Analysis of Water and Energy Budgets and Trends Using the NLDAS Monthly Data Sets

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Introduction

The North American Land Data Assimilation System (NLDAS) is a collaborative project between NASA GSFC, NOAA, Princeton University, and the University of Washington. NLDAS has created surface meteorological forcing data sets using the best-available observations and reanalyses. The forcing data sets are used to drive four separate land-surface models (LSMs), Noah, VIC, SAC, and SAC, to produce data sets of soil moisture, snow, runoff, and surface fluxes. NLDAS hourly data, accessible from the NASA GES DISC Hydrology Data Holdings Portal, are widely used by various user communities in modeling, research, and applications, such as drought and flood monitoring, watershed and water quality management, and case studies of extreme events. More information is available at http://ldas.gsfc.nasa.gov.

To further facilitate analysis of water and energy budgets and trends, NLDAS monthly data sets have been recently released by NASA GES DISC.

NLDAS Data Characteristics

Table 1. NLDAS Data Basic Characteristics

<table>
<thead>
<tr>
<th>Content</th>
<th>Water and energy budget data, forcing data, soil moisture/temperature data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial coverage</td>
<td>Conterminous U.S., parts of southern Canada and northern Mexico (51N ~ 59N, 125W ~ 67W)</td>
</tr>
<tr>
<td>Spatial resolution</td>
<td>0.25° x 0.25°</td>
</tr>
<tr>
<td>Temporal resolution</td>
<td>Hourly and Monthly</td>
</tr>
<tr>
<td>Forcing</td>
<td>Multiple data sets derived from satellite measurements, radar estimation, precipitation gauges, and atmospheric analyses</td>
</tr>
<tr>
<td>Land surface models</td>
<td>Noah, SAC, VIC</td>
</tr>
<tr>
<td>Output format</td>
<td>NetCDF, Gridded Binary (GRIB)</td>
</tr>
<tr>
<td>Elevation definition</td>
<td>GTOPO30</td>
</tr>
<tr>
<td>Vegetation definition</td>
<td>University of Maryland, 1 km</td>
</tr>
</tbody>
</table>

How are the NLDAS monthly data generated?

- NLDAS monthly data are generated from their corresponding hourly data by monthly accumulation for some water-related variables and monthly average for others.
- Time period for each month is from 002 at the start of the month to 23:59Z at the end of the month, except for the first month (Jan. 1979). The period for Jan 1979 is dependent on data set starting date and time (more details available in NLDAS README documents).
- NLDAS-1 Monthly Forcing Data Set:
  - Monthly accumulation for precipitation variables (ACPcPdc, APcPdc, PEDAcSfc, and PRDAcSfc) and monthly average for others.
  - Two new variables for NLDAS-1 monthly forcing data set:
    1. Convective precipitation monthly total (CONVPcPdc)
    2. Shortwave radiation flux downwards (surface) blended from EDAS and GOES-UMD Pinker (RSWRFdc)
- NLDAS-2 Monthly Forcing Data Set:
  - Monthly accumulation for total precipitation, convective precipitation, and potential evaporation, and monthly average for other variables.
- NLDAS-2 Monthly Secondary Forcing Data Set:
  - Monthly accumulation for precipitation and convective precipitation and monthly average for others.
- NLDAS-2 Monthly Noah and Moses Model Data Sets:
  - Monthly accumulation for rainfall, snowfall, subsurface runoff, surface runoff, total evapotranspiration, and snow melt, and monthly average for others.

More detailed information is available in the NLDAS README documents, located at: http://disc.sci.gsfc.nasa.gov/hydrology/documentation.

NLDAS Water and Energy Variables

Table 2. Major Variables of NLDAS Forcing Data Sets and Model Outputs

<table>
<thead>
<tr>
<th>Energy Balance</th>
<th>Water Balance</th>
<th>Surface and subsurface State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longwave radiation flux downwards</td>
<td>Precipitation</td>
<td>Average layer soil moisture</td>
</tr>
<tr>
<td>Shortwave radiation flux downwards</td>
<td>Rainfall (unforced precipitation)</td>
<td>Average layer soil temperature</td>
</tr>
<tr>
<td>Ground heat flux</td>
<td>Snowfall (forced precipitation)</td>
<td>Humidity</td>
</tr>
<tr>
<td>Latent heat flux</td>
<td>Runoff (surface and subsurface)</td>
<td>Temperature</td>
</tr>
<tr>
<td>Sensible heat flux</td>
<td>Average layer soil moisture</td>
<td>Snow cover</td>
</tr>
<tr>
<td>Snow phase-change heat flux</td>
<td>Potential evaporation</td>
<td>Snow depth</td>
</tr>
<tr>
<td>Snow melt</td>
<td>Total evapotranspiration</td>
<td>Albedo</td>
</tr>
<tr>
<td>Snow melt</td>
<td>Snow melt</td>
<td>Leaf area index</td>
</tr>
</tbody>
</table>

NLDAS provides more than 33 years of data for these major water balance and energy balance variables, and the data can be used for studying water and energy budgets and trends. For the complete list of NLDAS variables, please go to NLDAS README Documents.

Summary

- NLDAS hourly data, accessible from NASA GES DISC, are widely used by various user communities in modeling, research, and applications, such as drought and flood monitoring, watershed and water quality management, and case studies of extreme events.
- To further facilitate analysis of water and energy budgets and trends, NLDAS monthly data products have been recently released by NASA GES DISC.
- NLDAS monthly data are generated from their corresponding hourly data by monthly accumulation for some water-related variables and monthly average for others.
- NLDAS provides major water balance and energy balance variables and can be used for studying water and energy budgets and trends.
- NLDAS monthly Climatology data will be released in Jan. 2013 and will facilitate analysis of trends and anomalies.

How to access NLDAS data?

- Direct file: simple, fast, and navigation
- Mirador: keyword search, navigation, subsetting, and format conversion
- ADS Data Server (GDS): data aggregation and retrieving data in ASCI
- Giovanni: visualization, analysis, and data download
- Simple Subset Wizard (SSW): keyword search, subsetting, and format conversion (GRIB to NetCDF), currently for all hourly data sets and, in the future, for all monthly data.

How to access NLDAS data as a service?

- NLDAS Data Access and Services webpage (http://disc.sci.gsfc.nasa.gov/hydrology/data-holdings)
- via the following access methods:
  - Direct file: simple, fast, and navigation
  - Mirador: keyword search, navigation, subsetting, and format conversion
  - ADS Data Server (GDS): data aggregation and retrieving data in ASCI

How to access NLDAS data in NetCDF format?

- NLDAS Monthly Data - Data Access and Services https://ntrs.nasa.gov/search.jsp?R=20180000791
- 2018-05-15T17:16:56+00:00Z

Upcoming New Data and Services

New Data Services (expected release date)
- NLDAS-1 & 2 Monthly climatology (Jan. 2013)
- NLDAS monthly data sets and monthly SAC model data (Spring 2013)
- NLDAS-2 monthly and yearly VIC model data (Summer 2013)

New Data Sets (expected release date)
- NLDAS-1 & 2 Monthly climatology (Jan. 2013)
- NLDAS-2 monthly and yearly SAC model data (Spring 2013)
- NLDAS-2 monthly and yearly VIC model data (Summer 2013)

Acknowledgments

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