

README Document for

North America Land Data Assimilation System Phase 2 (NLDAS-2) Products

Prepared by

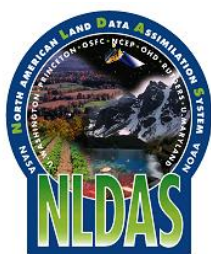
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Revision History

<i>Revision Date</i>	<i>Changes</i>	<i>Author</i>
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
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03/06/2012	Add new publications to the References	Hualan Rui
03/14/2012	Review and revise	David Mocko
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11/02/2012	Review and revise	David Mocko
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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 Jan 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, OHD's 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); this group also 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 [FTP access](#), through the [GrADS Data Server \(GDS\)](#), and via Giovanni and Mirador services – all through the GES DISC. Currently, NLDAS-2 SAC model output are only available from NCEP/EMC's NLDAS website.

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°

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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

However, due to limitations of the GRIB 1 format, the location of the origin (lower-left grid point) can be expressed only to a precision of .001 degree in the GDS (Grid Description Section) of the GRIB header. The values for the lower-left, as given by the GDS in NLDAS-1 GRIB files, are 25.063 for latitude and -124.938 for longitude.

Updates

Currently, users can access the data by searching and downloading via anonymous ftp or [Mirador](#). Mirador, a Spanish word for a window offering an extensive view, uses keywords to find data quickly in a Google-like interface. The NLDAS data are also provided to GrADS Data Server (GDS) users via <http://hydro1.sci.gsfc.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. Also, please consider signing up for the LDAS mailing list for updates and revisions of the datasets: <https://lists.nasa.gov/mailman/listinfo/ldas-users>

Data Citation

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).

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

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Data Organization

File Naming Convention

1. Hourly Data Sets

“<HH>” in the following is GMT hour of the day.

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 1/8th 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. Monthly Data Sets

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

```
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
```

“M” is an indication for monthly.

“<YYYYMM>” is a date format for year and month.

3. Monthly Climatology Data Sets

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NLDAS-2 monthly data files are named as following:

```
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
```

“MC” is an indication for monthly climatology.

“CLIM<MM>” is a date format for month.

File Format 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](#).

Data Contents

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).

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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 2a 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 2a. 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.

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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 2b shows a list of parameters provided in the NLDAS-2 monthly forcing “File A” GRIB files.

Table 2b. 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 2b.

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

2. Secondary Forcing Data

NLDAS-2 is providing 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

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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 3a 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 3a. 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 other variables. 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 3b shows a list of parameters provided in the NLDAS-2 monthly forcing “File B” GRIB files.

Table 3b. 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 3b.

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

LSM output Data

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 4a). The vertical layers and time are described in Table 4b and Table 4c 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 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 4a, except that time is defined differently (see Table 4c).

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 4a, except that time is defined differently (see Table 4c).

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

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.

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(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 4a). The vertical layers and time are described in Table 4b and Table 4c 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 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 4a, except that the time is defined differently (see Table 4c).

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 4a, except that time is defined differently (see Table 4c).

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

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 modes 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 4a). The vertical layers and time are described in Table 4b and Table 4c respectively.

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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 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 4a, except that the time is defined differently (see Table 4c).

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 4a, except that time is defined differently (see Table 4c).

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

Table 4a 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 4a. Parameters in the NLDAS-2 LSM Mosaic, Noah, and VIC data.

*Check mark “✓” indicates if a model contains the parameter.

MOS	NOAH	VIC	PDS IDs	Short Name	Name	Unit	Time
✓	✓	✓	179	ACOND	Aerodynamic conductance	m/s	Averaged
✓	✓	✓	84	ALBDO	Albedo	%	Instantaneous
✓	✓	✓	162	ARAIN	Liquid precipitation (rainfall)	kg/m ²	Accumulated
✓	✓	✓	161	ASNOW	Frozen precipitation (snowfall)	kg/m ²	Accumulated
✓	✓	✓	148	AVSFT	Average surface skin temperature	K	Instantaneous
✓	✓	✓	234	BGRUN	Subsurface runoff (baseflow)	kg/m ²	Accumulated
✓	✓		181	CCOND	Canopy conductance	m/s	Averaged
✓	✓	✓	223	CNWAT	Plant canopy surface water	kg/m ²	Instantaneous
✓	✓	✓	205	DLWRF	Downward longwave radiation flux	W/m ²	Averaged
✓	✓	✓	204	DSWRF	Downward shortwave radiation flux	W/m ²	Averaged
✓	✓	✓	199	EVBS	Direct evaporation from bare soil	W/m ²	Averaged
✓	✓	✓	200	EVCW	Canopy water evaporation	W/m ²	Averaged

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✓	✓	✓	57	EVP	Evaporation	kg/m ²	Accumulated
✓	✓	✓	155	GFLUX	Ground heat flux	W/m ²	Averaged
✓	✓	✓	182	LAI	Leaf area index (0-9)	unitless	Instantaneous
✓	✓	✓	121	LHTFL	Latent heat flux	W/m ²	Averaged
	✓	✓	151	LSOIL	Liquid soil moisture content (non-frozen)	Kg/m ²	Averaged
✓	✓	✓	207	MSTAV	Moisture availability	%	Instantaneous
		✓	159	MXSALB	Maximum snow albedo	%	Instantaneous
✓	✓	✓	112	NLWRS	Net longwave radiation flux (surface)	W/m ²	Averaged
✓	✓	✓	111	NSWRS	Net shortwave radiation flux (surface)	W/m ²	Averaged
	✓		145	PEVPR	Potential latent heat flux (potential evaporation)	W/m ²	Averaged
		✓	139	RADT	Surface radiative temperature	K	Averaged
	✓		248	RCQ	Humidity parameter in canopy conductance	fraction	Averaged
	✓		246	RCS	Solar parameter in canopy conductance	fraction	Averaged
	✓		249	RCSOL	Soil moisture parameter in canopy conductance	fraction	Averaged
	✓		247	RCT	Temperature parameter in canopy conductance	fraction	Averaged
	✓		255	RSMACR	Relative soil moisture availability control factor (0-1)	unitless	Averaged
	✓		203	RSMIN	Minimal stomatal resistance	s/m	Averaged
	✓	✓	250	RZS	Root zone soil moisture content	kg/m ²	Averaged
✓	✓	✓	198	SBSNO	Sublimation (evaporation from snow)	W/m ²	Averaged
✓	✓	✓	122	SHTFL	Sensible heat flux	W/m ²	Averaged
✓	✓	✓	66	SNOD	Snow depth	m	Instantaneous
✓	✓	✓	229	SNOHF	Snow phase-change heat flux	W/m ²	Averaged
✓	✓	✓	99	SNOM	Snow melt	kg/m ²	Accumulated
		✓	239	SNOT	Snow temperature	K	Instantaneous
✓	✓	✓	238	SNOWC	Snow cover	fraction	Instantaneous
✓	✓	✓	86	SOILM	Soil moisture content	kg/m ²	Instantaneous
✓	✓	✓	235	SSRUN	Surface runoff (non-infiltrating)	kg/m ²	Accumulated
✓	✓	✓	210	TRANS	Transpiration	W/m ²	Averaged
✓	✓	✓	85	TSOIL	Soil temperature	K	Instantaneous
✓	✓		87	VEG	Vegetation	fraction	Instantaneous
✓	✓	✓	65	WEASD	Water equivalent of accumulated snow depth	kg/m ²	Instantaneous

Table 4b. Definition of NLDAS-2 LSM vertical layers

Model	PDS ID	Name	Layer Description
Mosaic	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 4c. 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 4a: 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 again Noah output). For more information on these variables and the evaporation components, please see [this question/answer](#) in the [NLDAS FAQ](#).

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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>.

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://grads.iges.org/grads/>.

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 Appendices B.1~B.2, for the forcing datasets and then 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)

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
```


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```
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
```

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```
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
```

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```
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.

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Preparation of GrADS Control Files

Set the environmental variables (See Set NLDAS-specific GRIB Parameter Table above) first before starting GrADS. 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]
CONVfracsf 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
```

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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 -O -i NLDAS_MOS0125_H.002.ctl
gribmap -O -i NLDAS_NOAH0125_H.002.ctl
gribmap -O -i NLDAS_VIC0125_H.002.ctl

gribmap -O -i NLDAS_FORA0125_M.002.ctl
gribmap -O -i NLDAS_FORB0125_M.002.ctl
gribmap -O -i NLDAS_MOS0125_M.002.ctl
gribmap -O -i NLDAS_NOAH0125_M.002.ctl
gribmap -O -i NLDAS_VIC0125_M.002.ctl

gribmap -O -i NLDAS_FORA0125_MC.002.ctl
gribmap -O -i NLDAS_FORB0125_MC.002.ctl
gribmap -O -i NLDAS_MOS0125_MC.002.ctl
gribmap -O -i NLDAS_NOAH0125_MC.002.ctl
gribmap -O -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:
ftp://hydro1.sci.gsfc.nasa.gov/data/gds/NLDAS/NLDAS_FORA0125_H.002.ctl
ftp://hydro1.sci.gsfc.nasa.gov/data/gds/NLDAS/NLDAS_FORB0125_H.002.ctl
ftp://hydro1.sci.gsfc.nasa.gov/data/gds/NLDAS/NLDAS_MOS0125_H.002.ctl
ftp://hydro1.sci.gsfc.nasa.gov/data/gds/NLDAS/NLDAS_NOAH0125_H.002.ctl
ftp://hydro1.sci.gsfc.nasa.gov/data/gds/NLDAS/NLDAS_VIC0125_H.002.ctl

ftp://hydro1.sci.gsfc.nasa.gov/data/gds/NLDAS/NLDAS_FORA0125_M.002.ctl
ftp://hydro1.sci.gsfc.nasa.gov/data/gds/NLDAS/NLDAS_FORB0125_M.002.ctl
ftp://hydro1.sci.gsfc.nasa.gov/data/gds/NLDAS/NLDAS_MOS0125_M.002.ctl
ftp://hydro1.sci.gsfc.nasa.gov/data/gds/NLDAS/NLDAS_NOAH0125_M.002.ctl
ftp://hydro1.sci.gsfc.nasa.gov/data/gds/NLDAS/NLDAS_VIC0125_M.002.ctl

ftp://hydro1.sci.gsfc.nasa.gov/data/gds/NLDAS/NLDAS_FORA0125_MC.002.ctl
ftp://hydro1.sci.gsfc.nasa.gov/data/gds/NLDAS/NLDAS_FORB0125_MC.002.ctl
ftp://hydro1.sci.gsfc.nasa.gov/data/gds/NLDAS/NLDAS_MOS0125_MC.002.ctl
ftp://hydro1.sci.gsfc.nasa.gov/data/gds/NLDAS/NLDAS_NOAH0125_MC.002.ctl

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ftp://hydro1.sci.gsfc.nasa.gov/data/gds/NLDAS/NLDAS_VIC0125_MC.002.ctl

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
http://hydro1.sci.gsfc.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 rbcsls'
'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?**”

[http://hydro1.sci.gsfc.nasa.gov/dods/NLDAS_NOAH0125_H.002.ascii?soilm0_100cm\[2844:2848\]\[78:80\]\[300:305\]](http://hydro1.sci.gsfc.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
```

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```
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
```

Data Interpretation

1. The number of vertical levels for soil moisture (SOILM) and soil temperature (TSOIL) is model specific. Please see Table 4b for the correct depths of soil layers for each LSM.

Data Access

The NASA GES DISC maintains archives of all NLDAS data products and many other Hydrology data sets. The archived data can be accessed via FTP network transfer.

Data Volume

Model	Resolution	Hourly		Monthly	
		Files/day	Vol/Year	Files/year	Vol/Year
Primary forcing	$0.125^{\circ} \times 0.125^{\circ}$	24	14.3 GB	12	22 MB
Secondary forcing	$0.125^{\circ} \times 0.125^{\circ}$	24	12.5 GB	12	20 MB
Mosaic	$0.125^{\circ} \times 0.125^{\circ}$	24	44.9 GB	12	66 MB
Noah	$0.125^{\circ} \times 0.125^{\circ}$	24	60.0 GB	12	84 MB
VIC	$0.125^{\circ} \times 0.125^{\circ}$	24	52.5 GB	12	70 MB

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

Search and Access System

NLDAS data can be accessed via the GES DISC's Hydrology Data and Information Services Center (HDISC), <http://disc.sci.gsfc.nasa.gov/hydrology/data-holdings>.

Use the Mirador service to search and download NLDAS data in a batch mode (<http://mirador.gsfc.nasa.gov/>). Mirador is a fast interface for searching Earth science data at NASA GES DISC. In the Mirador interface, NLDAS data can be searched through a keyword (e.g., Mosaic) and the time span.

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

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Anonymous ftp

The hourly NLDAS data can be downloaded directly via the GES DISC anonymous ftp: <ftp://hydro1.gsfc.nasa.gov/data/s4pa/NLDAS/>.

Data Services

On-the-Fly (OTF) Parameter and Spatial Subset

For example, a user selects three days of NLDAS Phase 2 (NLDAS-2) data from [Mirador](#) by entering the beginning and end dates of the desired time range. Then the user proceeds by clicking on the **Search GES-DISC** button. On the next screen, the user clicks **Select All**, followed by **Add Selected Files to Cart**. The following screen will appear:

NASA National Aeronautics and Space Administration | Goddard Earth Sciences Data and Information Services Center | Search DISC + 60 + Advanced Search

+ ATMOS COMPOSITION + HYDROLOGY + A-TRAIN + AIRS + MODELING + NEESPI + PRECIPITATION

+ GES DISC Home

Mirador
Data Access Made Simple

You are here: [Keyword Search](#) » [Data sets from NLDAS search](#) » [File Listing](#) [Service Selection](#) » [Your Cart](#) » [Checkout](#)

Service Selection Total Number of Files being added to the Cart is: 218

- Data set files added to the cart have their corresponding services, and only one service can be selected per data set.
- To enable a service, click on the link for any of the available services.
- To change options for a service you have already selected, click on a link in the Available Services column.
- After choosing your services, click "Continue to Shopping Cart" to proceed, or click "Cancel" to return to your search results.
- Selecting a subsetting service will take you to the Service Options page and then back to this page.

Available Services

- Subset Spatially and/or by Parameter [What's this?](#)

Data Set	Selected Service	Available Services (Select 1)
NLDAS Primary Forcing Data L4 Hourly 0.125 x 0.125 degree (NLDAS_FORA0125_H.002)	None	Subset Spatially and/or by Parameter...
NLDAS Secondary Forcing Data L4 Hourly 0.125 x 0.125 degree (NLDAS_FORB0125_H.002)	None	Subset Spatially and/or by Parameter...
NLDAS Mosaic Land Surface Model L4 Hourly 0.125 x 0.125 degree (NLDAS_MOS0125_H.002)	None	Subset Spatially and/or by Parameter...

[Continue to Shopping Cart](#) [Cancel](#)

Then, from the list of **Available Services**, the user can select **Subset Spatially and/or by Parameter**, which leads to a new page that allows parameter selection and the spatial region-of-interest to subset. In the current example, the user selects **Subset Spatially and/or by Parameter** for “NLDAS Primary Forcing (NLDAS_FORA0125_H.002),” which leads to a page for the NLDAS_FORA0125_H.002 parameter and spatial selections, shown below:

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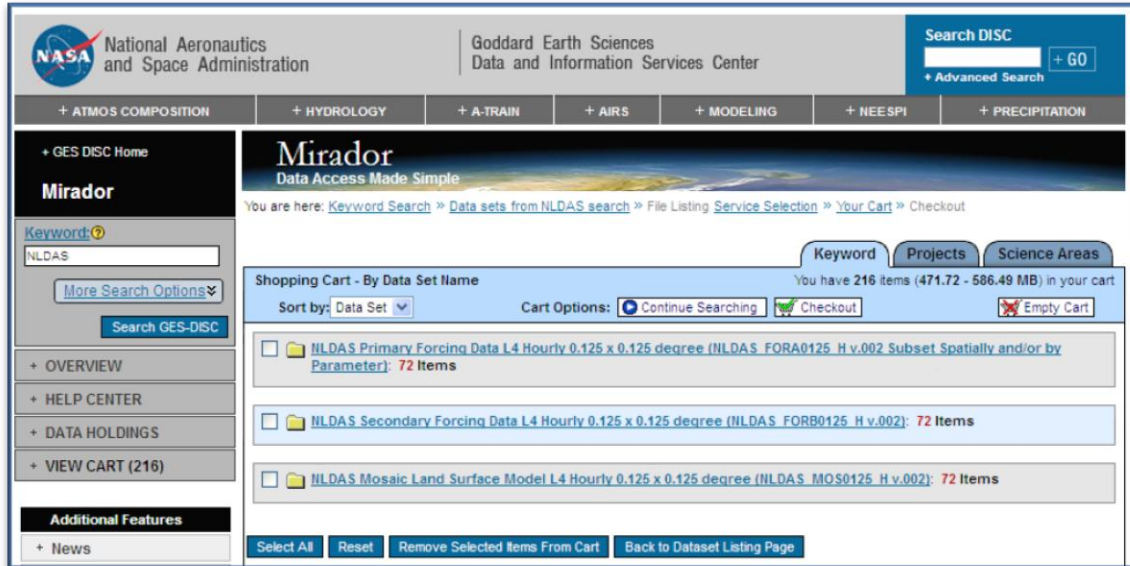
The screenshot shows the Mirador Data Access Made Simple interface. At the top, there's a NASA logo and the text "National Aeronautics and Space Administration" and "Goddard Earth Sciences Data and Information Services Center". A search bar labeled "Search DISC" with a "+ GO" button and a link to "+ Advanced Search" is in the top right. Below this is a navigation bar with tabs: "+ ATMOS COMPOSITION", "+ HYDROLOGY", "+ A-TRAIN", "+ AIRS", "+ MODELING", "+ NEESPI", and "+ PRECIPITATION". The left sidebar contains links: "+ GES DISC Home", "Mirador", "Keyword: NLDAS", "More Search Options", "Search NASA GES-DISC", "+ OVERVIEW", "+ HELP CENTER", "+ DATA HOLDINGS", "+ VIEW CART", and "Additional Features" (News, Restricted Data, Feedback, FAQ). The main content area is titled "Mirador Data Access Made Simple" and "Service Options". It explains that the GRIB subsetting service allows specifying spatial constraints and variable subsetting. A "Submit Selected Criteria" button is at the top of the form. The form includes spatial constraints (South: 35, North: 45, West: -80, East: -70) and a list of parameters to select. The selected parameters are: "Precipitation hourly total", "SW radiation flux downwards", "LW radiation flux downwards", and "Potential evaporation". The parameters are listed as "NLDAS_FORA0125_H.002 Hourly 0.125 degree".

After the user has specified the spatial region and selected the parameters of interest, clicking the *Submit Selected Criteria* button leads to an updated page listing all selected data sets (three in this example) and services, shown below:

The screenshot shows the Mirador Service Selection page. At the top, there's a NASA logo and the text "National Aeronautics and Space Administration" and "Goddard Earth Sciences Data and Information Services Center". A search bar labeled "Search DISC" with a "+ GO" button and a link to "+ Advanced Search" is in the top right. Below this is a navigation bar with tabs: "+ ATMOS COMPOSITION", "+ HYDROLOGY", "+ A-TRAIN", "+ AIRS", "+ MODELING", "+ NEESPI", and "+ PRECIPITATION". The left sidebar contains links: "+ GES DISC Home", "Mirador", "Keyword: NLDAS", "More Search Options", "Search GES-DISC", "+ OVERVIEW", "+ HELP CENTER", "+ DATA HOLDINGS", "+ VIEW CART", and "Additional Features" (News, Restricted Data, Feedback, FAQ). The main content area is titled "Mirador Data Access Made Simple" and "Service Selection". It shows the breadcrumb "You are here: Keyword Search > Data sets from NLDAS search > File Listing > Service Selection > Your Cart > Checkout". The "Service Selection" section shows "Total Number of Files being added to the Cart is: 218". Below this is a list of data sets and their corresponding services. The data sets are: "NLDAS Primary Forcing Data L4 Hourly 0.125 x 0.125 degree (NLDAS_FORA0125_H.002)", "NLDAS Secondary Forcing Data L4 Hourly 0.125 x 0.125 degree (NLDAS_FORB0125_H.002)", and "NLDAS Mosaic Land Surface Model L4 Hourly 0.125 x 0.125 degree (NLDAS_MOS0125_H.002)". The services are: "Subset Spatially and/or by Parameter" (selected for the first two data sets) and "None" (selected for the third data set). The "Available Services" section shows "Subset Spatially and/or by Parameter" as the only available service. At the bottom, there are buttons for "Continue to Shopping Cart" and "Cancel".

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From the updated page, the user can continue selecting *Subset Spatially and/or by Parameter* for another data set, or click the *Continue to Shopping Cart* button. If the latter option is chosen, then the user sees all selected files in the shopping cart, shown below:



The “Checkout” button leads to a batch download interface for the subsetting files. The subsetting data are in the GRIB format, same as that of the original NLDAS products.

Online Visualization and Analysis in Giovanni


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.

All parameters from NLDAS hourly and monthly data sets are available via the Giovanni [NLDAS Hourly Portal](#) and [NLDAS Monthly Portal](#) respectively.

Users simply select one or more parameters, spatial and temporal ranges, and the visualization function, and then click on “Generate Visualization” button to get a result. Seven visualization and analysis functions are available in the current instance: animation, lat-lon map (time-averaged), correlation map, lat-lon map (time-averaged differences), scatter plot, scatter plot (time-averaged), and time series. More advanced services will be added in the future.

In the example of NLDAS Hourly Portal below, a user selects area as 95W ~ 67W, 25N ~ 48N, parameter as the “Precipitation hourly total” from Primary Forcing, time range as 08Z Sept. 02, 2011 to 12Z Sept. 09, 2011, and visualization type as the “Lat-Lon Map, Time-averaged”, to examine the average precipitation rate of 2011 Tropical Storm Lee. As shown below, “Edit Preferences” is available as well.

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National Aeronautics
and Space Administration

Search DISC
+ Advanced Search + GO

Giovanni The Bridge Between Data and Science

+ ABOUT GIOVANNI + NEWS + INSTANCES + FEEDBACK + RELEASE NOTES + HELP

North American Land Data Assimilation System (NLDAS) 0.125 degree Hourly Products

Home Remove All


North American Land Data Assimilation System (NLDAS) is 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 four land surface models (SAC, Mosaic, Noah and VIC).

Current data holdings include a set of 0.125 degree resolution data products from forcing data and Mosaic model, covering 1979 to the present. This instance focuses on NLDAS Phase 1 and Phase 2 0.125 degree hourly products.

Select:

Spatial

Cursor Coordinates: -52.78711, 42.03711



Area of Interest: West: -95 North: 48 South: 25 East: -87 Update Map

Parameters

Display: ☒ Data Product Info ☐ Units

NLDAS Phase 1

☐ NLDAS-1 Forcing (0.125x0.125 degree) (1996/08/01 - 2007/12/31)

Parameter	Data Product Info
<input type="checkbox"/> Convective Available Potential Energy	NLDAS_FOR0125_H.001 Forcing 1996/08/01 - 2007/12/31
<input type="checkbox"/> PAR Photosynthetically Active Radiation from GOES-UMD	NLDAS_FOR0125_H.001 Forcing 1996/08/01 - 2007/12/31
<input type="checkbox"/> Precipitation hourly total	NLDAS_FOR0125_H.001 Forcing 1996/08/01 - 2007/12/31
<input type="checkbox"/> Precipitation hourly total (convective)	NLDAS_FOR0125_H.001 Forcing 1996/08/01 - 2007/12/31
<input type="checkbox"/> Precipitation hourly total from FDAS	NLDAS_FOR0125_H.001 Forcing 1996/08/01 - 2007/12/31

NLDAS Phase 2

☐ NLDAS-2 Primary Forcing (0.125x0.125 degree) (1979/01/01 - 2011/09/14)

Parameter	Data Product Info
<input type="checkbox"/> Convective Available Potential Energy (180-0 mb above ground)	NLDAS_FORA0125_H.002 Primary Forcing 1979/01/01 - 2011/09/14
<input type="checkbox"/> Potential evaporation	NLDAS_FORA0125_H.002 Primary Forcing 1979/01/01 - 2011/09/14
<input type="checkbox"/> Precipitation (fraction of total precipitation that is convective)	NLDAS_FORA0125_H.002 Primary Forcing 1979/01/01 - 2011/09/14
<input checked="" type="checkbox"/> Precipitation hourly total	NLDAS_FORA0125_H.002 Primary Forcing 1979/01/01 - 2011/09/14

☐ NLDAS-2 Secondary Forcing (0.125x0.125 degree) (1979/01/01 - 2011/09/14)

Parameter	Data Product Info
<input type="checkbox"/> Aerodynamic conductance	NLDAS_FORB0125_H.002 secondary Forcing 1979/01/01 - 2011/09/14
<input type="checkbox"/> Geopotential height (NARR hybrid level)	NLDAS_FORB0125_H.002 secondary Forcing 1979/01/01 - 2011/09/14
<input type="checkbox"/> Precipitation hourly total	NLDAS_FORB0125_H.002 secondary Forcing 1979/01/01 - 2011/09/14
<input type="checkbox"/> Precipitation hourly total (convective)	NLDAS_FORB0125_H.002 secondary Forcing 1979/01/01 - 2011/09/14
<input type="checkbox"/> Pressure (NARR hybrid level)	NLDAS_FORB0125_H.002 secondary Forcing 1979/01/01 - 2011/09/14
<input type="checkbox"/> Specific humidity (NARR hybrid level)	NLDAS_FORB0125_H.002 secondary Forcing 1979/01/01 - 2011/09/14

☐ NLDAS-2 Mosaic Model (0.125x0.125 degree) (1979/01/02 - 2011/09/14)

Parameter	Data Product Info
<input type="checkbox"/> Aerodynamic conductance	NLDAS_MOS0125_H.002 Mosaic Model 1979/01/02 - 2011/09/14
<input type="checkbox"/> Albedo	NLDAS_MOS0125_H.002 Mosaic Model 1979/01/02 - 2011/09/14
<input type="checkbox"/> Availability of moisture (0-200 cm total column)	NLDAS_MOS0125_H.002 Mosaic Model 1979/01/02 - 2011/09/14
<input type="checkbox"/> Availability of moisture (0-40 cm root zone)	NLDAS_MOS0125_H.002 Mosaic Model 1979/01/02 - 2011/09/14
<input type="checkbox"/> Average layer 1 soil moisture content (0-10 cm)	NLDAS_MOS0125_H.002 Mosaic Model 1979/01/02 - 2011/09/14
<input type="checkbox"/> Average layer 2 soil moisture content (10-40 cm)	NLDAS_MOS0125_H.002 Mosaic Model 1979/01/02 - 2011/09/14

Temporal


Begin Date Year 2011 Month Sep Day 2 Hour 08 (Date Begin: 01 Jan 1979)

End Date Year 2011 Month Sep Day 9 Hour 12 (Date End: 14 Sep 2011)

Select Visualization:

Lat-Lon map, Time-averaged Edit Preferences Visualization Help

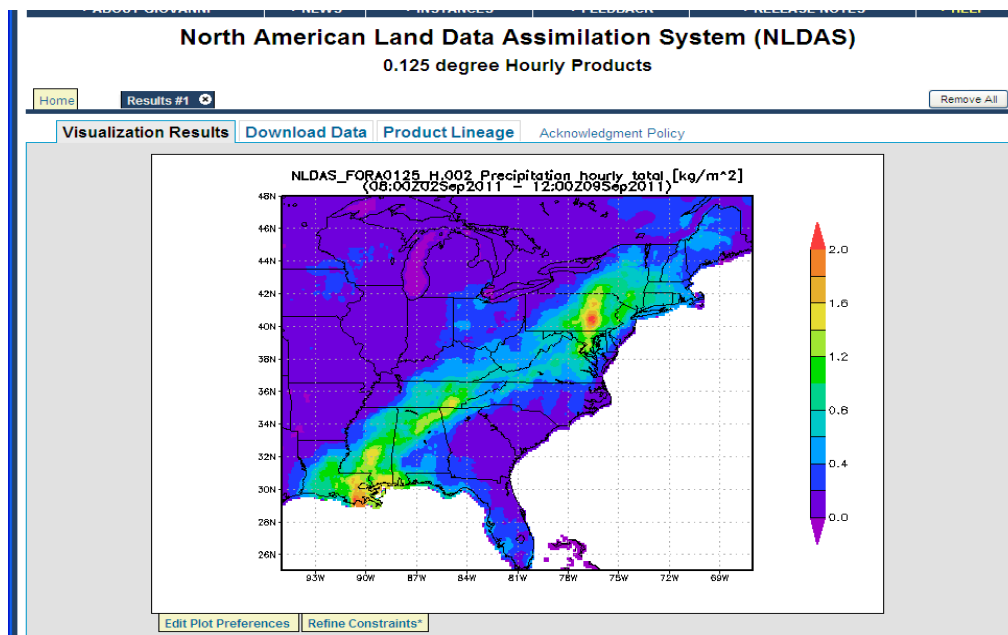
Generate Visualization Reset


Responsible NASA Official: Steven J. Kempler@nasa.gov
Web Curator: M. Hegde <web-contact-disc@latserv.gsfc.nasa.gov>

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Then the user clicks on the “Generate Visualization” button and sees a resultant Lat-Lon Map of average precipitation rate between Sept. 2 and Sept. 9 2011, shown below:



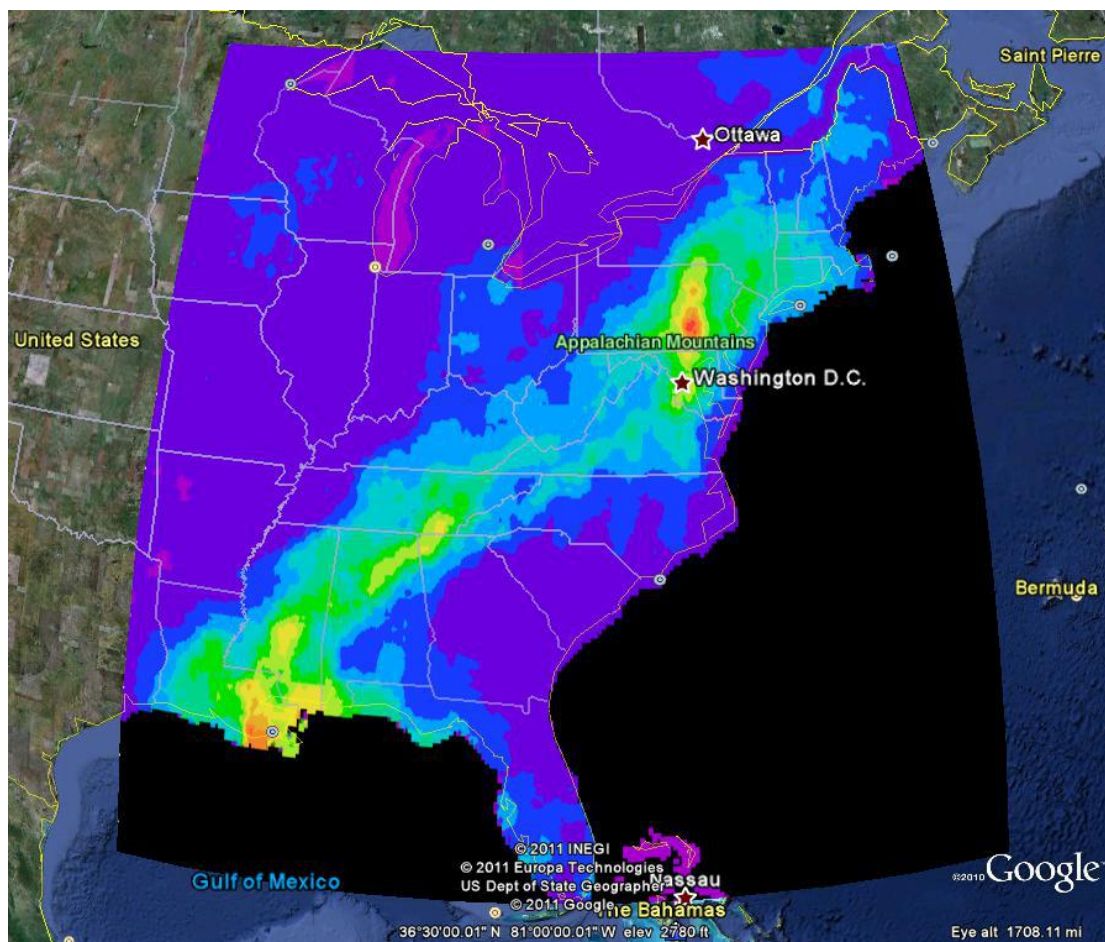
There are many user options available from the resulting page, i.e., “Download Data”, “Product Lineage”, “Acknowledgement Policy”, “Edit Plot Preferences”, and “Refine Constraints”. In this example, the user clicks on “Download Data” tab, and then sees a page allowing downloading the data in HDF, netCDF, ASCII, and KMZ formats, shown below:

The screenshot displays the NLDAS-2 web interface for downloading data. The title is "North American Land Data Assimilation System (NLDAS) 0.125 degree Hourly Products". Below the title, there are navigation tabs: "Home", "Results #1", "Result #2", and "Remove All". The "Result #2" tab is active, showing a sub-tab "Download Data". The main content area contains a table of data products and download options. The table has columns for "Data Product", "Start Time", "File Size (b)", and "Download Files". The "Download Files" column includes checkboxes for "HDF", "NCD", and "ASC". There are also buttons for "Download in Batch" and "Download Files".

Data Product	Start Time	File Size (b)	Download Files
NLDAS_FORA0125_H.002 (apcpsfc)	2011-09-02T08:00:00Z	39454	<input type="checkbox"/> HDF <input type="checkbox"/> NCD <input type="checkbox"/> ASC
NLDAS_FORA0125_H.002 (apcpsfc)	2011-09-02T09:00:00Z	40016	<input type="checkbox"/> HDF <input type="checkbox"/> NCD <input type="checkbox"/> ASC
NLDAS_FORA0125_H.002 (apcpsfc)	2011-09-02T10:00:00Z	44484	<input type="checkbox"/> HDF <input type="checkbox"/> NCD <input type="checkbox"/> ASC
NLDAS_FORA0125_H.002 (apcpsfc)	2011-09-02T11:00:00Z	45088	<input type="checkbox"/> HDF <input type="checkbox"/> NCD <input type="checkbox"/> ASC
NLDAS_FORA0125_H.002 (apcpsfc)	2011-09-02T12:00:00Z	44812	<input type="checkbox"/> HDF <input type="checkbox"/> NCD <input type="checkbox"/> ASC
NLDAS_FORA0125_H.002 (apcpsfc)	2011-09-02T13:00:00Z	36836	<input type="checkbox"/> HDF <input type="checkbox"/> NCD <input type="checkbox"/> ASC
Two Dimensional Map Plot			
Input Files	Start Time	File Size (b)	Download Files
NLDAS_FORA0125_H.002 (apcpsfc)	2011-09-02T08:00:00Z	170542	<input type="checkbox"/> HDF <input type="checkbox"/> NCD <input type="checkbox"/> ASC
Output Files			KMZ
apcpsfc.NLDAS_FORA0125_H.002_AreaMap_2011-09-02-08:00Z.gif		23435	<input type="checkbox"/> KMZ

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At the last, the user clicks on the KMZ icon, and then views the resultant image in [Google Earth](#), shown below:



More information about Giovanni can be found in the [Giovanni Online User Manual](#).

Points of Contact

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-help-disc@lists.nasa.gov
301-614-5224 (voice)
301-614-5268 (fax)

For general science questions and comments, please contact:
David M. Mocko

North America Land Data Assimilation System Phase 2 (NLDAS-2) Products README

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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

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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

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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 at <http://disc.sci.gsfc.nasa.gov/hydrology/documentation>.

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:HGTdbl:NARR hybrid level Geopotential height [gpm]
 1:PRESdbl:NARR hybrid level Pressure [Pa]
 51:SPFHdbl:NARR hybrid level Specific humidity [kg/kg]
 11:TMPdbl:NARR hybrid level Temperature [K]
 33:UGRDdbl:NARR hybrid level Zonal wind speed [m/s]
 34:VGRDdbl: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:HGTbhl:NARR hybrid level Geopotential height [gpm]
1:PREShbl:NARR hybrid level Pressure [Pa]
51:SPFHbhl:NARR hybrid level Specific humidity [kg/kg]
11:TMPbhl: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]

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```

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 Hourly VIC LSM GRIB Table

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```
-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:RZSMrzt: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

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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
Mirador	Fast interface for searching Earth science data at NASA GES DISC
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