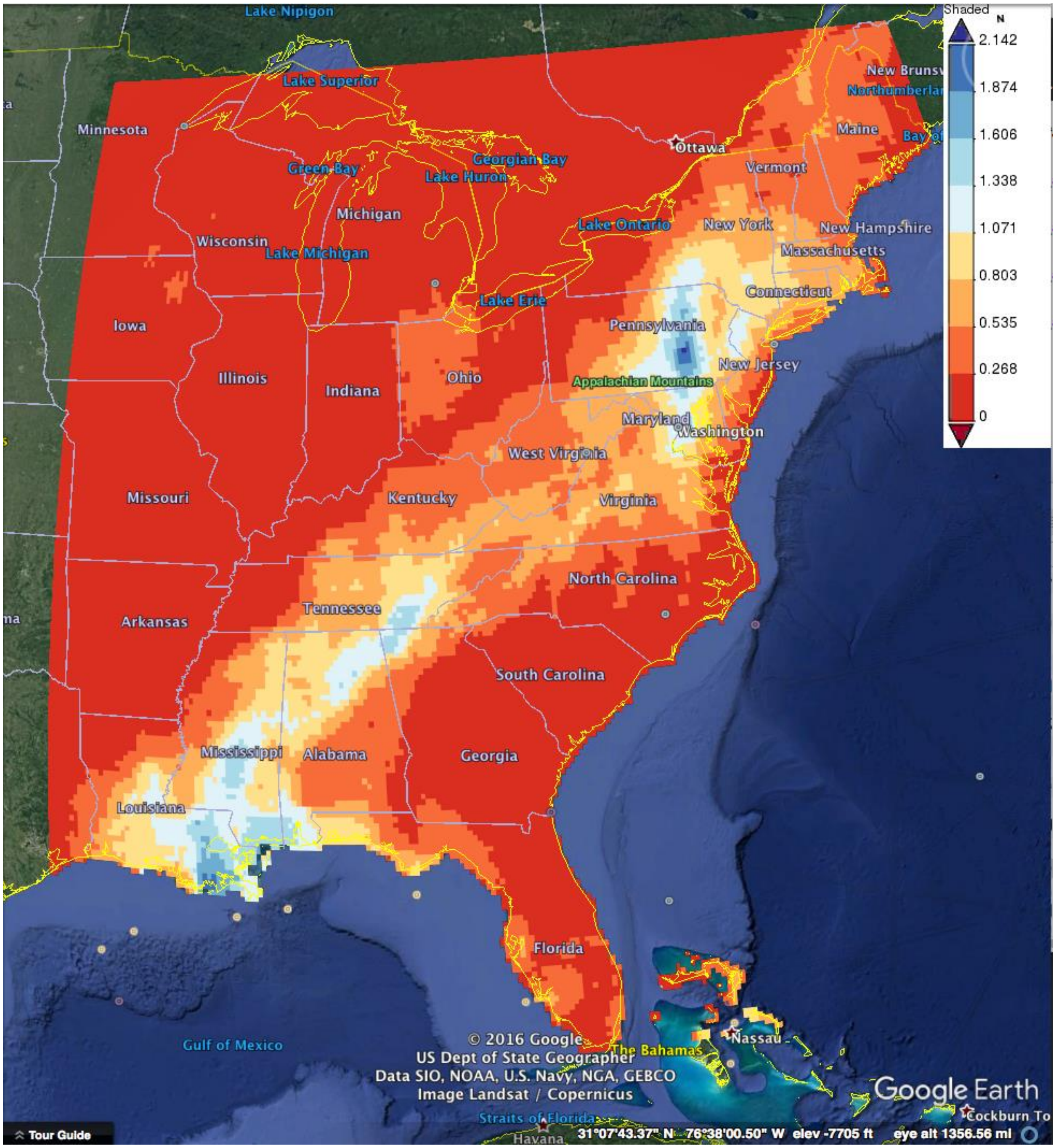


There are many user options available from the resulting page, including being able to download the data. In this example, the user clicks on the "Downloads" tab under "1. Time

Averaged Map” on the left panel, and then sees a page allowing downloading the data in NetCDF, PNG, GEOTIFF, and KMZ formats, shown below.



At last, the user clicks on the KMZ link, and then views the resultant image in Google Earth, shown below:



If you need assistance 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

6.0 More Information

6.1 Data Volume

Model	Resolution	Hourly		Monthly	
		Files/day	**Vol/Year**	**Files/year**	**Vol/Year**
Primary forcing	0.125° × 0.125°	24	14.3 GB	12	22 MB
Secondary forcing	0.125° × 0.125°	24	12.5 GB	12	20 MB
Mosaic	0.125° × 0.125°	24	44.9 GB	12	66 MB
Noah	0.125° × 0.125°	24	60.0 GB	12	84 MB
VIC	0.125° × 0.125°	24	52.5 GB	12	70 MB

The monthly climatology data sets have total 60 files with total volume about 280 MB.

7.0 Acknowledgements

The North America Land Data Assimilation System (NLDAS) project is funded in part by the NOAA Climate Program Office's Modeling, Analysis, Predictions, and Projections Program (MAPP).

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Appendices

A. Description of Metadata

Table A.1. Collection level metadata

Metadata items
C1. Collection data description
1. ShortName
2. LongName
3. TemporalRange
4. SpatialCoverage
5. DataResolution
6. Format (e.g., GRIB1)
7. LandSurfaceModel
8. LandSurfaceModelVersionID
C2. ScienceParameter group
(Parameters listed in Table 2)

Table A.2. Granule level metadata

Metadata items
G1. General description
1. GranuleID
2. GranuleDate
3. LatitudeResolution
4. LongitudeResolution
5. Format (e.g., GRIB1)
6. SizeBytesDataGranule
7. LandSurfaceModel
G2. Grib data description
1. SouthernmostLatitude
2. NorthernmostLatitude
3. WesternmostLongitude
4. EasternmostLongitude
5. BeginningDateTime
6. EndingDateTime
G3. ScienceParameter Group
1. ParameterShortName
2. ParameterLongName
3. Center
4. Subcenter
5. Process

6.	Level (or Layer)
7.	Height (or Pressure)
8.	TimeRange
9.	PeriodTime1
10.	PeriodTime2
11.	ForecastTimeUnit
12.	GridSize
13.	ForecastAnalysisFlag
14.	NumberGridsAverage
15.	MinValueData
16.	MaxValueData
G4. Ingest information	
1.	ProductionDateTime
2.	InsertDateTime

B. User-defined Parameter Tables for NLDAS GRIB files

Below are the parameter tables used for NLDAS data. It is necessary to set the respective parameter table before using WGRIB or GrADS to read the data. All GRIB Tables are also available online on the GES DISC Hydrology Documentation page.

Table B.1a. NLDAS-2 Hourly Primary Forcing GRIB Table ("FORA" dataset)

```
-1:7:12:130
 61:APCPsfc:Precipitation hourly total [kg/m^2]
157:CAPE180_0mb:180-0 mb above ground Convective Available Potential
Energy [J/kg]
153:CONVfracsfc:Fraction of total precipitation that is convective
[unitless]
205:DLWRFsfc:Longwave radiation flux downwards (surface) [W/m^2]
204:DSWRFsfc:Shortwave radiation flux downwards (surface) [W/m^2]
228:PEVAPsfc:Potential evaporation hourly total [kg/m^2]
  1:PRESsfc:Surface pressure [Pa]
 51:SPFH2m:2-m above ground Specific humidity [kg/kg]
 11:TMP2m:2-m above ground Temperature [K]
 33:UGRD10m:10-m above ground Zonal wind speed [m/s]
 34:VGRD10m:10-m above ground Meridional wind speed [m/s]
```

Table B.1b. NLDAS-2 Monthly Primary Forcing GRIB Table ("FORA" dataset)

```
-1:7:12:130
 61:APCPsfc:Precipitation monthly total [kg/m^2]
157:CAPE180_0mb:180-0 mb above ground Convective Available Potential
Energy [J/kg]
153:CONVAPCPsfc:Convective precipitation monthly total [kg/m^2]
205:DLWRFsfc:Longwave radiation flux downwards (surface) [W/m^2]
204:DSWRFsfc:Shortwave radiation flux downwards (surface) [W/m^2]
```

```
228:PEVAPsfc:Potential evaporation monthly total [kg/m^2]
  1:PRESsfc:Surface pressure [Pa]
 51:SPFH2m:2-m above ground Specific humidity [kg/kg]
 11:TMP2m:2-m above ground Temperature [K]
 33:UGRD10m:10-m above ground Zonal wind speed [m/s]
 34:VGRD10m:10-m above ground Meridional wind speed [m/s]
```

Table B.2a. NLDAS-2 Hourly Secondary Forcing GRIB Table ("FORB" dataset)

```
-1:7:12:130
179:ACONDsfc:Aerodynamic conductance [m/s]
 63:ACPCPsfc:Convective precipitation hourly total [kg/m^2]
 61:APCPsfc:Precipitation hourly total [kg/m^2]
204:DSWRFsfc:Shortwave radiation flux downwards (surface) [W/m^2]
  7:HGThbl:NARR hybrid level Geopotential height [gpm]
  1:PREShbl:NARR hybrid level Pressure [Pa]
 51:SPFHhbl:NARR hybrid level Specific humidity [kg/kg]
 11:TMPhbl:NARR hybrid level Temperature [K]
 33:UGRDhbl:NARR hybrid level Zonal wind speed [m/s]
 34:VGRDhbl:NARR hybrid level Meridional wind speed [m/s]
```

Table B.2b. NLDAS-2 Monthly Secondary Forcing GRIB Table ("FORB" dataset)

```
-1:7:12:130
179:ACONDsfc:Aerodynamic conductance [m/s]
 63:ACPCPsfc:Convective precipitation monthly total [kg/m^2]
 61:APCPsfc:Precipitation monthly total [kg/m^2]
204:DSWRFsfc:Shortwave radiation flux downwards (surface) [W/m^2]
  7:HGThbl:NARR hybrid level Geopotential height [gpm]
  1:PREShbl:NARR hybrid level Pressure [Pa]
 51:SPFHhbl:NARR hybrid level Specific humidity [kg/kg]
 11:TMPhbl:NARR hybrid level Temperature [K]
 33:UGRDhbl:NARR hybrid level Zonal wind speed [m/s]
 34:VGRDhbl:NARR hybrid level Meridional wind speed [m/s]
```

Table B.3. NLDAS-2 Hourly and Monthly Mosaic LSM GRIB Table

```
-1:7:138:130
179:ACOND:Aerodynamic conductance [m/s]
 84:ALBDO:Albedo [%]
162:ARAIN:Rainfall (unfrozen precipitation) [kg/m^2]
161:ASNOW:Snowfall (frozen precipitation) [kg/m^2]
148:AVSFT:Average surface skin temperature [K]
234:BGRUN:Subsurface runoff (baseflow) [kg/m^2]
181:CCOND:Canopy conductance [m/s]
223:CNWAT:Plant canopy surface water [kg/m^2]
205:DLWRF:Longwave radiation flux downwards (surface) [W/m^2]
204:DSWRF:Shortwave radiation flux downwards (surface) [W/m^2]
199:EVBS:Direct evaporation from bare soil [W/m^2]
200:EVCW:Canopy water evaporation [W/m^2]
 57:EVP:Total evapotranspiration [kg/m^2]
155:GFLUX:Ground heat flux [W/m^2]
182:LAI:Leaf area index (0-9) [unitless]
121:LHTFL:Latent heat flux [W/m^2]
207:MSTAV:Moisture availability [%]
112:NLWRS:Longwave radiation flux net (surface) [W/m^2]
111:NSWRS:Shortwave radiation flux net (surface) [W/m^2]
198:SBSNO:Sublimation (evaporation from snow) [W/m^2]
```

```
122:SHTFL:Sensible heat flux [W/m^2]
 66:SNOD:Snow depth [m]
229:SNOHF:Snow phase-change heat flux [W/m^2]
99:SNOM:Snow melt [kg/m^2]
238:SNOWC:Snow cover [fraction]
86:SOILM:Soil moisture content [kg/m^2]
235:SSRUN:Surface runoff (non-infiltrating) [kg/m^2]
210:TRANS:Transpiration [W/m^2]
 85:TSOIL:Deep Soil temperature [K]
 87:VEG:Vegetation [fraction]
 65:WEASD:Accumulated snow water-equivalent [kg/m^2]
```

Table B.4. NLDAS-2 Hourly and Monthly Noah LSM GRIB Table

```
-1:7:138:130
179:ACOND:Aerodynamic conductance [m/s]
 84:ALBDO:Albedo [%]
162:ARAIN:Rainfall (unfrozen precipitation) [kg/m^2]
161:ASNOW:Snowfall (frozen precipitation) [kg/m^2]
148:AVSFT:Average surface skin temperature [K]
234:BGRUN:Subsurface runoff (baseflow) [kg/m^2]
181:CCOND:Canopy conductance [m/s]
223:CNWAT:Plant canopy surface water [kg/m^2]
205:DLWRF:Longwave radiation flux downwards (surface) [W/m^2]
204:DSWRF:Shortwave radiation flux downwards (surface) [W/m^2]
199:EVBS:Direct evaporation from bare soil [W/m^2]
200:EVCW:Canopy water evaporation [W/m^2]
 57:EVP:Total evapotranspiration [kg/m^2]
155:GFLUX:Ground heat flux [W/m^2]
182:LAI:Leaf area index (0-9) [unitless]
121:LHTFL:Latent heat flux [W/m^2]
151:LSOIL0_10cm:0-10 cm Liquid soil moisture content (non-frozen)
[kg/m^2]
151:LSOIL10_40cm:10-40 cm Liquid soil moisture content (non-frozen)
[kg/m^2]
151:LSOIL40_100cm:40-100 cm Liquid soil moisture content (non-frozen)
[kg/m^2]
151:LSOIL100_200cm:100-200 cm Liquid soil moisture content (non-frozen)
[kg/m^2]
207:MSTAV:Moisture availability [%]
112:NLWRS:Longwave radiation flux net (surface) [W/m^2]
111:NSWRS:Shortwave radiation flux net (surface) [W/m^2]
145:PEVPR:Potential evaporation rate [W/m^2]
248:RCQ:Humidity parameter in canopy conductance [fraction]
246:RCS:Solar parameter in canopy conductance [fraction]
249:RCSOL:Soil moisture parameter in canopy conductance [fraction]
247:RCT:Temperature parameter in canopy conductance [fraction]
255:RSMACR:Relative soil moisture availability control factor [0-1]
203:RSMIN:Minimal stomatal resistance [s/m]
250:RZSMrzl:Root zone soil moisture content[kg/m^2]
198:SBSNO:Sublimation (evaporation from snow) [W/m^2]
122:SHTFL:Sensible heat flux [W/m^2]
 66:SNOD:Snow depth [m]
229:SNOHF:Snow phase-change heat flux [W/m^2]
 99:SNOM:Snow melt [kg/m^2]
238:SNOWC:Snow cover [fraction]
 86:SOILM0_10cm:0-10 cm layer 1 Soil moisture content [kg/m^2]
```

```
 86:SOILM0_100cm:0-100 cm top 1 meter Soil moisture content [kg/m^2]
 86:SOILM0_200cm:0-200 cm total column Soil moisture content [kg/m^2]
 86:SOILM10_40cm:10-40 cm layer 2 Soil moisture content [kg/m^2]
 86:SOILM40_100cm:40-100 cm layer 3 Soil moisture content [kg/m^2]
 86:SOILM100_200cm:100-200 cm layer 4 Soil moisture content [kg/m^2]
235:SSRUN:Surface runoff (non-infiltrating) [kg/m^2]
210:TRANS:Transpiration [W/m^2]
 85:TSOIL0_10cm:0-10 cm Soil temperature [K]
 85:TSOIL10_40cm:10-40 cm Soil temperature [K]
 85:TSOIL40_100cm:40-100 cm Soil temperature [K]
 85:TSOIL100_200cm:100-200 cm Soil temperature [K]
 87:VEG:Vegetation [fraction]
 65:WEASD:Accumulated snow water-equivalent [kg/m^2]
```

Table B.5. NLDAS-2 VIC LSM GRIB Table

```
-1:7:223:130
179:ACONDsfc:Aerodynamic conductance [m/s]
84:ALBDOsfc:Albedo [%]
162:ARAINsfc:Rainfall (unfrozen precipitation) [kg/m^2]
161:ASNOWsfc:Snowfall (frozen precipitation) [kg/m^2]
148:AVSFTsfc:Average surface skin temperature [K]
234:BGRUNsfc:Subsurface runoff (baseflow) [kg/m^2]
223:CNWATsfc:Plant canopy surface water [kg/m^2]
205:DLWRFsfc:Longwave radiation flux downwards (surface) [W/m^2]
204:DSWRFsfc:Shortwave radiation flux downwards (surface) [W/m^2]
199:EVBSsfc:Direct evaporation from bare soil [W/m^2]
200:EVCWsfc:Canopy water evaporation [W/m^2]
57:EVPsfc:Total evapotranspiration [kg/m^2]
155:GFLUXsfc:Ground heat flux [W/m^2]
182:LAIsfc:Leaf area index (0-9) [unitless]
121:LHTFLsfc:Latent heat flux [W/m^2]
151:LSOILlyr1:VIC soil layer 1 Liquid soil moisture content (non-rozen)
[kg/m^2]
151:LSOILlyr2:VIC soil layer 2 Liquid soil moisture content (non-rozen)
[kg/m^2]
151:LSOILlyr3:VIC soil layer 3 Liquid soil moisture content (non-rozen)
[kg/m^2]
207:MSTAV0_100cm:0-100 cm Moisture availability [%]
207:MSTAVtot:Total column Moisture availability [%]
159:MXSALBsfc:Maximum snow albedo [%]
112:NLWRSsfc:Longwave radiation flux net (surface) [W/m^2]
111:NSWRSsfc:Shortwave radiation flux net (surface) [W/m^2]
139:RADTsfc:Surface radiative temperature [K]
250:RZSMrzl:Root zone soil moisture content [kg/m^2]
198:SBSNOsfc:Sublimation (evaporation from snow) [W/m^2]
122:SHTFLsfc:Sensible heat flux [W/m^2]
66:SNODsfc:Snow depth [m]
229:SNOHFsfc:Snow phase-change heat flux [W/m^2]
99:SNOMsfc:Snow melt [kg/m^2]
239:SNOTsno:Snow temperature [K]
238:SNOWCsfc:Snow cover [fraction]
86:SOILMlyr1:VIC soil layer 1 Soil moisture content [kg/m^2]
86:SOILM0_100cm:0-100 cm top 1 meter Soil moisture content [kg/m^2]
86:SOILMtot:Total column Soil moisture content [kg/m^2]
86:SOILMlyr2:VIC soil layer 2 Soil moisture content [kg/m^2]
86:SOILMlyr3:VIC soil layer 3 Soil moisture content [kg/m^2]
```

```
235:SSRUNsfc:Surface runoff (non-infiltrating) [kg/m^2]
210:TRANSsfc:Transpiration [W/m^2]
85:TSOILlyr1:VIC soil layer 1 Soil temperature [K]
85:TSOILlyr2:VIC soil layer 2 Soil temperature [K]
85:TSOILlyr3:VIC soil layer 3 Soil temperature [K]
65:WEASDsfc:Accumulated snow water-equivalent [kg/m^2]
```

C. Acronyms

The following acronyms and abbreviations are used in this document.

CAPE	Convective Available Potential Energy
CMORPH	CPC precipitation MORPHing technique

CPC	NCEP's Climate Prediction Center
CPPA	Climate Prediction Program for the Americas
EMC	NCEP's Environmental Modeling Center
GDS	GrADS Data Server
GES DISC	Goddard Earth Sciences Data and Information Services Center
Giovanni	GES-DISC Interactive On-line 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
NARR	*North American* Regional Reanalysis
NASA	National Aeronautics and Space Administration
NCEP	National Centers for Environmental Prediction
netCDF	network Common Data Form
NIDIS	National Drought Integrated Information System
NLDAS	North America Land Data Assimilation System
NOAA	National Oceanic and Atmospheric Administration
OHD	NOAA's Office of *Hydrologic* Development
PDS	Product Definition Section (for GRIB ID)
PRISM	Parameter-Elevation Regressions on Independent Slopes Model
SAC	Sacramento model
SVAT	*Soil Vegetation* Atmosphere Transfer model
VIC	Variable Infiltration Capacity macroscale model
WSR-88D	Weather Service Radar-Doppler