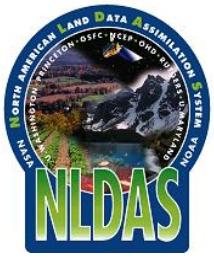

README Document for

North America Land Data Assimilation System Phase 1 (NLDAS-1) Products

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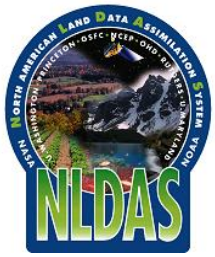
Revision History

Revision Date	***Changes***	***Author***
05/19/2010	Initial version based on information on http://ldas.gsfc.nasa.gov/nldas/	Hualan Rui
06/30/2010	Review and revise	David Mocko
03/10/2011	Add parameter and spatial subsetting service	Hualan Rui
03/10/2011	Add Giovanni Online Visualization and Analysis	Hualan Rui
11/21/2011	Update GES DISC Helpdesk email address	Hualan Rui
10/26/2012	Add information for monthly forcing data	Hualan Rui
11/08/2012	Review and revise	David Mocko
01/22/2013	Add information for monthly climatology data	Hualan Rui
03/14/2013	Review and revise	David Mocko

Contents



Introduction

The goal of the North American Land Data Assimilation System (NLDAS) is to construct quality-controlled, and spatially and temporally consistent, land-surface model (LSM) datasets from the best available observations and model output to support modeling activities. More information about NLDAS is available at http://ldas.gsfc.nasa.gov/nldas/.

NLDAS is a collaboration project among several groups: NOAA/NCEP's Environmental Modeling Center (EMC), NASA's Goddard Space Flight Center (GSFC), Princeton University, the University of Washington, the NOAA/NWS Office of Hydrological Development (OHD), and the NOAA/NCEP Climate Prediction Center (CPC). NLDAS is a core project with support from NOAA's Climate Prediction Program for the Americas (CPPA). Data from the project can be accessed from the NASA Goddard Earth Science Data and Information Services Center (GES DISC) as well as from the NCEP/EMC NLDAS website.

This document specifically describes the forcing data for Phase 1 of the North American Land Data Assimilation System (hereafter, NLDAS-1). The information about NLDAS-1 model data will be added in the future.

NLDAS-1 forcing data are in 1/8th-degree grid spacing and range from 01 Aug 1996 to 31 Dec 2007. The temporal resolutions are hourly and monthly. The file format is WMO GRIB-1.

Basic characteristics of the NLDAS-1 data

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

Contents	Forcing data, land-surface model output
Latitude extent	25° to 53°
Longitude extent	-125° to -67°
Spatial resolution	1/8th degree
Temporal resolution	Hourly and monthly
Temporal coverage	1 August 1996 to 31 December 2007
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

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.

What are the differences between NLDAS -1 and NLDAS-2?

The most significant difference 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-2 and NLDAS-2, please visit LDAS FAQ at: http://ldas.gsfc.nasa.gov/faq/#NLDAS_1vs2.

Updates

Please check periodically the GES DISC web site and GES DISC Hydrology Portal for the latest NLDAS data.

Data Citation

Please refer to Mitchell et al. (2004) for more information about the NLDAS project.

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-help-disc@lists.nasa.gov

Data Organization

File Naming Convention

1. Hourly Data Set

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

The **NLDAS-1hourly forcing** data files are named in accordance with the following convention:

NLDAS_<Forcing dataset><Grid spacing>_H.A<Date>.<Product version>.grb

Attribute	Description
<Forcing dataset>	"FOR" for forcing dataset "File FOR"
<Grid spacing>	"0125" for 1/8th degree
<Date> *	With format <YYYYMMDD>.<HH>00
<Product version>	"001" for NLDAS-1

* (4-digit year; 2-digit month; 2-digit day of month; **2-digit GMT hour of the day**)

For example, file name for NLDAS-1 1/8th degree forcing data 00:00Z on 1 August 1996 is *"NLDAS_FOR0125_H.A19960801.0000.001.grb"*.

2. Monthly Data Set

The NLDAS-1 **monthly data** have the same name convention, except replacing the "H" with "M" for denoting Monthly and with format <YYYYMM> for <Date>.

For example, file name of NLDAS-1 1/8th degree forcing data for August 1996 is *"NLDAS_FOR0125_M.A199608.001.grb"*.

3. Monthly Climatology Data Set

The NLDAS-1 **monthly climatology data** have the same name convention, except replacing the "H" with "MC" for denoting "Monthly Climatology" and with format "<CLIMMM>" for <Date>.

For example, file name of NLDAS-1 1/8th degree monthly climatology data for August is "*NLDAS_FORA0125_MC.ACLIM08.001.grb*".

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-1 data are provided in Appendix B. WGRIB or other GRIB reader (grib2ctl.pl) is required to read the GRIB files. The NLDAS-1 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. NLDAS-1 parameter IDs names, units, and abbreviations are defined in the GRIB-1 Parameter Table 130. The parameter IDs 000-127 in Part 1 of Table 130 are identical to those defined in ON388 Table 2.

Data Contents

Forcing Data

NLDAS-1 **hourly land surface forcing data** contains fifteen fields.

The chief source of NLDAS-1 forcing is NCEP's Eta model-based Data Assimilation System (EDAS) [Rogers et al., 1995], a continuously cycled North American 4DDA system. GOES-based solar insolation (Pinker et al., 2003) provides the primary insolation forcing (shortwave down at the surface) for NLDAS-1. NLDAS-1 precipitation forcing over CONUS is anchored to NCEP's 1/4th-degree gauge-only daily precipitation analyses of Higgins et al. [2000]. More information about the source of NLDAS-1 forcing data is available at:

http://ldas.gsfc.nasa.gov/nldas/NLDAS1forcing.php.

Table 2a shows a list of parameters provided in the NLDAS-1 hourly forcing 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-1 hourly forcing data.

PDS ID	Full Name	Unit	Time
63	Convective precipitation hourly total from EDAS	kg/m^2	Hourly backward-accumulated
61	Precipitation hourly total	kg/m^2	Hourly backward-accumulated
118	Surface brightness temperature from GOES-UMD Pinker	K	Hourly instantaneous
157	Convective Available Potential Energy	J/kg	Hourly instantaneous
205	Longwave radiation flux downwards (surface)	W/m^2	Hourly instantaneous
204	Shortwave radiation flux downwards (surface)	W/m^2	Hourly instantaneous
101	PAR Photosynthetically Active Radiation from GOES-UMD Pinker	W/m^2	Hourly instantaneous
201	Precipitation hourly total from EDAS	kg/m^2	Hourly backward-accumulated

202	Precipitation hourly total from StageII	kg/m^2	Hourly backward-accumulated
1	Surface pressure	Pa	Hourly instantaneous
206	Shortwave radiation flux downwards (surface) from GOES-UMD Pinker	W/m^2	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-1 **monthly forcing data**, containing 17 variables, are generated from the NLDAS-1 hourly forcing data. More information about how monthly data are generated can be found below Table 2b.

Table 2b shows a list of parameters provided in the NLDAS-1 monthly forcing GRIB files.

Table 2b. Parameters in the NLDAS-1 monthly forcing data.

PDS ID	Short Name	Full Name	Unit	Time*
63	ACPCPsfc	Convective precipitation monthly total from EDAS	kg/m^2	Mon-acc
61	APCPsfc	Precipitation monthly total	kg/m^2	Mon-acc
118	BRTMPsfc	Surface brightness temperature from GOES-UMD Pinker	K	Mon-ave
157	CAPEsfc	Convective Available Potential Energy	J/kg	Mon-ave
153	CONVAPCPsfc	Convective precipitation monthly total	Kg/m^2	Mon-acc
205	DLWRFsfc	Longwave radiation flux downwards (surface)	W/m^2	Mon-ave
204	DSWRFsfc	Sshortwave radiation flux downwards (surface)	W/m^2	Mon-ave
101	PARsfc	PAR Photosynthetically Active Radiation from GOES-UMD Pinker	W/m^2	Mon-ave
201	PEDASsfc	Precipitation monthly total from EDAS	kg/m^2	Mon-acc
202	PRDARsfc	Precipitation monthly total from StageII	kg/m^2	Mon-acc
1	PRESsfc	Surface pressure	Pa	Mon-ave
206	RGOESsfc	Shortwave radiation flux downwards (surface) from GOES-UMD Pinker	W/m^2	Mon-ave
209	RSWRFsfc	Shortwave radiation flux downwards (surface) blended from EDAS and GOES-UMD Pinker	W/m^2	Mon-ave
51	SPFH2m	2-m above ground Specific humidity	kg/kg	Mon-ave
11	TMP2m	2-m above ground Temperature	K	Mon-ave

33	UGRD10m	10-m above ground Zonal wind speed	m/s	Mon-ave
34	VGRD10m	10-m above ground Meridional wind speed	m/s	Mon-ave

* In the "Time" column, "Mon-acc" indicates "Monthly accumulated" and "Mon-ave" indicates "Monthly averaged".

How are the NLDAS-1 monthly forcing data generated?

The variables, DLWRFsfc, DSWRFsfc, PRESsfc, SPFH2m, TMP2m, UGRD10m, and VGRD10m, are the monthly average from 00Z01 of the month to 23:59Z of the last day of the month.

The variables, BRTMPsfc and CAPEsfc, are the monthly average from 00Z01 of the month to 23:59Z of the last day of the month, except if any hour has an undefined value of -9999, then do not include the hour in the monthly average.

The variables, PARsfc and RGOESsfc, are the monthly average from 00Z01 of the month to 23:59Z of the last day of the month, except if any hour has an undefined value of -9999, then reassign the variable as zero and include the hour in the monthly average.

The variables, ACPCPsfc, APCPsfc, CONVAPCPsfc, PEDASsfc, and PRDARsfc, are the monthly accumulation from 00Z01 of the month to 23:59Z of the last day of the month. However, ACPCPsfc is actually the monthly sum of the hourly (ACPCPsfc/PEDASsfc)*APCPsfc from each hour, where the ratio of (ACPCPsfc/PEDASsfc) is the fraction of convective precipitation from EDAS, and then multiplied by the APCPsfc to get the convective precipitation. For PRDARsfc accumulation, if hourly PRDARsfc is undefined or negative, fill the hour with a zero value and include the hour in the monthly average.

The last variable, RSWRFsfc, is the monthly average from 00Z01 of the month to 23:59Z of the last day of the month, representing the monthly average of the hourly "blend" of the DSWRFsfc from EDAS and RGOESsfc from GEOS. T he blend algorithm is that, for each hour, the RGOESsfc from GEOS is used for all the grid points where it is available. Where it is not available, the DSWRFsfc from EDAS is used. Because the spatial extent/availability of GEOS varies from hour to hour, this blend is done for hourly data first, and then the monthly average is applied to the hourly blended data. This last variable thus best represents the shortwave radiation flux downwards at the surface that is used in the NLDAS-1 LSMs. More about this blending/supplementation can be found from http://ldas.gsfc.nasa.gov/nldas/NLDAS1forcing.php.

The NLDAS-1 **monthly climatology forcing data** are generated from the NLDAS-1 monthly forcing data, as the 11-year (1997 – 2007) monthly average, and contain the 17 parameters same as listed in the Table 2b.

Reading the Data

WGRIB, GrADS, or other GRIB readers are required for reading the NLDAS data.

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.

Examples for setting the environment variable GRIBTAB:

MS-DOS or Windows:	`set GRIBTAB=~/data/gribtab`
Bash:	`export GRIBTAB=~/data/gribtab`
Csh:	`setenv GRIBTAB ~/data/gribtab`
Sh:	`GRIBTAB=$HOME/data/gribtab; export GRIBTAB`

The GRIBTAB file for NLDAS-1 Forcing Data is defined in Appendix B.

Reading the data by WGRIB

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.

Download the corresponding GRIBTAB (See Appendix B) and set the environmental variable GRIBTAB (See Set NLDAS-specific GRIB Parameter Table above) first before using WGRIB.

1. GRIB data verbose inventory

Usage:	./wgrib grib_file [options]
Example:	wgrib –v NLDAS_FOR0125_H.20010101.1800.001.grb

```
1:0:D=2001010118:TMP2m:2 m above gnd:kpds=11,105,2:anl:"2-m above ground Temperature [K]
2:143796:D=2001010118:SPFH2m:2 m above gnd:kpds=51,105,2:anl:"2-m above ground Specific humidity [kg/kg]
3:317756:D=2001010118:PRESsfc:sfc:kpds=1,1,0:anl:"Surface pressure [Pa]
4:491716:D=2001010118:UGRD10m:10 m above gnd:kpds=33,105,10:anl:"10-m above ground Zonal wind speed [m/s]
5:625456:D=2001010118:VGRD10m:10 m above gnd:kpds=34,105,10:anl:"10-m above ground Meridional wind speed [m/s]
6:759196:D=2001010118:DSWRFsfc:sfc:kpds=204,1,0:anl:"Shortwave radiation flux downwards (surface) [W/m^2]
7:933156:D=2001010118:DLWRFsfc:sfc:kpds=205,1,0:anl:"Longwave radiation flux downwards (surface) [W/m^2]
8:1097062:D=2001010117:PEDASsfc:sfc:kpds=201,1,0:0-1hr acc:"Precipitation hourly total from EDAS [kg/m^2]
9:1250912:D=2001010117:ACPCPsfc:sfc:kpds=63,1,0:0-1hr acc:"Convective precipitation hourly total [kg/m^2]
10:1374598:D=2001010118:CAPEsfc:sfc:kpds=157,1,0:anl:"Convective Available Potential Energy [J/kg]
11:1548558:D=2001010118:RGOESsfc:sfc:kpds=206,1,0:anl:"Shortwave radiation flux downwards (surface) from GOES-UMD Pinker
[W/m^2]
12:1722518:D=2001010118:BRTMPsfc:sfc:kpds=118,1,0:anl:"Surface brightness temperature from GOES-UMD Pinker [K]
13:1896478:D=2001010118:PARsfc:sfc:kpds=101,1,0:anl:"PAR Photosynthetically Active Radiation from GOES-UMD Pinker [W/m^2]
14:2070438:D=2001010117:APCPsfc:sfc:kpds=61,1,0:0-1hr acc:"Precipitation hourly total [kg/m^2]
15:2234344:D=2001010117:PRDARsfc:sfc:kpds=202,1,0:0-1hr acc:"Precipitation hourly total from StageII [kg/m^2]
```

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 (See Appendix A) with the GRIB 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
Convert to a binary file	wgrib –s NLDAS_FORA0125_H.20010101.1800.002.grb|grep ":TMP:"| wgrib –i NLDAS_FORA0125_H.20010101.1800.002.grb -o tmp2m.2001010118.bin
Convert to 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

Examples are for converting a specific GRIB field, e.g., 2-meter surface temperature to a binary file and a text file respectively.

A sample tmp2m.2001010118.txt file looks like:

```
464 224
9.999e+20
9.999e+20
9.999e+20
9.999e+20
9.999e+20
…….
…….
```

```
294.29
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.

Reading/viewing the data by 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://grads.iges.org/grads/.

1. Preparation for using GrADS

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) Create a GrADS control file for GRIB files by using script grib2ctl.pl

Usage:	grib2ctl.pl [options] [grib file] [optional index file]>[control file]
Example:	grib2ctl.pl NLDAS_FOR0125_H.20010101.1800.001.grb>NLDAS_FOR0125_H.001.ctl

2) Create the "grib map" file by using gribmap (gribmap is used by GrADS)

Usage:	gribmap [options] [control file]
For hourly data:	gribmap -E -i NLDAS_FOR0125_H.001.ctl
For monthly data	gribmap -0 -i NLDAS_FOR0125_M.001.ctl

Here is an example of a control file (NLDAS_FOR0125_H.001.ctl):

```
dset ^NLDAS_FOR0125_H.A20010101.1800.001.grb
index ^NLDAS_FOR0125_H.A20010101.1800.001.grb.idx
undef 9.999E+20
title NLDAS_FOR0125_H.A20010101.1800.001.grb
*  produced by grib2ctl v0.9.12.5p39c
dtype grib 110
ydef 224 linear 25.0625 0.125
xdef 464 linear -124.9375 0.125
tdef 2 linear 17Z01jan2001 1hr
zdef 1 linear 1 1
vars 15
ACPCPsfc 0 63,1,0  ** Convective precipitation hourly total [kg/m^2]
```

```
APCPsfc 0 61,1,0  ** Precipitation hourly total [kg/m^2]
BRTMPsfc 0 118,1,0  ** Surface brightness temperature from GOES-UMD Pinker [K]
CAPEsfc 0 157,1,0  ** Convective Available Potential Energy [J/kg]
DLWRFsfc 0 205,1,0  ** Longwav radiation flux downwards (surface) [W/m^2]
DSWRFsfc 0 204,1,0  ** Shortwave radiation flux downwards (surface) [W/m^2]
PARsfc 0 101,1,0  ** PAR Photosynthetically Active Radiation from GOES-UMD Pinker [W/m^2]
PEDASsfc 0 201,1,0  ** Precipitation hourly total from EDAS [kg/m^2]
PRDARsfc 0 202,1,0  ** Precipitation hourly total from StageII [kg/m^2]
PRESsfc 0 1,1,0  ** Surface pressure [Pa]
RGOESsfc 0 206,1,0  ** Shortwave radiation flux downwards (surface) from GOES-UMD Pinker [W/m^2]
SPFH2m2m  0 51,105,2 ** 2 m above ground 2-m above ground Specific humidity [kg/kg]
TMP2m2m  0 11,105,2 ** 2 m above ground 2-m above ground Temperature [K]
UGRD10m10m  0 33,105,10 ** 10 m above ground 10-m above ground Zonal wind speed [m/s]
VGRD10m10m  0 34,105,10 ** 10 m above ground 10-m above ground Meridional wind speed [m/s]
ENDVARS
```

Notes:

A. Be sure to use appropriate option for each product.
B. Also, 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.
C. 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".

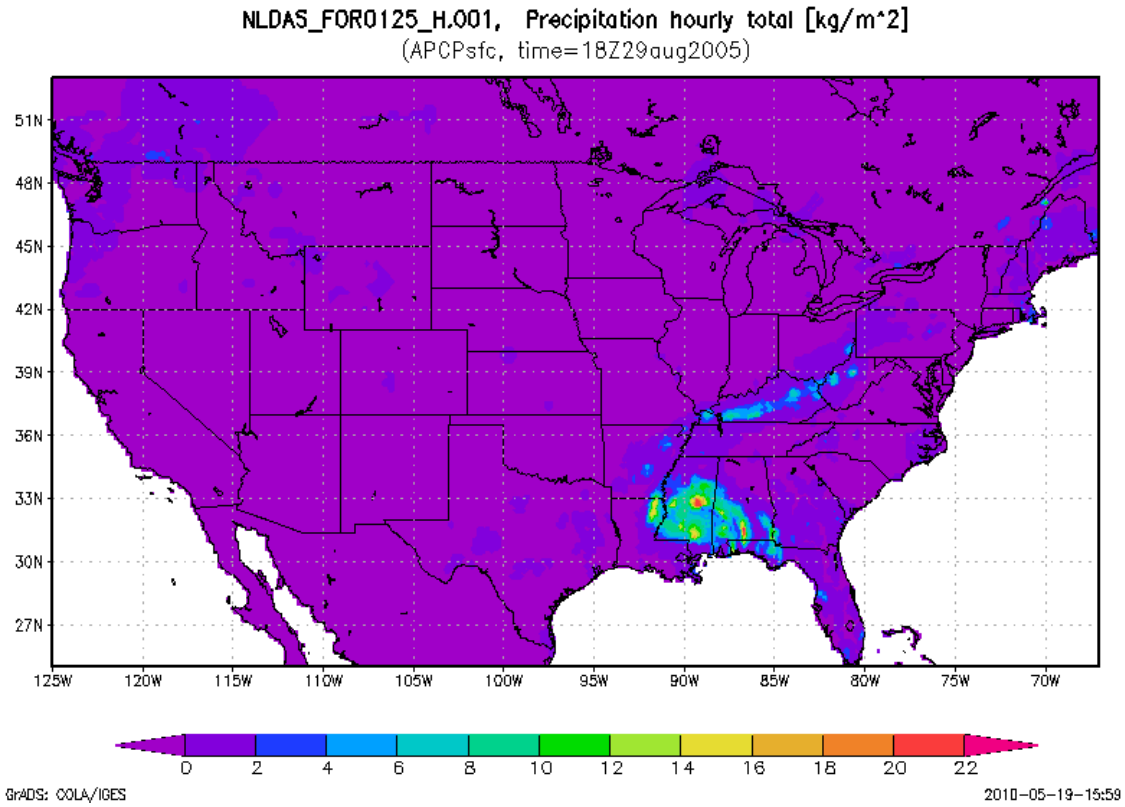
2. View the data by GrADS

Users can read/view NLDAS-1 data by using GrADS.

Example for plotting an image of NLDAS-1 Precipitation Hourly Total.

```
'reinit'
'open NLDAS_FOR0125_H.001.ctl
'set lon -124.9375 -67.0625'
'set lat 25.0625 52.9375'
'set gxout grfill'
'set grads off'
'set time 18Z29Aug2005'
'd apcpsfc'
'set rbcols'
'run cbarn'
'draw title NLDAS_FOR0125_H.001, Precipitation Hourly Total
[kg/m^2] \ (APCPsfc, time=18Z29aug2005)'
'printim NLDAS_FOR0125_H.001_apcpsfc.A20050829.1800.gif white'
```

Sample image:



Retrieve Data through the GrADS Data Server (GDS)

The GrADS Data Server is a stable, secure data server that provides subsetting and analysis services across the internet. The NLDAS-1 data is accessible via the GDS at GES DISC.

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_FOR0125_H.001'
'set lon -124.9375 -67.0625'
'set lat 25.0625 52.9375'
'set gxout grfill'
'set grads off'
'set time 18Z29Aug2005'
'd apcpsfc'
'set rbcols'
'run cbarn'
'draw title NLDAS_FOR0125_H.001, Precipitation Hourly Total
[kg/m^2] \ (APCPsfc, time=18Z29aug2005)'
'printim NLDAS_FOR0125_H.001_apcpsfc.A20050829.1800.gif white'
```

Users can convert the NLDAS-1 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_FOR0125_H.001.ascii?apcpsfc[802:804][85:88][302:306]

The output looks like:

```
apcpsfc, [3][4][5]
[0][0], 0.1328, 0.1408, 0.2592, 2.1208, 2.2368
[0][1], 0.3872, 3.4616, 4.4656, 3.3304, 3.4408
[0][2], 0.2696, 2.4912, 2.2696, 2.1808, 6.5312
[0][3], 0.272, 0.8256, 2.1712, 4.448, 9.1088

[1][0], 0.0, 0.0, 0.1136, 1.0196, 1.3596
[1][1], 0.0040, 0.2244, 0.346, 0.3552, 0.5244
[1][2], 0.0064, 0.1848, 0.1736, 0.1388, 0.41
[1][3], 0.0232, 0.084, 0.1372, 0.3028, 0.5052

[2][0], 0.0, 0.0, 0.1384, 1.2248, 2.8024
[2][1], 0.0, 0.0, 0.0, 0.036, 1.0528
[2][2], 0.0, 0.0, 0.0, 0.0, 0.2944
[2][3], 0.0, 0.0, 0.0, 0.0, 0.0072

time, [3]
728906.4166666666, 728906.4583333334, 728906.5
lat, [4]
35.6875, 35.8125, 35.9375, 36.0625
lon, [5]
-87.1875, -87.0625, -86.9375, -86.8125, -86.6875
```

The expression apcpsfc[802:804][85:88][302:306] is an array expression; the numbers are array indexes, starting from 0; and "apcpsfc" is the variable name for "precipitation hourly total".

The dimension information is listed at the end of the results page. For this example, they are time, latitude, and longitude.

The time indexes, "`728906.4166666666, 728906.4583333334, 728906.5`," are for days referenced from 00z01Jan0001. For this NLDAS-1 Hourly Forcing Data, corresponding time steps are 10Z03SEP1996, 11Z03SEP1996, and 12Z03SEP1996.

Data Interpretation

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. NLDAS-1 data can be accessed via the GES DISC's Hydrology Data and Information Services Center (HDISC), http://disc.gsfc.nasa.gov/hydrology.

Data Volume

Data Set	Resolution	Hourly		Monthly	
		Files/Day	Vol/Year	Files/Year	Vol/Year
Forcing	0.125° × 0.125°	24	21.5 GB	12	33 MB

The monthly climatology data set has total 12 files with total volume about 33 MB.

Search and download data via Mirador

NLDAS data can be searched through a keyword (e.g., Mosaic) and the time span, and downloaded in a batch mode via Mirador, http://mirador.gsfc.nasa.gov/.

Mirador is a fast interface for searching Earth science data at NASA GES DISC.

Access data via GrADS Data Server (GDS)

The NLDAS products are accessible via the GDS at 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. (See the example in Retrieve Data through the GrADS Data Server (GDS) above.)

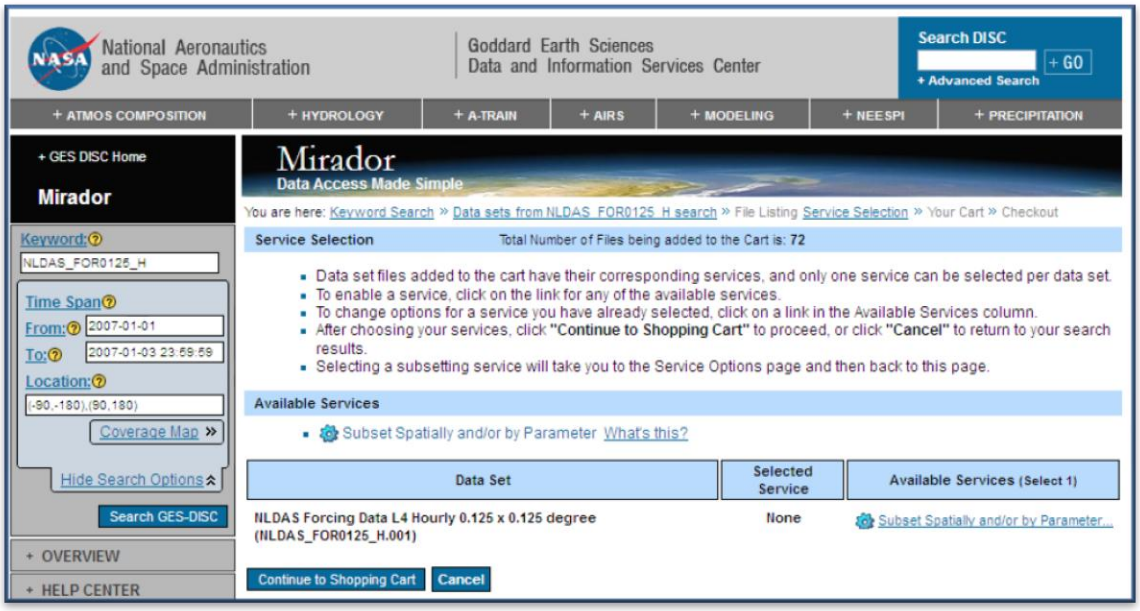
Anonymous ftp

The hourly NLDAS-1 data can be downloaded directly via the GES DISC anonymous ftp: ftp://hydro1.gsfc.nasa.gov/data/s4pa/NLDAS/.

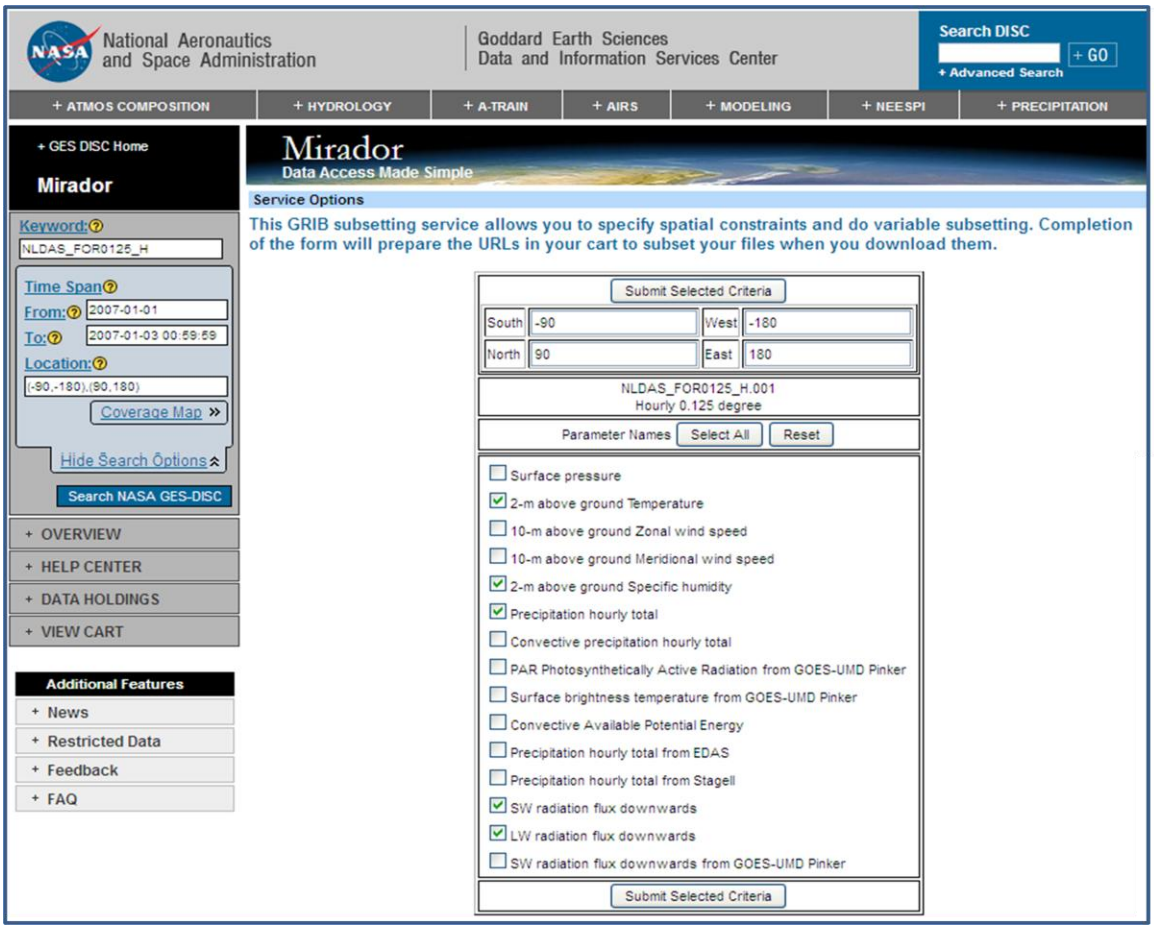
Data Services

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

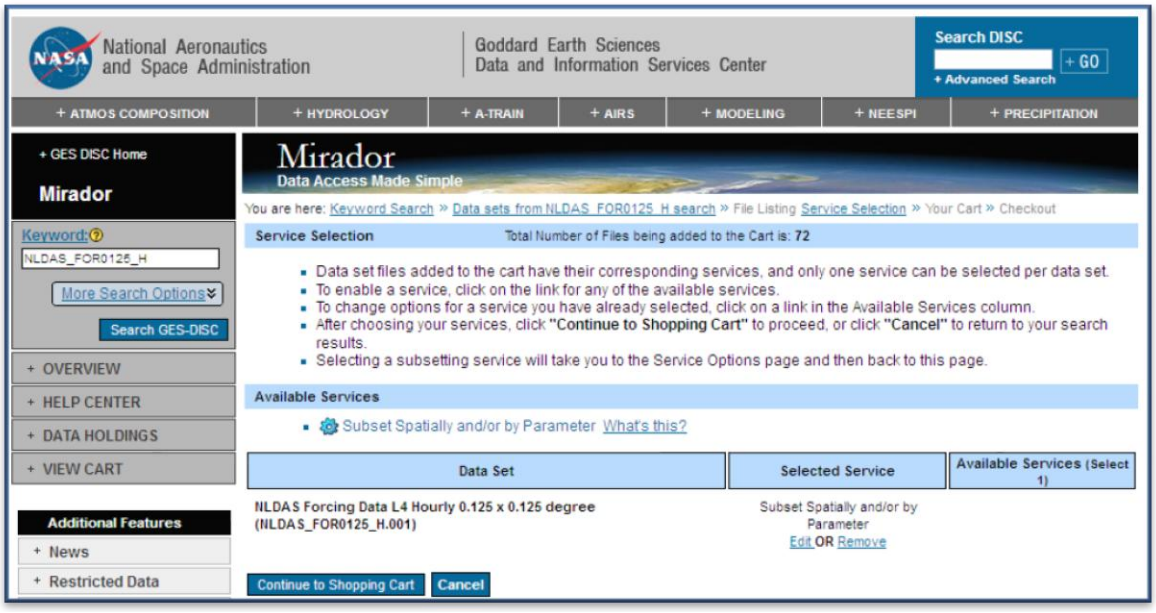
For example, a user selects three days of NLDAS Phase1 (NLDAS-1) data from Mirador by entering the begin date and the end date of the desired time range. Then the user proceeds by clicking on the ***Search GES-DISC*** button. On the next screen, the user clicks ***Select All***, followed by ***Add Selected Files to Cart***. The following screen will appear:



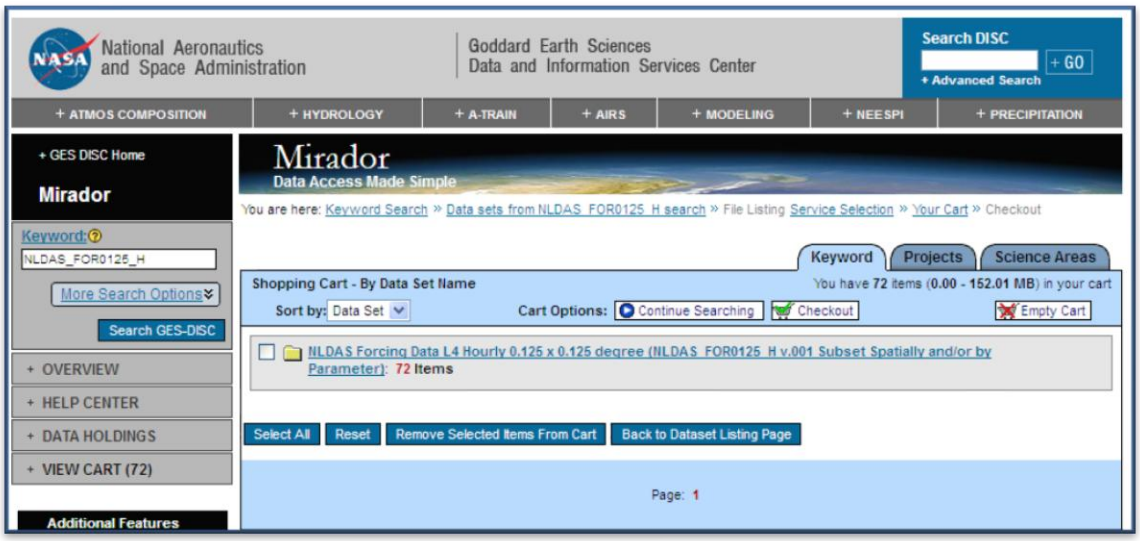
Then, from the list of ***Available Services***, the user can select ***Subset Spatially and/or by Parameter***, which leads to a new page that allows parameter selection and the spatial region-of-interest to subset. In the current example, the user selects ***Subset Spatially and/or by Parameter*** for "NLDAS Primary Forcing (NLDAS_FOR0125_H.001)," which leads to a page for the NLDAS_FOR0125_H.001 parameter and spatial selections, shown below:



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:



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



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

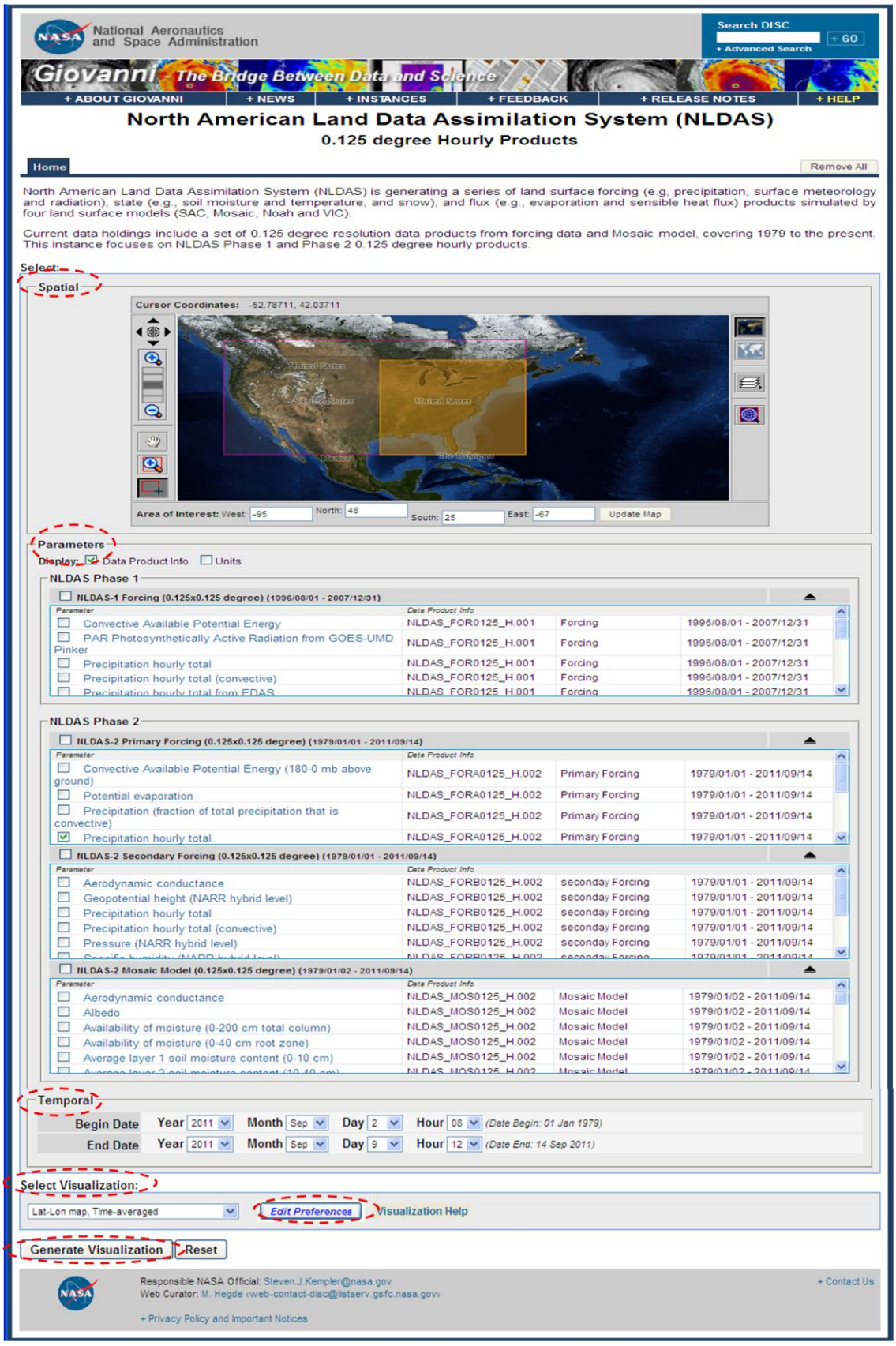
Online Visualization and Analysis in Giovanni

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.

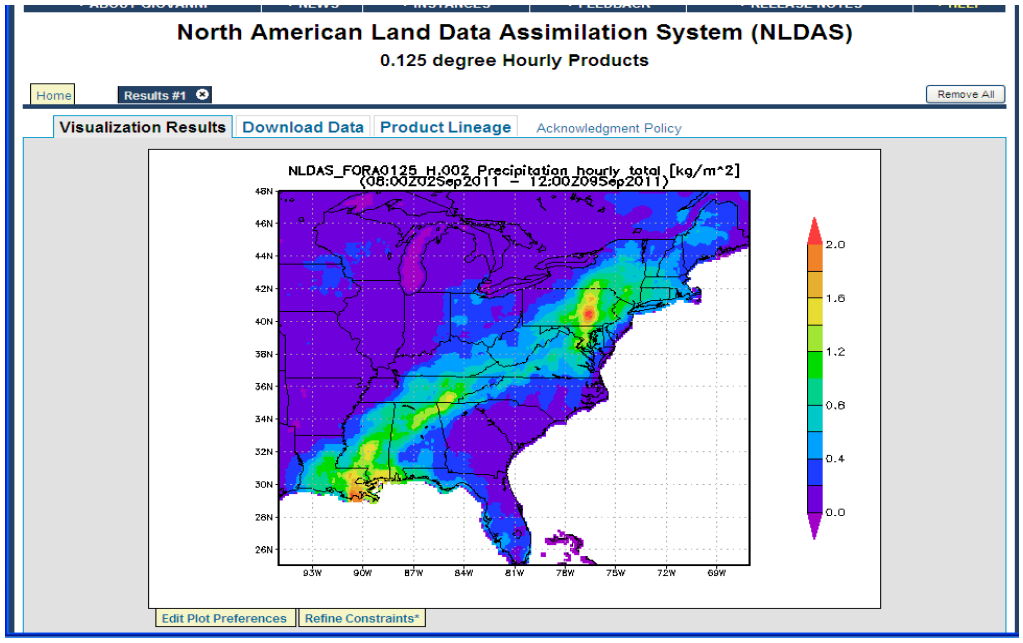
All parameters from NLDAS hourly and monthly data sets are available via the Giovanni NLDAS Hourly Portal and NLDAS Monthly Portal respectively.

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.

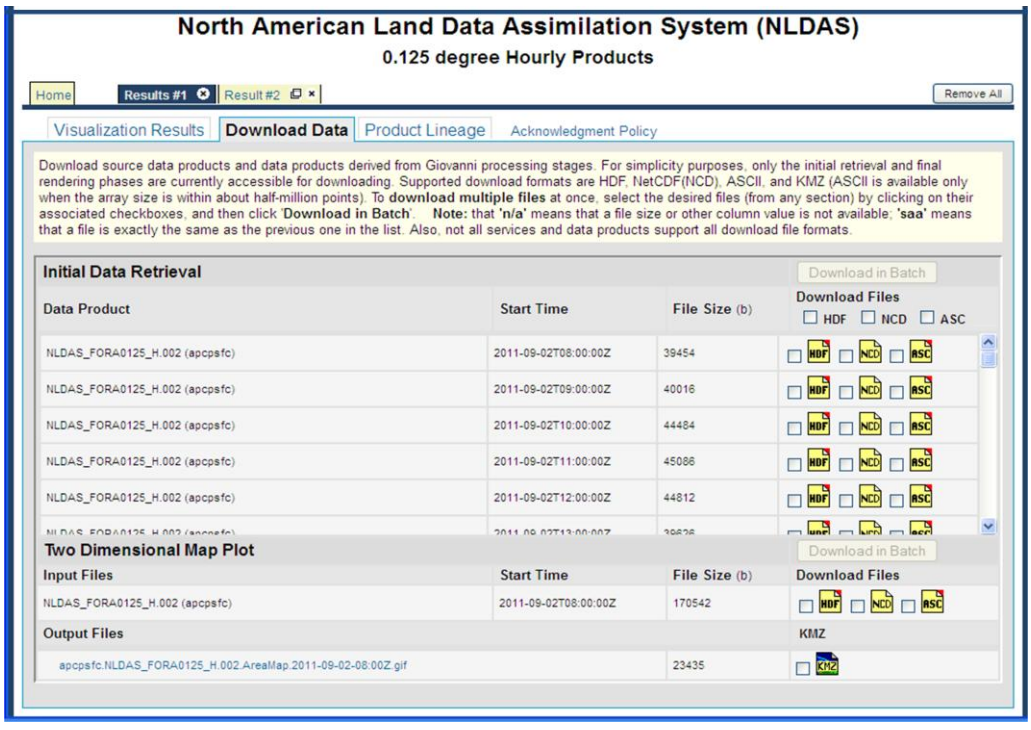
In the example of the NLDAS Hourly Portal below, a user selects area as 95W ~ 67W, 25N ~ 48N, parameter as the "Precipitation hourly total" from Primary Forcing, time range as 08Z Sept. 02, 20011 to 12Z Sept. 09, 2011, and visualization type as the "Lat-Lon Map, Time-averaged", to exam the average precipitation rate of 2011 Tropical Storm Lee, As shown below. "Edit Preferences" is available as well.


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: -67 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
Convective Available Potential Energy | NLDAS_FOR0125_H.001 | Forcing | 1996/08/01 - 2007/12/31
PAR Photosynthetically Active Radiation from GOES-UMD Pinker | NLDAS_FOR0125_H.001 | Forcing | 1996/08/01 - 2007/12/31
Precipitation hourly total | NLDAS_FOR0125_H.001 | Forcing | 1996/08/01 - 2007/12/31
Precipitation hourly total (convective) | NLDAS_FOR0125_H.001 | Forcing | 1996/08/01 - 2007/12/31
Precipitation hourly total from EDAS | 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
Convective Available Potential Energy (180-0 mb above ground) | NLDAS_FORA0125_H.002 | Primary Forcing | 1979/01/01 - 2011/09/14
Potential evaporation | NLDAS_FORA0125_H.002 | Primary Forcing | 1979/01/01 - 2011/09/14
Precipitation (fraction of total precipitation that is convective) | NLDAS_FORA0125_H.002 | Primary Forcing | 1979/01/01 - 2011/09/14
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
Aerodynamic conductance | NLDAS_FORB0125_H.002 | seconday Forcing | 1979/01/01 - 2011/09/14
Geopotential height (NARR hybrid level) | NLDAS_FORB0125_H.002 | seconday Forcing | 1979/01/01 - 2011/09/14
Precipitation hourly total | NLDAS_FORB0125_H.002 | seconday Forcing | 1979/01/01 - 2011/09/14
Precipitation hourly total (convective) | NLDAS_FORB0125_H.002 | seconday Forcing | 1979/01/01 - 2011/09/14
Pressure (NARR hybrid level) | NLDAS_FORB0125_H.002 | seconday 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
Aerodynamic conductance | NLDAS_MOS0125_H.002 | Mosaic Model | 1979/01/02 - 2011/09/14
Albedo | NLDAS_MOS0125_H.002 | Mosaic Model | 1979/01/02 - 2011/09/14
Availability of moisture (0-200 cm total column) | NLDAS_MOS0125_H.002 | Mosaic Model | 1979/01/02 - 2011/09/14
Availability of moisture (0-40 cm root zone) | NLDAS_MOS0125_H.002 | Mosaic Model | 1979/01/02 - 2011/09/14
Average layer 1 soil moisture content (0-10 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@listserv.gsfc.nasa.gov>
+ Contact Us
+ Privacy Policy and Important Notices

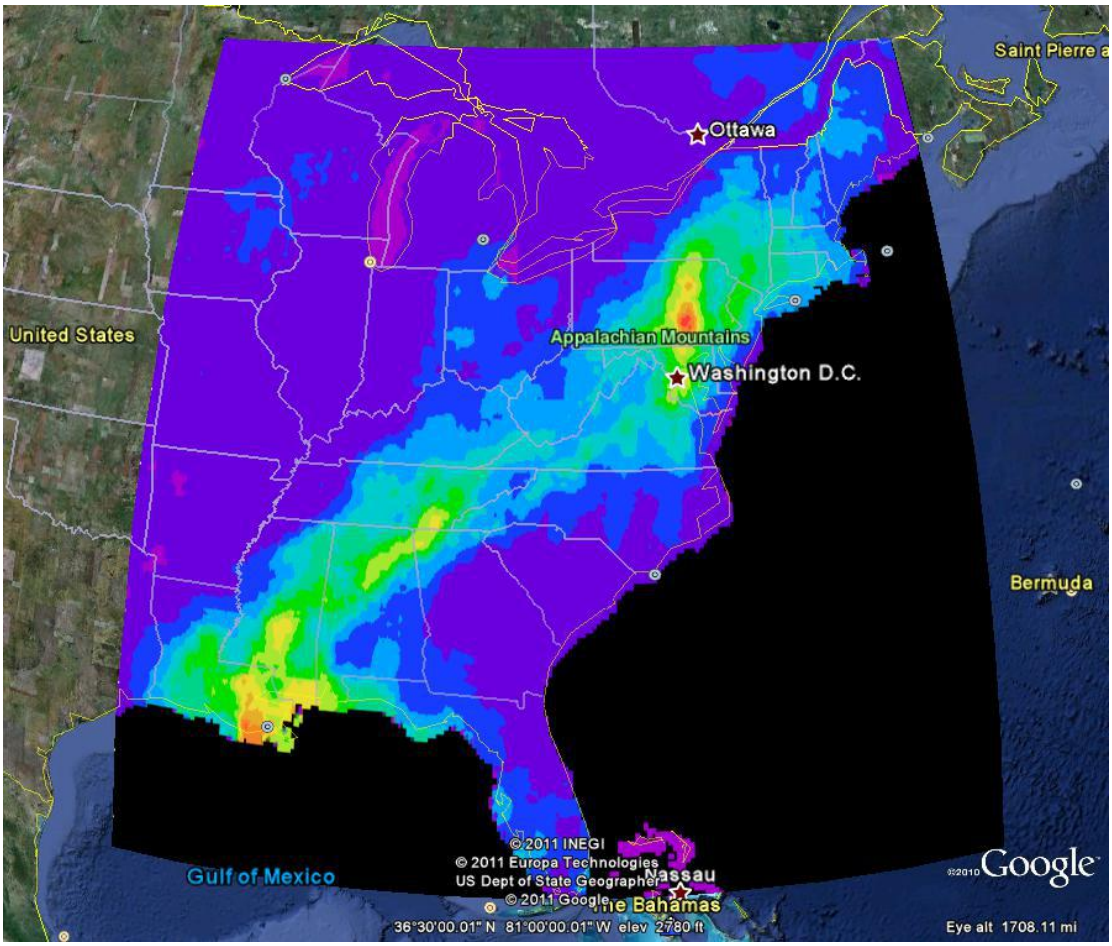
Then the user clicks on the "Generate Visualization" button and sees a resultant Lat-Lon Map of average precipitation rate between Sept. 2 and Sept. 9 2011, shown below:



There are many user options available from the result 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:



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
Hydrological Sciences Laboratory, Code 617
NASA Goddard Space Flight Center
Greenbelt, Maryland 20771
Email: David.Mocko@nasa.gov
301-614-6222 (voice)
301-614-6264 (fax)

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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 Different 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.

Table B.1a. NLDAS-1 grib table for hourly forcing dataset FOR

```
-1:7:4:130
63:ACPCPsfc:Convective precipitation hourly total [kg/m^2]
61:APCPsfc:Precipitation hourly total [kg/m^2]
118:BRTMPsfc:Surface brightness temperature from GOES-UMD Pinker [K]
157:CAPEsfc:Convective Available Potential Energy [J/kg]
205:DLWRFsfc:LW radiation flux downwards (surface) [W/m^2]
204:DSWRFsfc:SW radiation flux downwards (surface) [W/m^2]
101:PARsfc:PAR Photosynthetically Active Radiation from GOES-UMD Pinker [W/m^2]
201:PEDASsfc:Precipitation hourly total from EDAS [kg/m^2]
202:PRDARsfc:Precipitation hourly total from StageII [kg/m^2]
1:PRESsfc:Surface pressure [Pa]
206:RGOESsfc:SW radiation flux downwards (surface) from GOES-UMD Pinker [W/m^2]
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-1 grib table for monthly forcing dataset FOR

```
-1:7:4:130
 63:ACPCPsfc:Convective precipitation monthly total [kg/m^2]
 61:APCPsfc:Precipitation monthly total [kg/m^2]
118:BRTMPsfc:Surface brightness temperature from GOES-UMD Pinker [K]
157:CAPEsfc: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]
101:PARsfc:PAR Photosynthetically Active Radiation from GOES-UMD Pinker [W/m^2]
201:PEDASsfc:Precipitation monthly total from EDAS [kg/m^2]
202:PRDARsfc:Precipitation monthly total from StageII [kg/m^2]
  1:PRESsfc:Surface pressure [Pa]
206:RGOESsfc:Shortwave radiation flux downwards (surface) from GOES-UMD Pinker
[W/m^2]
209:RSWRFsfc:Shortwave radiation flux downwards (surface) blended from EDAS and
GOES-UMD Pinker [W/m^2]
```

```
 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]
```

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
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