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Technical Implementation Notice 14-24
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From: Tim McClung
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 Office of Science and Technology

Subject: New North American Land Data Assimilation System
 (NLDAS): Effective June 24, 2014

Effective on or about Tuesday, June 24, 2014, the National Centers for Environmental Prediction (NCEP) will begin to run and disseminate data from the North American Land Data Assimilation System Version 2.0.0 (NLDAS-2).

NLDAS is a multi-model land modeling and assimilation system run in an uncoupled mode on a common one-eighth degree grid covering the Continental United States (CONUS) along with northern Mexico and southern Canada, and driven by atmospheric forcing.

NLDAS provides retrospective and real-time high-resolution water and energy cycle products, such as surface fluxes, soil moisture, snow cover, and runoff/streamflow, along with the near-surface atmospheric and precipitation data sets used as forcings for the NLDAS land models. These products support drought monitoring, seasonal hydrological prediction, weather and climate forecasting, model evaluation, and land-hydrology research within these communities.

NLDAS has become a mature system and is being implemented into real-time National Centers for Environmental Prediction (NCEP) operations in the near future. The retrospective component of Phase 2 of NLDAS (NLDAS-2; Ek et al, 2011) was completed in 2008

<http://www.emc.ncep.noaa.gov/mmb/nldas>

Since then, NLSDA has continued in near real time. NLDAS-2 was developed at the National Oceanic and Atmospheric Administration NCEP Environmental Modeling Center (EMC) in collaboration with its NOAA Climate Program Office (CPO) Climate Prediction Program of the Americas (CPPA) partners. These partners include the National Aeronautics and Space Administration/Goddard Space

Flight Center (NASA/GSFC), Princeton University, the University of Washington (UW), the NWS Office of Hydrologic Development (OHD), and the NCEP Climate Prediction Center (CPC). It can be considered as the follow-on to Phase 1 of NLDAS (Mitchell et al, 2004), which was supported through the NOAA Office of Global Programs (now CPO) GEWEX Americas Prediction Project (GAPP) and the NASA Terrestrial Hydrology Program.

Ek, M. B., and co-authors, 2011: North American Land Data Assimilation System Phase 2 (NLDAS-2). Development and Applications, GEWEX News, May, 21(2), 6-7, 20

www.gewex.org/gewexnews/May2011.pdf

Mitchell, K. E., and co-authors, 2004: The multi-institution North American Land Data Assimilation System (NLDAS): Utilizing multiple GCIP products and partners in a continental distributed hydrological modeling system. J. Geophys. Res., 109, D07S90, doi:10.1029/2003JD003823.

For references see NLDAS publications in NASA NLDAS-2 website

<http://ldas.gsfc.nasa.gov/nldas/NLDASpublications.php>

1. NLDAS-2 data and their distribution:

NLDAS Version 2 generates hourly surface forcing at standard model boundary layers (e.g., 2m air temperature and specific humidity, 10 m wind speed, surface pressure, downward shortwave and longwave radiation, precipitation) and the NCEP RCDAS lowest model layer. NLDAS also provides hourly simulation for energy fluxes (e.g., sensible heat flux, latent heat flux, ground heat flux, net radiation etc.), water fluxes (e.g., evapotranspiration, total runoff/streamflow, precipitation, etc.), and state variables (e.g., soil moisture, soil temperature, snow water equivalent, land surface temperature, snow cover, etc.) listed below from the four land surface models, once per day for the 12 UTC cycle.

The NLDAS-2 output will be available in GRIB2 format on a 1/8th x 1/8th degree output grid. The NLDAS output will be disseminated via the ftp/http server:

<http://www.ftp.ncep.noaa.gov/data/nccf/com/nldas/>
<ftp://ftp.ncep.noaa.gov/pub/data/nccf/com/nldas>

NLDAS produces the forcing files with a 3.5-day lag and the output from the four LSMs with a 4-day lag. Therefore, NLDAS output generated today will be available in directories dated 3 and 4 days ago. Output files and their contents include:

1.1 NLDAS-2 forcing:

NLDAS produces "a" and "b" forcing files. The "a" files are the primary NLDAS forcing files. The "b" files are directly downscaled from the NARR/RCDAS reanalysis at the lowest prognostic model level with a spatial variation for diverse terrain.

File a: nldas.t12z.force-a.grb2f\$HR, where HR = 00, 01, ..., 23

2D products include:

- (1) TMP at 2 m: 2-m air temperature (K),
- (2) SPFH at 2 m: Specific Humidity (kg/kg),
- (3) PRES on the surface: surface pressure (pa),
- (4) UGRD at 10 m: 10 m u component (m/s),
- (5) VGRD at 10 m: 10 m v component (m/s),
- (6) DLWRF on the surface: downscaled RCDAS downward longwave radiation (W/m^2),
- (7) FRAIN on surface: convection precipitation fraction to total precipitation (--),
- (8) CAPE: Convective Available Potential Energy (J/kg),
- (9) PEVAP Potential Evaporation (kg/m^2),
- (10) APCPN: Gauge-based total precipitation (kg/m^2),
- (11) DSWRF: Bias-corrected RCDAS Downward Short-Wave Radiation Flux (W/m^2)

File b: nldas.t12z.force-b.grb2\$HR, where HR=00, 01, ..., 23

2D products include:

- (1) DSWRF: downscaled RCDAS Downward Short-Wave Radiation Flux [W/m^2],
- (2) APCPN: Downscaled RCDAS Total precipitation [kg/m^2],
- (3) ACPCP: Convective Precipitation [kg/m^2],
- (4) ACOND: Aerodynamic conductance [m/s],
- (5) TMP: The lowest model layer Temperature [K],
- (6) SPFH: the lowest model layer Specific Humidity [kg/kg],
- (7) PRES: The lowest model layer Pressure [Pa],
- (8) UGRD: The lowest model layer U-Component of Wind [m/s],
- (9) VGRD: The lowest model layer V-Component of Wind [m/s], and
- HGT: Geopotential Height [gpm].

1.2 Output from the Four Land Surface Models:

\$model.t12z.grbf\$HR, where model=Mosaic, Noah, SAC, and VIC;
HR=00, 01, 02, ..., 23

Model outputs include hourly energy fluxes, water fluxes, and states variables. For details, see the Model Output tab on the NCEP/EMC NLDAS website:

<http://www.emc.ncep.noaa.gov/mmb/nldas>

NASA NLDAS website:

http://ldas.gsfc.nasa.gov/faq/#NLDAS_NASAvsEMC

Details are also in NLDAS-2 publications (Xia et al., 2012a). It should be noted that soil moisture in SAC model is not for any

specific soil layer rather than six components of two reservoirs (shallow upper and deeper lower). A post-process algorithm can be used to generate soil moisture for a specific soil layer (Xia et al., 2012a, Xia et al., 2014). Soil moisture and temperature for VIC model are not for a specific soil layers for the second and third soil layer as soil layers for these two layers vary from grid cell to grid cell. Similar to the SAC model, a post-process algorithm developed by Princeton University can be used to generate soil moisture and temperature for a given soil layer (Xia et al., 2012a).

1.3 Routed Streamflow from the Four Land Surface Models:

The River Routing Model developed by Lohmann et al. (2004) was used to generate gridded streamflow over the CONUS. The results from NLDAS-2 have been comprehensively evaluated using long-term observed streamflow from 961 USGS basins (Xia et al., 2012b). The output data include routed streamflow:

\$model.t12z.STRM.grbf\$HR, where model=Mosaic, Noah, SAC, and VIC; HR=00, 01, 02,..., 23; STRM: routed streamflow (m^3/s)

2. NLDAS-2 Operational Run:

A consistent parallel feed of data is currently available on the NCEP server at:

<ftp://ftp.ncep.noaa.gov/pub/data/nccf/com/nldas/para>,
or
<http://www.ftp.ncep.noaa.gov/data/nccf/com/nldas/para>

Users please note that NLDAS-2 products are encoded in GRIB2 using a relatively-new GRIB template. Users should download the latest versions of wgrib2 and the other NCEP GRIB utilities to use the NLDAS-2 output products. Users can access the NCEP GRIB utilities from this URL:

<http://www.nco.ncep.noaa.gov/pmb/codes/nwprod/util/exec>

A website containing more information about GRIB2 can find at:

http://www.nco.ncep.noaa.gov/pmb/docs/grib2/grib2_doc.shtml

For questions regarding the scientific content of the NLDAS system please contact:

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NWS National Technical Implementation Notices are online at:

<http://www.nws.noaa.gov/os/notif.htm>

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