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NLDAS EMC CCB meeting, April 03, 2014

**North American Land Data
Assimilation System (NLDAS)
Version 1.0.0 -- a New Implementation**

Michael B. Ek, Youlong Xia and Yuqiu Zhu

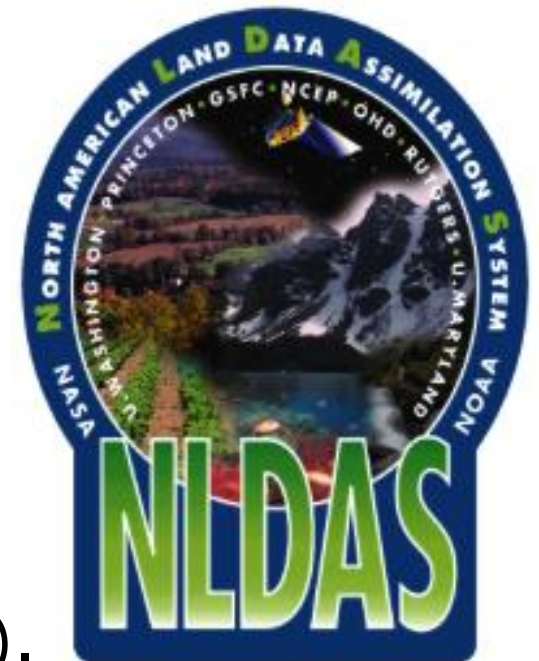
NLDAS: Partners

- NLDAS, Data Sets, Land Model Development:
 - M. Ek, Y. Xia, J. Dong, J. Meng (NCEP/EMC)
 - J. Sheffield, E. Wood et al (Princeton U.)
 - D. Mocko, C. Peters-Lidard (NASA/GSFC)
 - V. Koren, B. Cosgrove (NWS/OHD)
 - D. Lettenmaier et al (U. Washington)
 - L. Luo (U. Michigan, formerly Princeton)
 - Z-L Yang et al (UT-Austin); F. Chen et al (NCAR); X. Zeng et al (U. Ariz.)
- NLDAS Maintenance and Operational Transition:
 - Y. Xia (NCEP/EMC)
- NLDAS Products Application:
 - K. Mo, L.-C. Chen (NCEP/CPC)
 - E. Luebben, U.S.D.M. Author Group (USDA)

NLDAS V1.0.0 SET UP

North American Land Data Assimilation System (NLDAS)

- Multi-land-modeling & land data assimilation system.
- Uncoupled land model runs driven by atmospheric forcing using surface meteorology data sets.
- Long-term retrospective and near real-time runs.
- Land model output of water and energy budgets.
- 30-year land model runs provide **climatology**.
- **Anomalies** used for **drought monitoring**.
- Multi-institute collaboration (NCEP, OHD, NASA, Princeton, Univ. Wash.).





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Overview of the North American Land Data Assimilation System (NLDAS)

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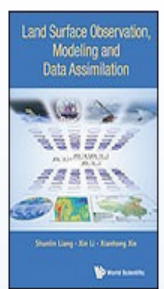
Youlong Xia, Brian A. Cosgrove, Michael B. Ek, Justin Sheffield, Lifeng Luo, Eric F. Wood, Kingtse Mo, and NDLAS team (2013) Overview of the North American Land Data Assimilation System (NLDAS). Land Surface Observation, Modeling and Data Assimilation: pp. 337-377.

doi: 10.1142/9789814472616_0011

Part 4: Application

Overview of the North American Land Data Assimilation System (NLDAS)

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Department of Environmental and Civil Engineering, Princeton University, Princeton, NJ, USA



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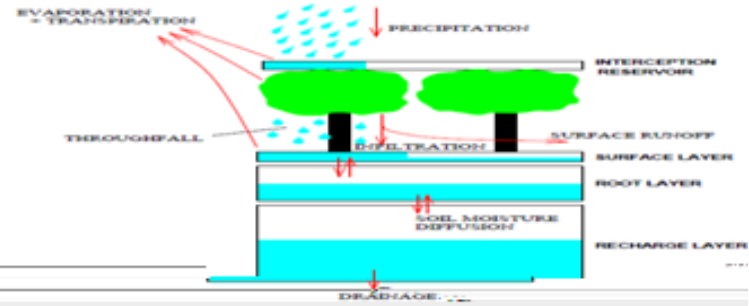
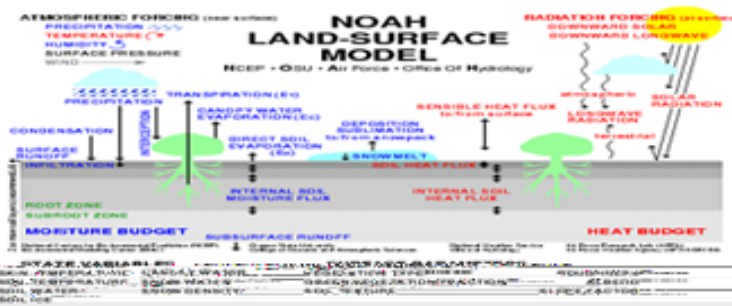
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NLDAS: Land Models

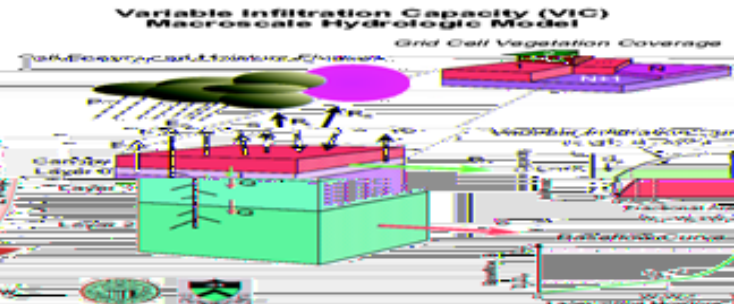
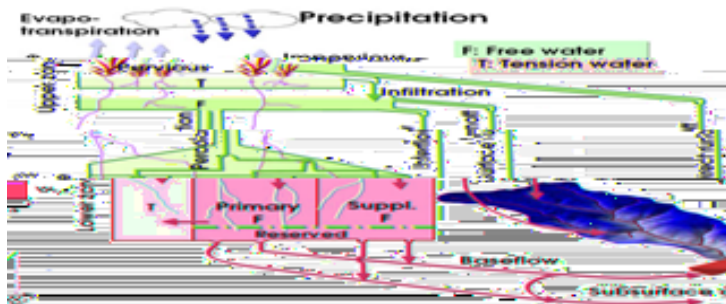
Atmospheric Community



Noah
NCEP operational
land model

Mosaic
NASA GSFC

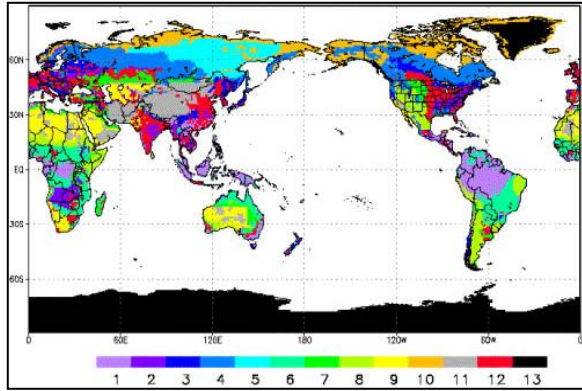
Hydrology Community



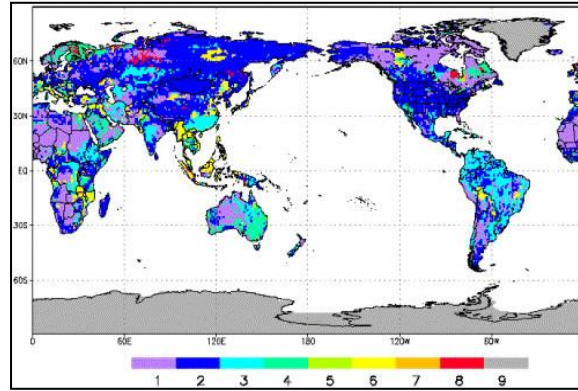
SAC
NWS operational
hydrological model

VIC
Princeton &
U. Washington

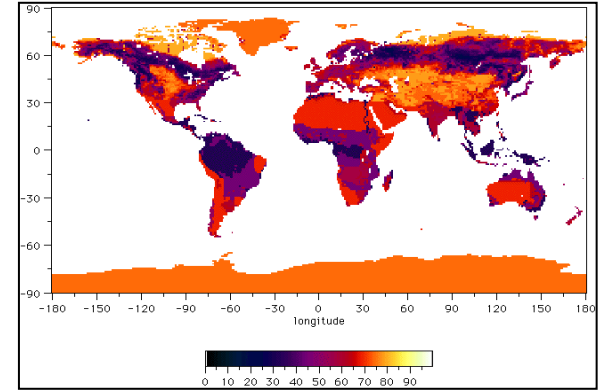
NLDAS: Land Data Sets



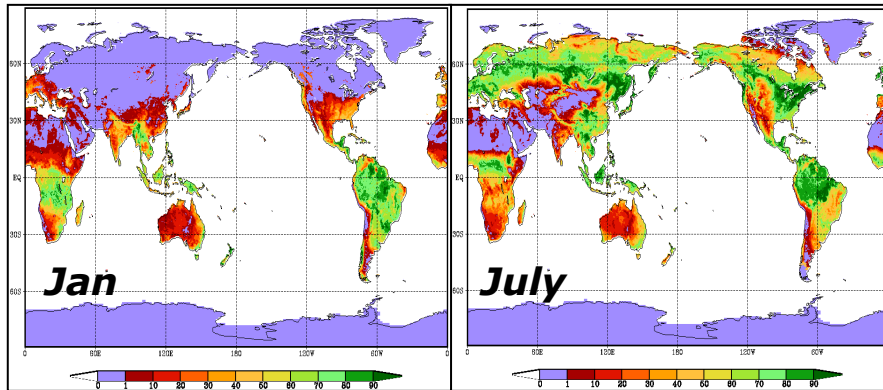
Vegetation Type
(1-deg, UMD)



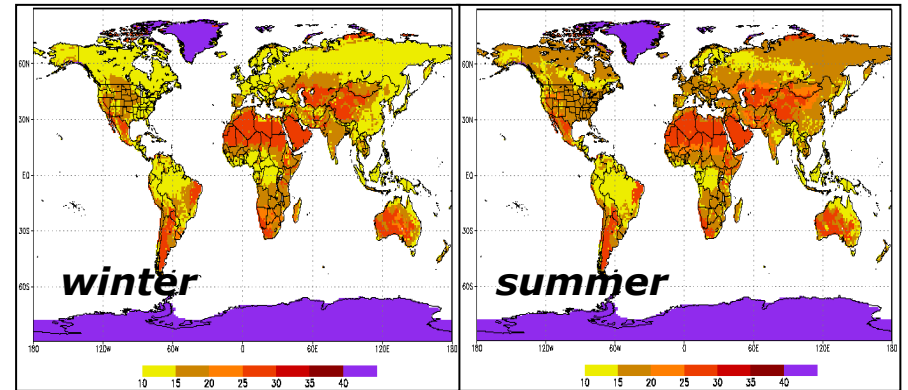
Soil Type
(1-deg, Zobler)



Max.-Snow Albedo
(1-deg, Robinson)



Green Vegetation Fraction
(monthly, 1/8-deg, NESDIS/AVHRR)



Snow-Free Albedo
(seasonal, 1-deg, Matthews)

- Fixed climatologies, or near real-time obs, some quantities to be assimilated (e.g. soil moist., snow),

NLDAS: Atmospheric Forcing

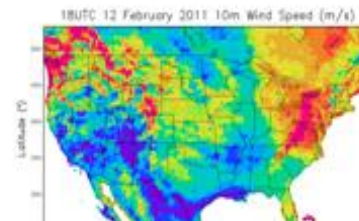
- Common atmospheric forcing from Regional Climate Data Assimilation System (real time extension of North American Regional Reanalysis), except precip.
- CPC gauge-based observed precipitation, temporally disaggregated using radar/satellite data (stage IV, CMORPH).



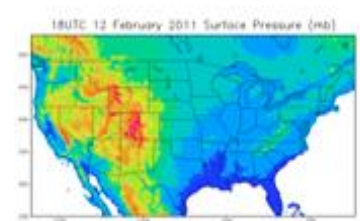
Precipitation



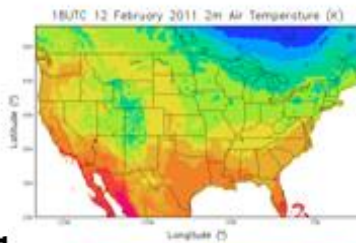
Incoming solar



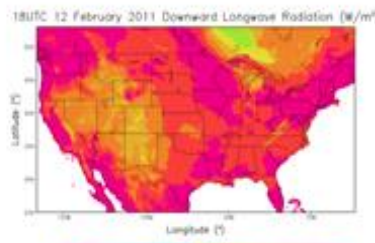
Wind speed



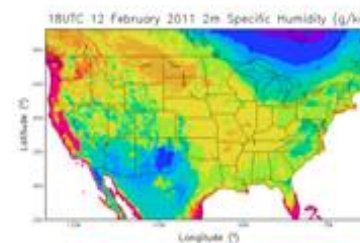
Pressure



Air temperature



Downward longwave

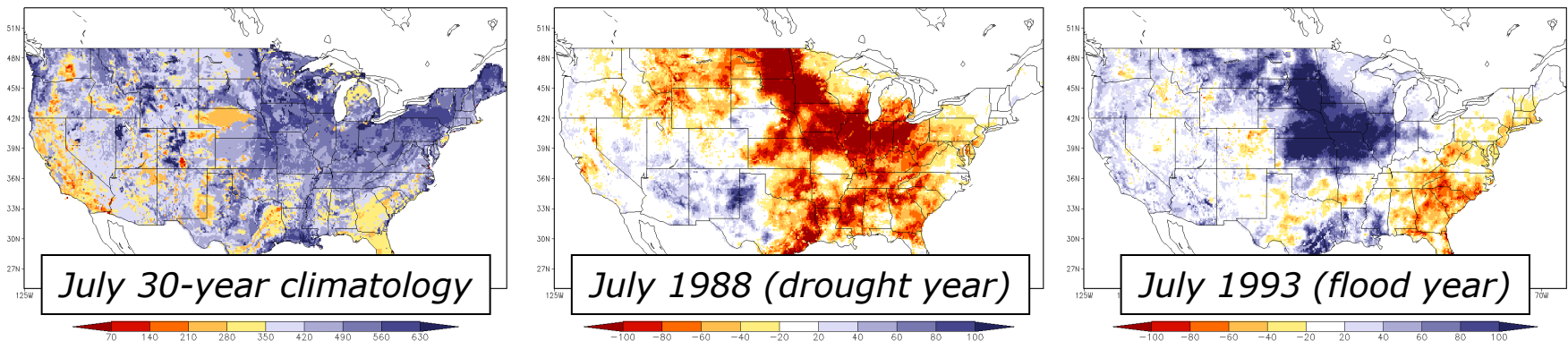


Specific humidity

12 Feb 2011

NLDAS: Simulations

- 30-year retrospective land model runs, Oct 1979 – Sep 2008 (after 15-year spin-up) to provide land model climatologies.
- Quasi-operational near real-time, Sep 2008–present; hourly, 0.125-deg, CONUS domain.
- Land model output: surface fluxes (latent, sensible & soil heat fluxes, & net radiation), soil states (soil moisture, temperature & ice), runoff/streamflow.
- Depict conditions as anomalies and percentiles.

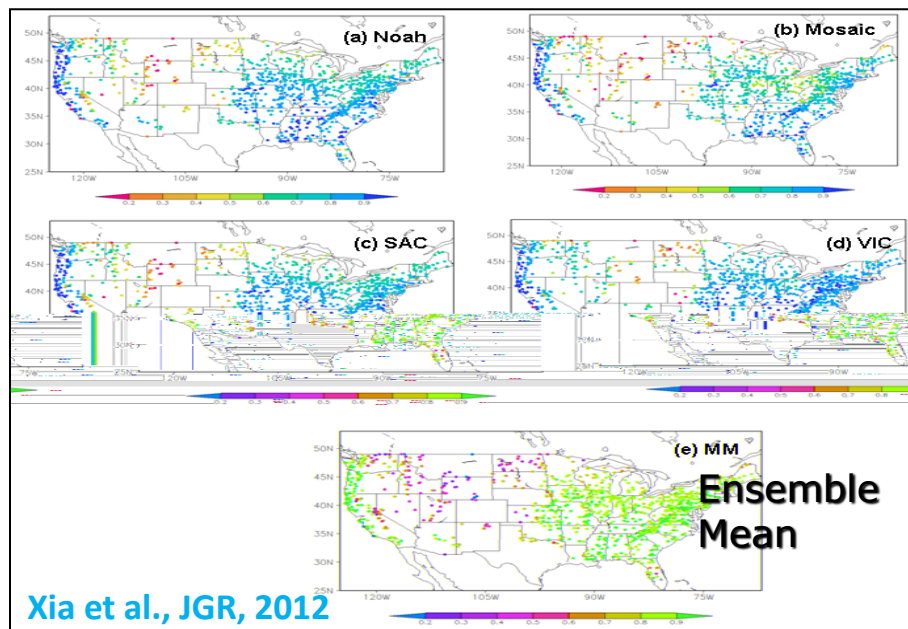


*NLDAS four-model ensemble monthly **soil moisture** anomaly*

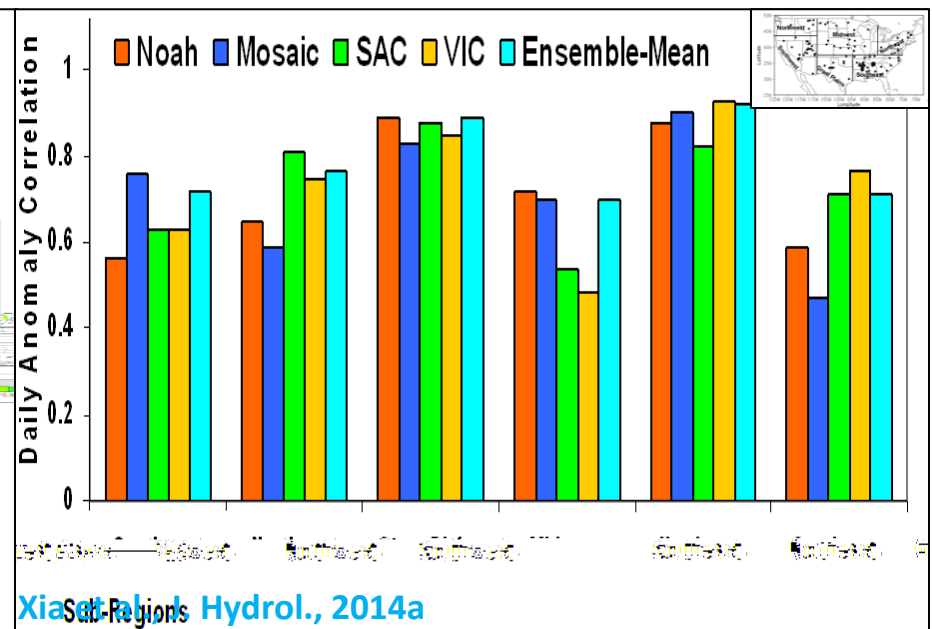
NLDAS V1.0.0 Products: Evaluation and Validation

NLDAS: Evaluation and Validation

- Energy flux validation from tower: net radiation, sensible, latent & ground heat fluxes.
- Water budget: evaporation, total runoff/streamflow.
- State variables: soil moisture, soil temperature, skin temperature, snow water equivalent, snow cover.



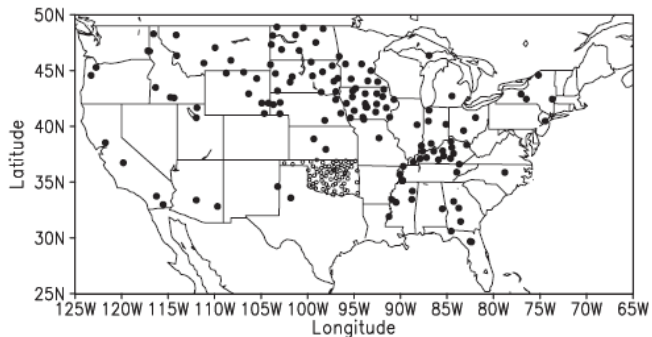
Monthly streamflow anomaly correlation
(1979-2007 USGS measured streamflow)



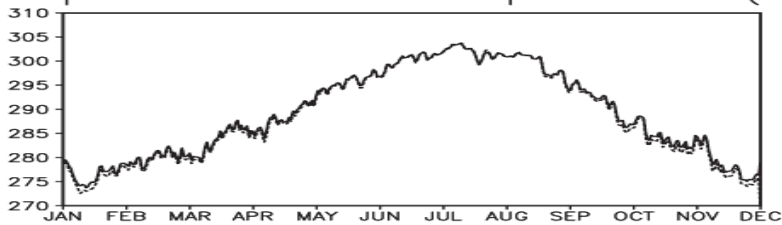
Daily top 1m soil moisture anomaly correlation
(2002-2009 US SCAN Network)

NLDAS: Evaluation (continue)

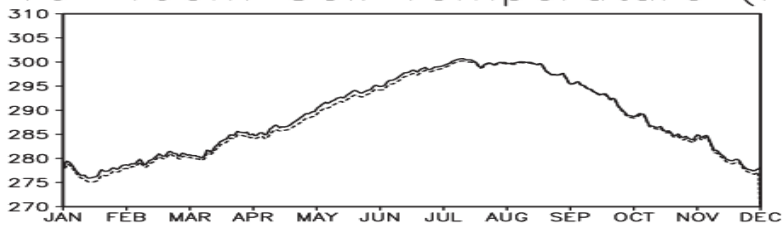
Soil Temperature Comparison: NLDAS vs US Soil T (Xia et al., JAMC, 2013)



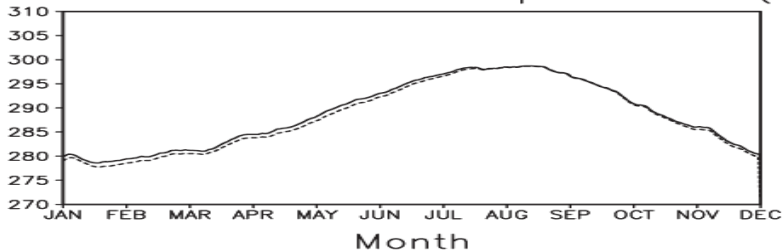
Top 10cm Soil Temperature (K)



10–40cm Soil Temperature (K)

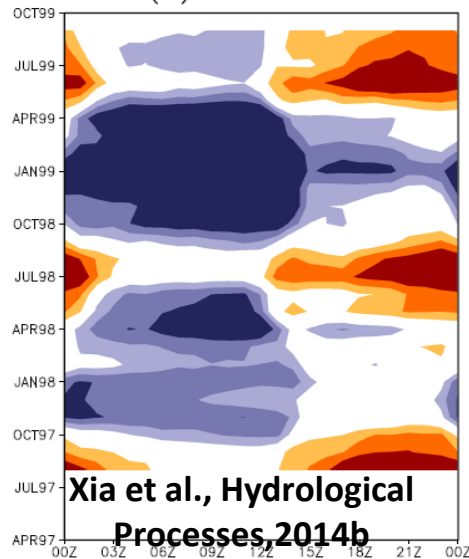


40–100cm Soil Temperature (K)



Land Skin Temperature in ARM/CART

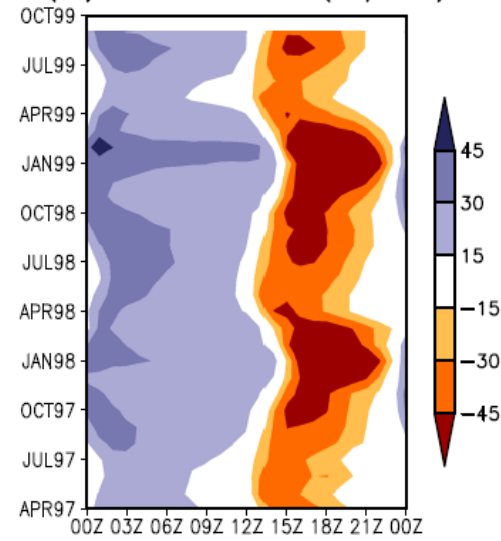
(a) Noah-OBS



Xia et al., Hydrological Processes, 2014b

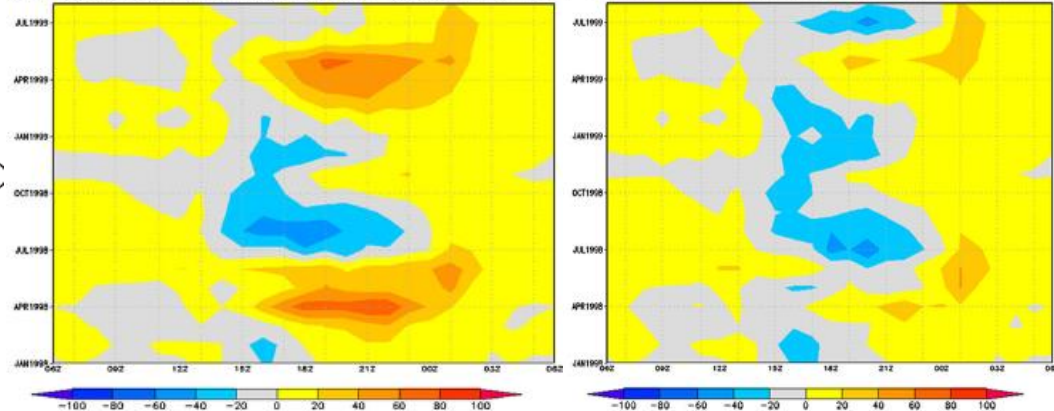
Ground Heat Flux in ARM/CART

(a) Noah-OBS (W/M^2)



Difference between Noah simulated and observed LH at ARM/CART (We et al., Hydrological Processes, 2012)

(a) Monthly Mean Latent Heat Flux (Wm^{-2}) CASE CNTR-OBS (b) Monthly Mean Latent Heat Flux (Wm^{-2}) CASE RTDS-OBS



NLDAS-1

NLDAS-2

NLDAS v1.0.0 Products: Users and Applications

NLDAS: Users

- NCEP/CPC Drought Monitoring & Drought Outlook (www.cpc.ncep.noaa.gov/products/Drought)
- US Drought Monitor (www.droughtmonitor.unl.edu)
- US Drought Portal/National Integrated Drought Information System (NIDIS) (www.drought.gov)
- Other government, academic, private users.

The screenshot displays the U.S. Drought Portal interface. At the top, a banner reads "Drought Information" in orange. Below this are three panels:

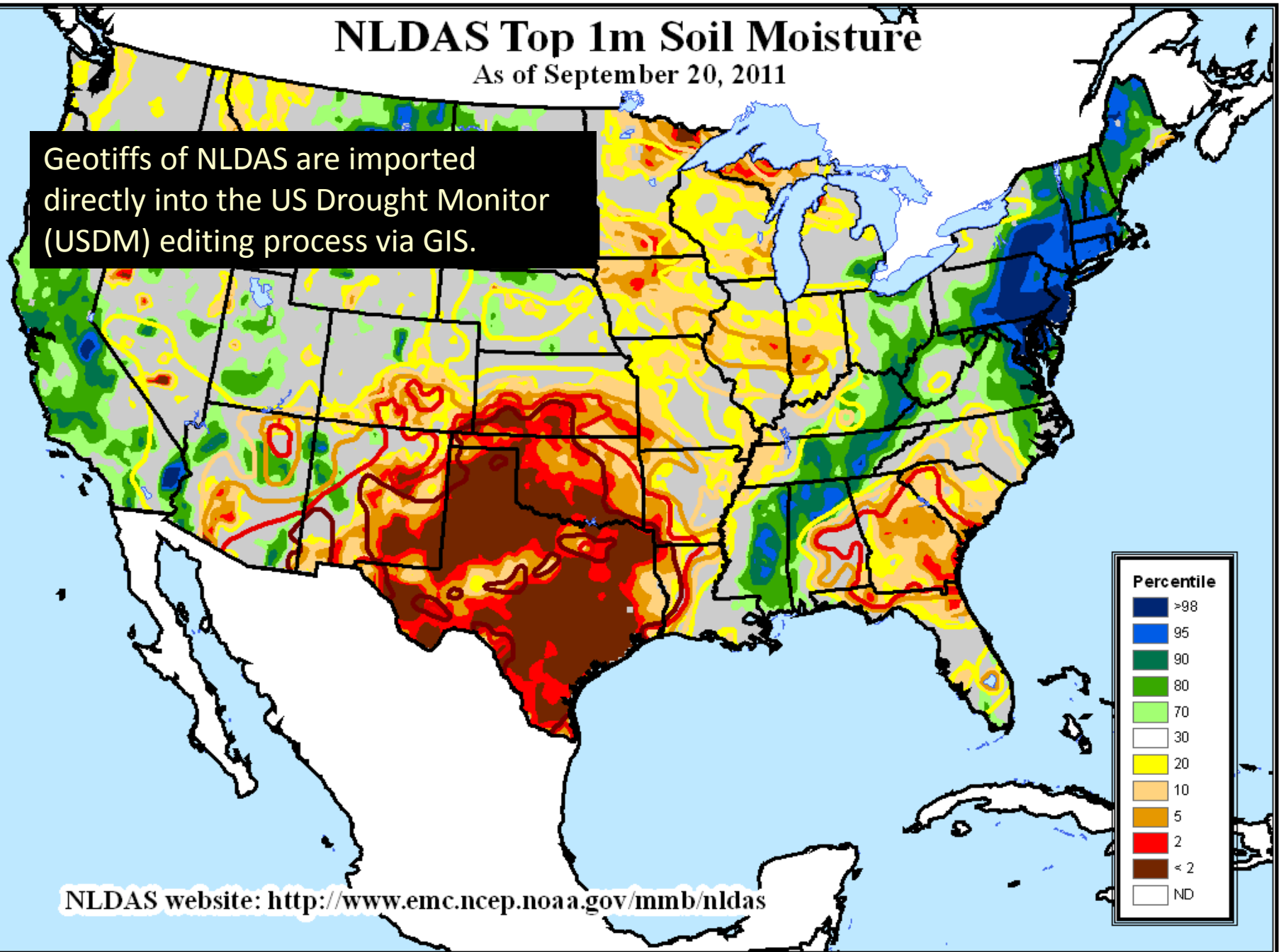
- U.S. Drought Monitor:** A map of the United States showing drought severity levels as of August 6, 2013. The map uses a color scale from yellow (moderate) to dark red (extreme). A legend indicates "Drought Impact Levels" and "DCC Metropolitan City".
- U.S. Monthly Drought Outlook:** A map showing drought tendency for August 31, 2013. The map is color-coded by tendency: brown for persistence, green for improvement, and blue for no drought. A legend includes "Persistence", "Improvement", and "No Drought".
- U.S. Seasonal Drought Outlook:** A map showing drought tendency for the period July 18 - October 31, 2013. The map uses a similar color scale to the monthly outlook, with a legend including "Removal", "Persistence", "Improvement", and "Development".

At the bottom of the page, the NIDIS logo is on the left. The main heading is "U.S. Drought Portal" with the website address "www.drought.gov". On the right, there is a search bar, a "Search" button, and links for "U.S.", "N.A.", "Global", and "Contact Us". Below these are social media icons for Facebook and Twitter. A navigation bar at the very bottom contains the following menu items: "WHAT IS NIDIS?", "PRODUCTS", "TOOLS", "REGIONAL PROGRAMS", and "RESOURCES".

NLDAS Top 1m Soil Moisture

As of September 20, 2011

Geotiffs of NLDAS are imported directly into the US Drought Monitor (USDM) editing process via GIS.

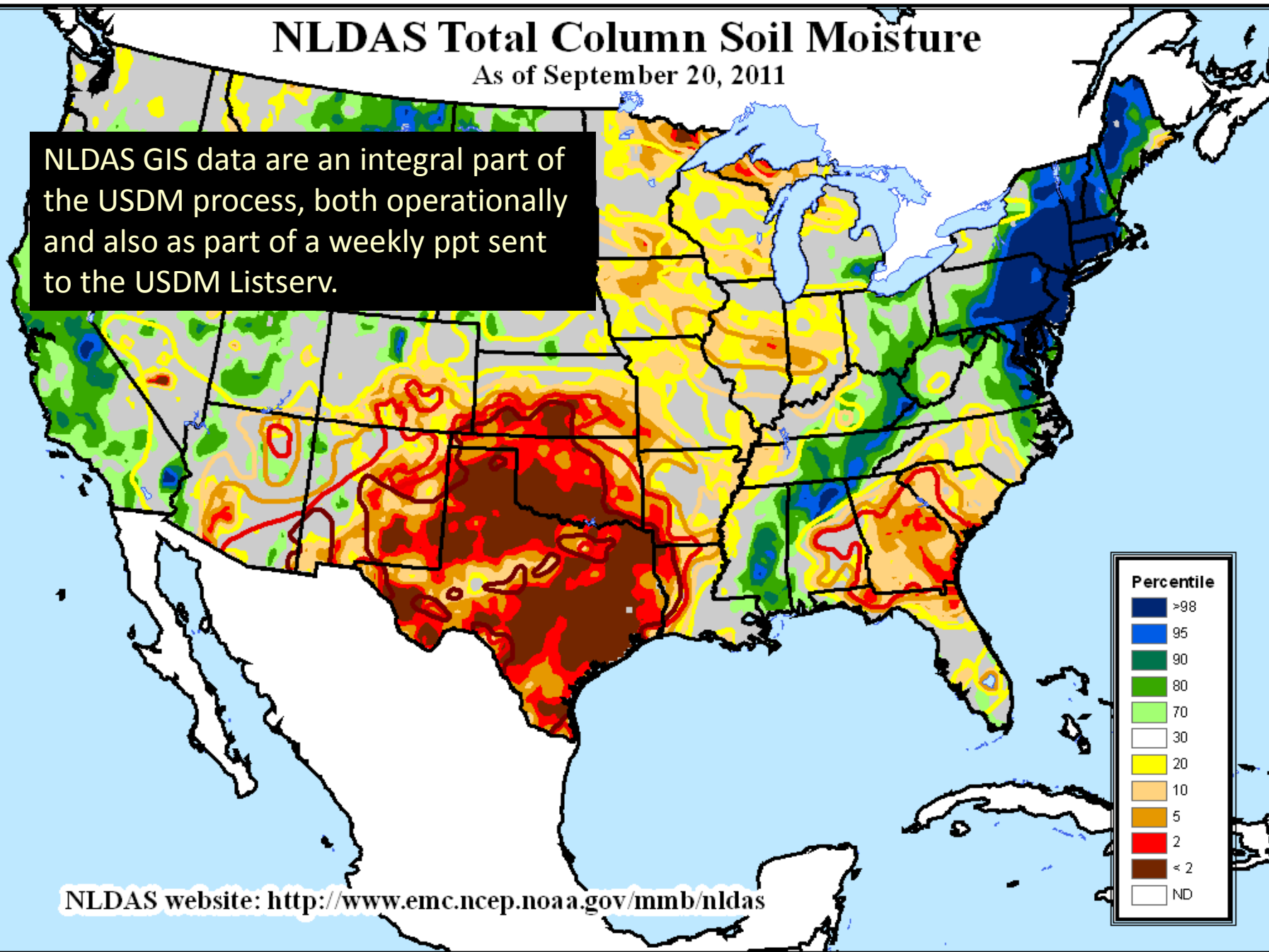


NLDAS website: <http://www.emc.ncep.noaa.gov/mmb/nldas>

NLDAS Total Column Soil Moisture

As of September 20, 2011

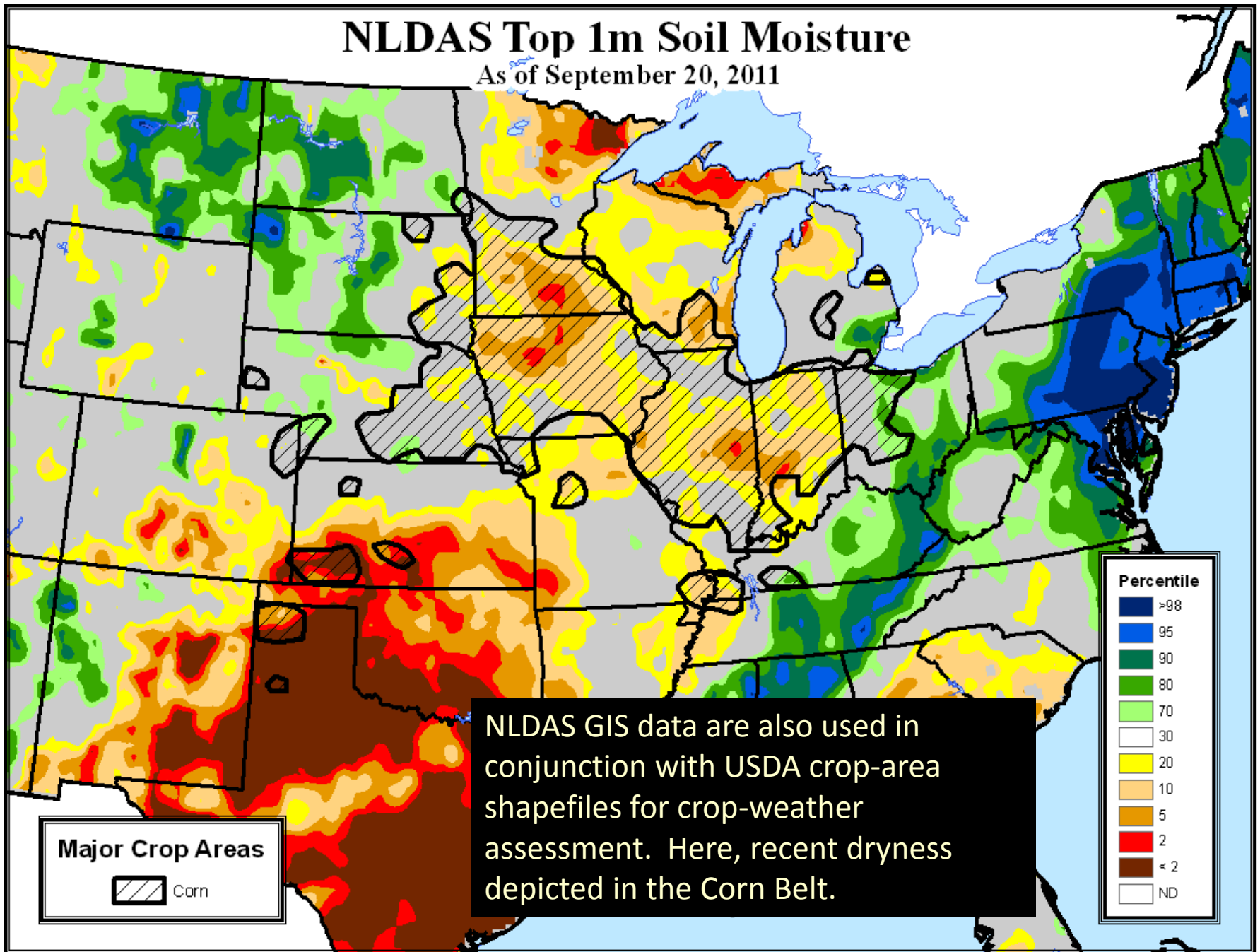
NLDAS GIS data are an integral part of the USDM process, both operationally and also as part of a weekly ppt sent to the USDM Listserv.



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

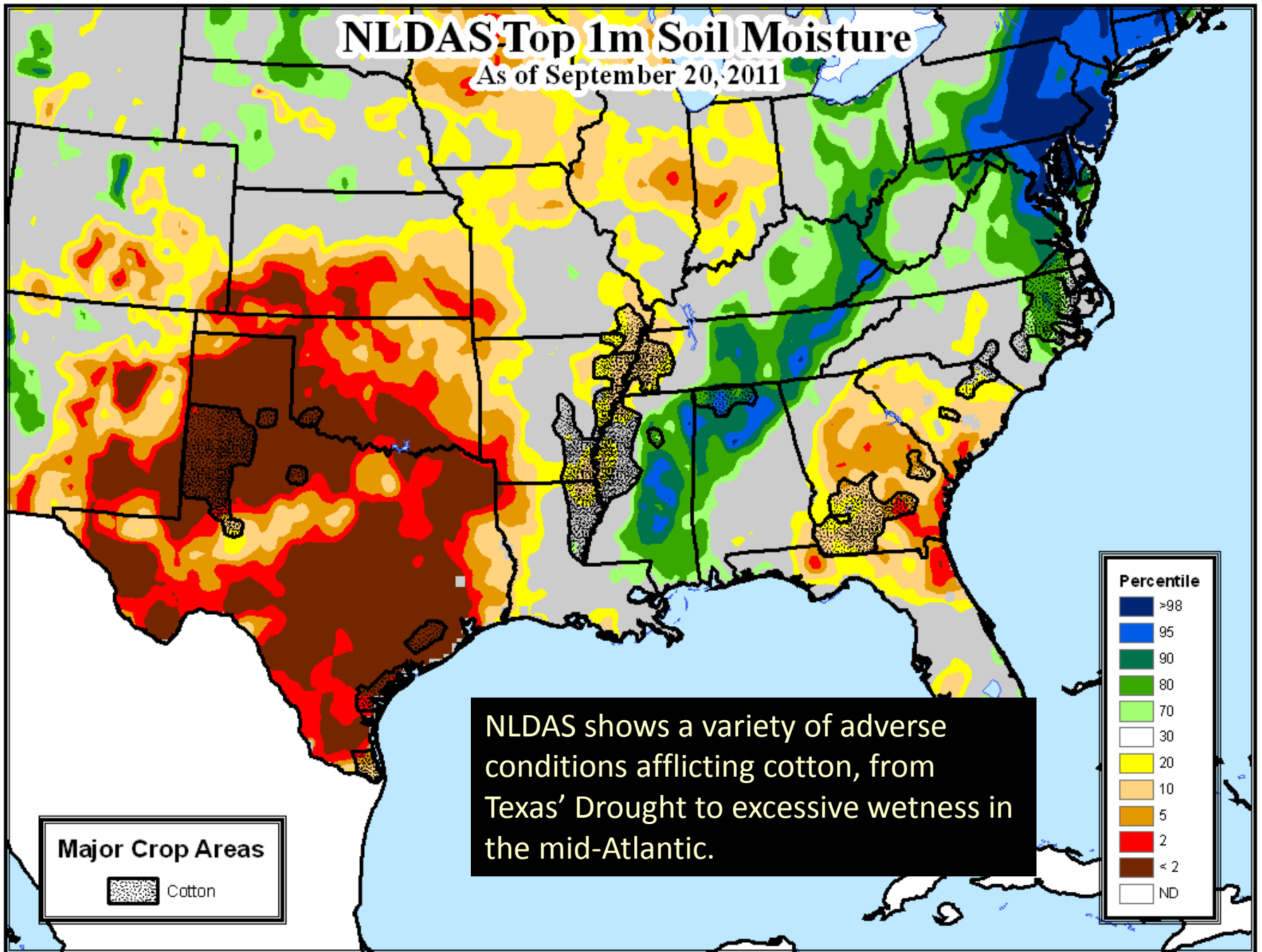
NLDAS Top 1m Soil Moisture

As of September 20, 2011



NLDAS Top 1m Soil Moisture

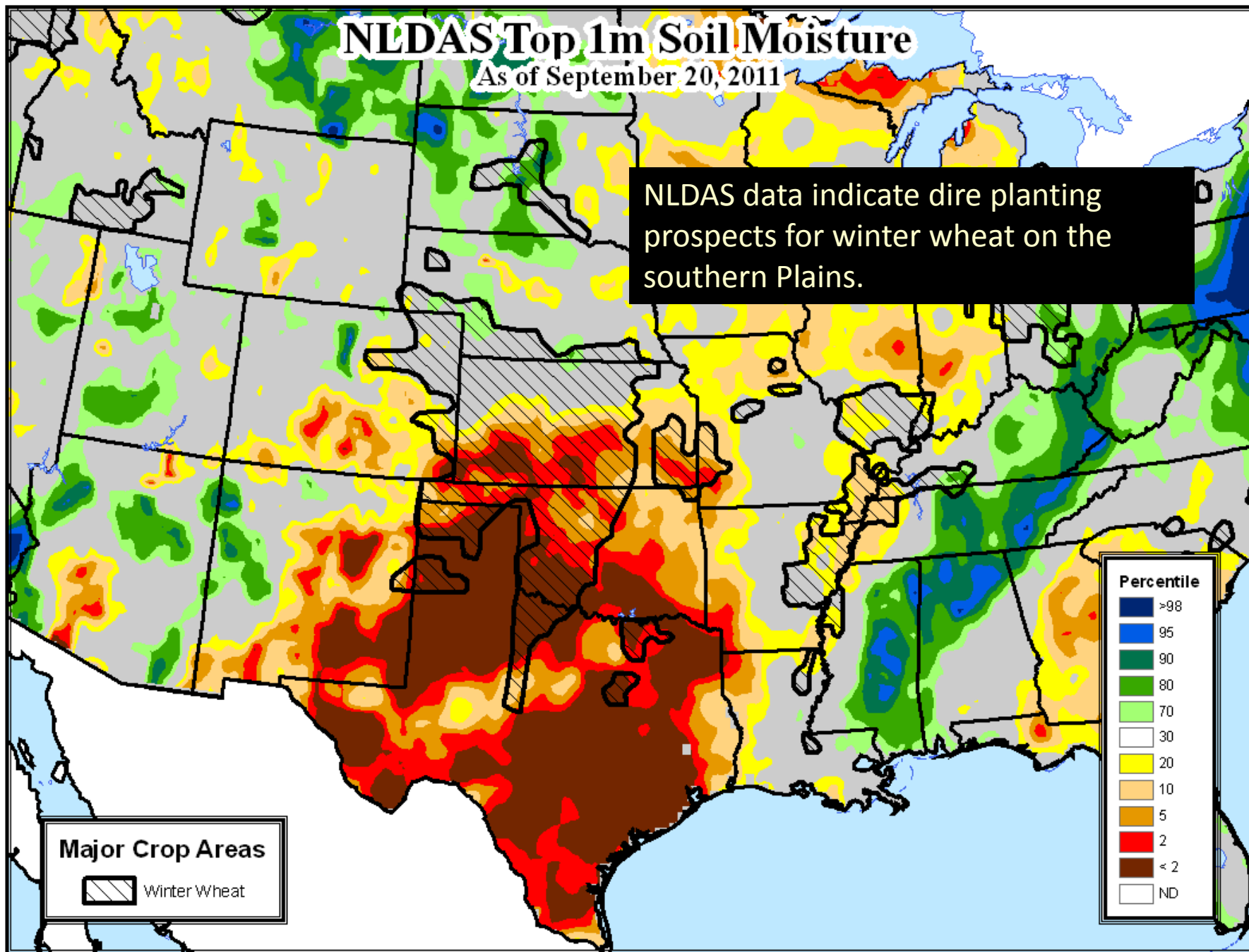
As of September 20, 2011



NLDAS Top 1m Soil Moisture

As of September 20, 2011

NLDAS data indicate dire planting prospects for winter wheat on the southern Plains.



Application for West Wide Drought Tracker

<http://www.wrcc.dri.edu/wwdt/about.html>



WestWideDroughtTracker

About

Current Maps

Archived Maps

Time Series

Download

Overview:

What is WestWide Drought Tracker?

The western United States consists of complex terrain where local precipitation and temperature can vary dramatically across short distances, which in turn impact local drought conditions. The goal of WestWide Drought Tracker (WWDT) is to provide easy access to fine-scale drought monitoring and climate products that can be utilized by a variety of users. The climate data sets, drought indices, and maps that are found on WWDT use monthly data which are updated with new values at the beginning of each month.

For days 1-10 of each month the NLDAS-2 data are used to provide an initial view of the spatial patterns before the PRISM data are available. The 1/8th degree (approximately 12 km) NLDAS-2 temperature and precipitation data are bilinearly interpolated to the PRISM grid and bias corrected by accounting for monthly differences in climatology of NLDAS and PRISM over a common time period from 1979-2011 (Abatzoglou, 2011). The PRISM data is then assimilated back into the WWDT once it is made available (after day 10 of each month).

What products are available on WWDT?

- Drought Indices
 - Palmer Drought Severity Index (PDSI)
 - Self-Calibrated Palmer Drought Severity Index (sc-PDSI)
 - Palmer Z-Index
 - Standardized Precipitation Index (SPI)
 - Standardized Precipitation Evapotranspiration Index (SPEI)
- Climate Data

Global Integrated Drought Monitoring and Prediction System (GIDMaPS)



UNIVERSITY OF CALIFORNIA • IRVINE

AMIR AGHA KOUCHAK

Assistant Professor

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- Software
- Data**
- GIDMaPS**
- CV
- Direction
- UCI

All data sets can be made available for interested researchers upon request. Please contact amir.a@uci.edu

Explore the available data using the Global Integrated Drought Monitoring and Prediction System (GIDMaPS)

Global Multivariate Standardized Drought Index, MSDI, (1980-present)

The data set include monthly Multivariate Standardized Drought Index (MSDI) obtained using the NASA Modern Land Data Reanalysis Analysis for Research and Applications (M2LR2A) soil moisture and precipitation data. MSDI combines both precipitation and soil moisture and provides a composite model for drought analysis. The data set is available at different time scales (e.g., 1 month, 6 month). Spatial resolution: 1/2 degrees latitude x 2/3 degrees longitude.

MLDAS-Based Multivariate Standardized Drought Index, MSDI, (1980-present)

The data set include monthly Multivariate Standardized Drought Index (MSDI) obtained using the NASA North American Land Data Assimilation System (MLDAS) soil moisture and precipitation data. MSDI combines both precipitation and soil moisture and provides a composite model for drought analysis. The data set is available at different time scales (e.g., 1 month, 6 month). Spatial resolution: 1/2 degrees latitude x 2/3 degrees longitude.

Global Standardized Soil Moisture Index, SSI, (1980-present)

The data set include monthly Standardized Soil Moisture Index (SSI) obtained using the NASA Modern Land Data Reanalysis Analysis for Research and Applications (M2LR2A) soil moisture data. The data set can be used to study the land surface hydrology and assess water resources. The data set is available at different time scales (e.g., 1 month, 6 month). Spatial resolution: 1/2 degrees latitude x 2/3 degrees longitude.

NLDAS to support other Government Agencies and Academia

Climate Data

NLDAS: NORTH AMERICAN LAND DATA ASSIMILATION SYSTEM: MONTHLY CLIMATOLOGIES

Summary Metadata Data Access References **NCAR/UCAR**

NLDAS July 1980-2009

The North American Land Data Assimilation System (NLDAS) monthly climatology data sets are broadly used by various user communities in modeling, research, and applications, such as drought and flood monitoring, watershed and water quality

North America Land Data Assimilation System (NLDAS) Daily

Request Form Results Map Chart About

[Environmental Data](#) [Dataset Documentation](#) [Data Use Restrictions](#) [How to Use WONDER](#)

Centers for Disease Control and Prevention

Make all desired selections and then click any Se

1. Organize table layout:

Group Results By Region **Select a temperature** Fahrenheit Celsius

And By None

And By None

And By None

And By None

Select Measures (Check box to include in results. Must select at least one.)

Daily Max Air Temperature (F):

Avg Temperature # of Observations Range

Daily Min Air Temperature (F):

Avg Temperature # of Observations Range

Daily Max Heat Index (F):

Avg Heat Index # of Observations Range

Title

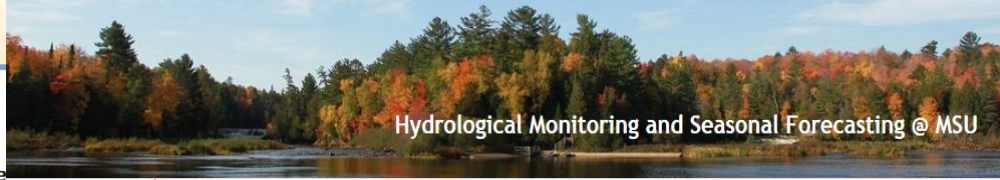
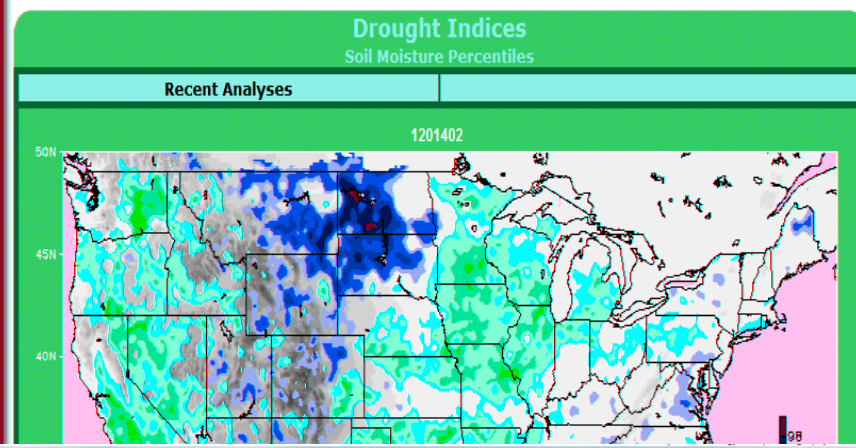
Search the CPC Go

- Drought Indices
- Standardized Precipitation Index (SPI)
 - Monitoring
 - Prediction
 - Verification

- Palmer Drought Severity Indices (PDSI)
- Crop Moisture Indices

- Soil Moisture Percentiles (based on NLDAS)
- Standardized Runoff Index

HOME > U.S. Drought > Drought Indices: Soil Moisture Percentiles



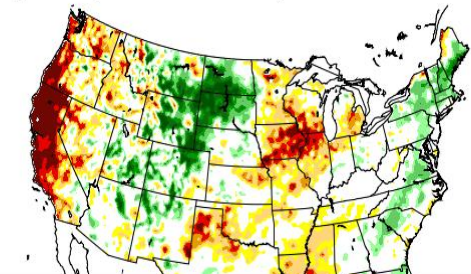
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 - 1-Month SPI
 - 3-Month SPI
 - 6-Month SPI
 - Weekly Soil Moisture
 - Monthly Soil Moisture
 - Soil Moisture Time Series
- Email me
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- Acknowledgement
- Today's Weather

VIC Model-based Drought Condition

Move mouse over the dates on the right to see the weekly drought monitor for the last three months and the most recent forecast

Princeton University Michigan State University

Daily Soil Moisture Percentile on 20140123 (wrt samples within a 49-day window in 1979-2011)



- 20140123
- 20140130
- 20140206
- 20140213
- 20140220
- 20140227
- 20140306
- 20140313
- 20140320
- 20140327
- 20140403 (fcst)
- 20140410 (fcst)
- 20140417 (fcst)
- 20140424 (fcst)

Objective Blended NLDAS Drought Index - OBNDI

To develop an objective framework to blend multiple drought indices to support operational drought monitoring task

AGU PUBLICATIONS

JGR

Journal of Geophysical Research: Atmospheres

RESEARCH ARTICLE

10.1002/2013JD020994

Key Points

- To develop an objective approach to blend NLDAS drought indices
- To establish the linkage between USDM statistics and NLDAS drought index
- To reconstruct long-term OBNDI

Correspondence to: Y. Xia, Yuxia@nasa.gov

Citation: Xia, Y., M. B. Ek, C. D. Peters-Lidard, D. Mody, M. Svoboda, J. Sheffield, and E. F. Wood (2014), Application of USDM statistics in NLDAS-2: Optimal blended NLDAS drought index over the continental United States, *J. Geophys. Res.*, *119*, doi:10.1002/2013JD020994.

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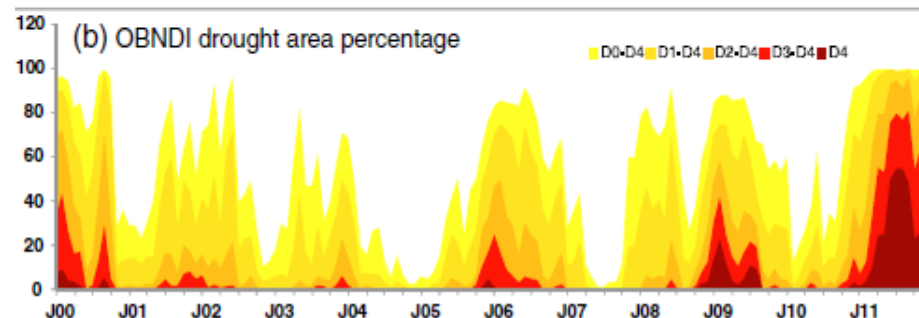
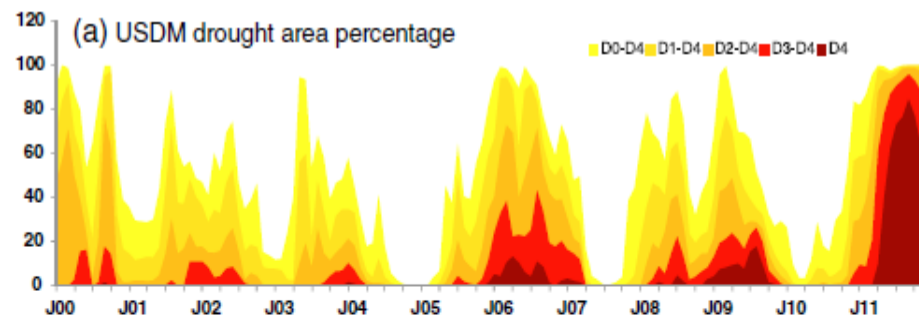
Application of USDM statistics in NLDAS-2: Optimal blended NLDAS drought index over the continental United States

Yuxiong Xia^{1,2}, Michael B. Ek¹, Christa D. Peters-Lidard³, David Mody^{3,4}, Mark Svoboda⁵, Justin Sheffield⁶, and Erik F. Wood⁶

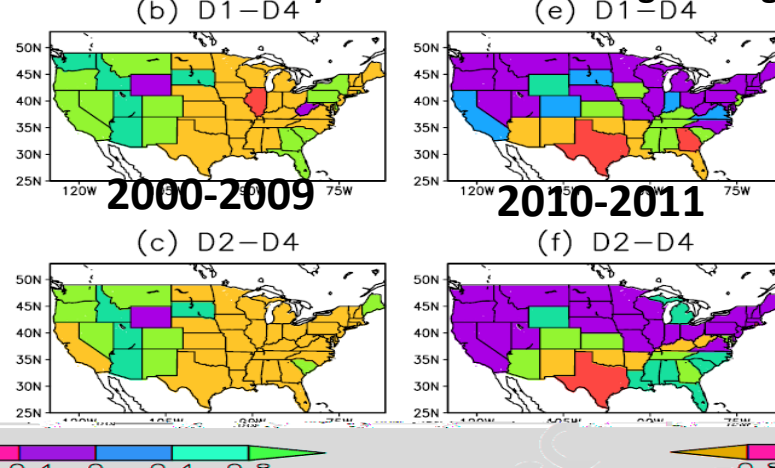
¹Environmental Modeling Center, National Centers for Environmental Prediction, College Park, Maryland, USA, ²MSG at NCEP/EMC, College Park, Maryland, USA, ³Hydrological Sciences Laboratory at Goddard Space Flight Center, National Aeronautics and Space Administration, Greenbelt, Maryland, USA, ⁴SAIC, Greenbelt, Maryland, USA, ⁵National Drought Mitigation Center, University of Nebraska-Lincoln, Lincoln, Nebraska, USA, ⁶Department of Environmental and Civil Engineering, Princeton University, Princeton, New Jersey, USA

Abstract This study performs three experiments to calibrate the drought area percentages in the continental United States (CONUS), six US Drought Monitor (USDM) regions, and 48 states downloaded from the USDM archive website. The corresponding three experiments are named CONUS, Region, and State, respectively. The data sets used in these experiments are from the North American Land Data Assimilation System Phase 2 (NLDAS-2). The main purpose is to develop an automated USDM-based approach to objectively generate and reconstruct USDM-style drought maps using NLDAS-2 data by mimicking 10 year (2000–2009) USDM statistics. The results show that State and Region have larger correlation coefficients and smaller root-mean-square error (RMSE) and bias than CONUS when compared to the drought area percentages derived from the USDM, indicating that State and Region perform better than CONUS. In general, State marginally outperforms Region in terms of RMSE, bias, and correlation. Analysis of normalized optimal weight coefficients shows that soil moisture percentiles (top 1 m and total column) play the dominant role in most of the 48 states. The optimal blended NLDAS drought index (OBNDI) has higher simulation skills (correlation coefficient and Nash-Sutcliffe efficiency) in the South, Southeast, High Plains, and Midwest regions when compared to those in the West and Northeast. The highest simulation skills appear in TX and OK. By using optimal equations, we can reconstruct the long-term drought area percentages and OBNDI over the continental United States for the entire period of the NLDAS-2 data sets (January 1979 to present).

Drought Extent in Texas: US Drought Monitor vs NLDAS

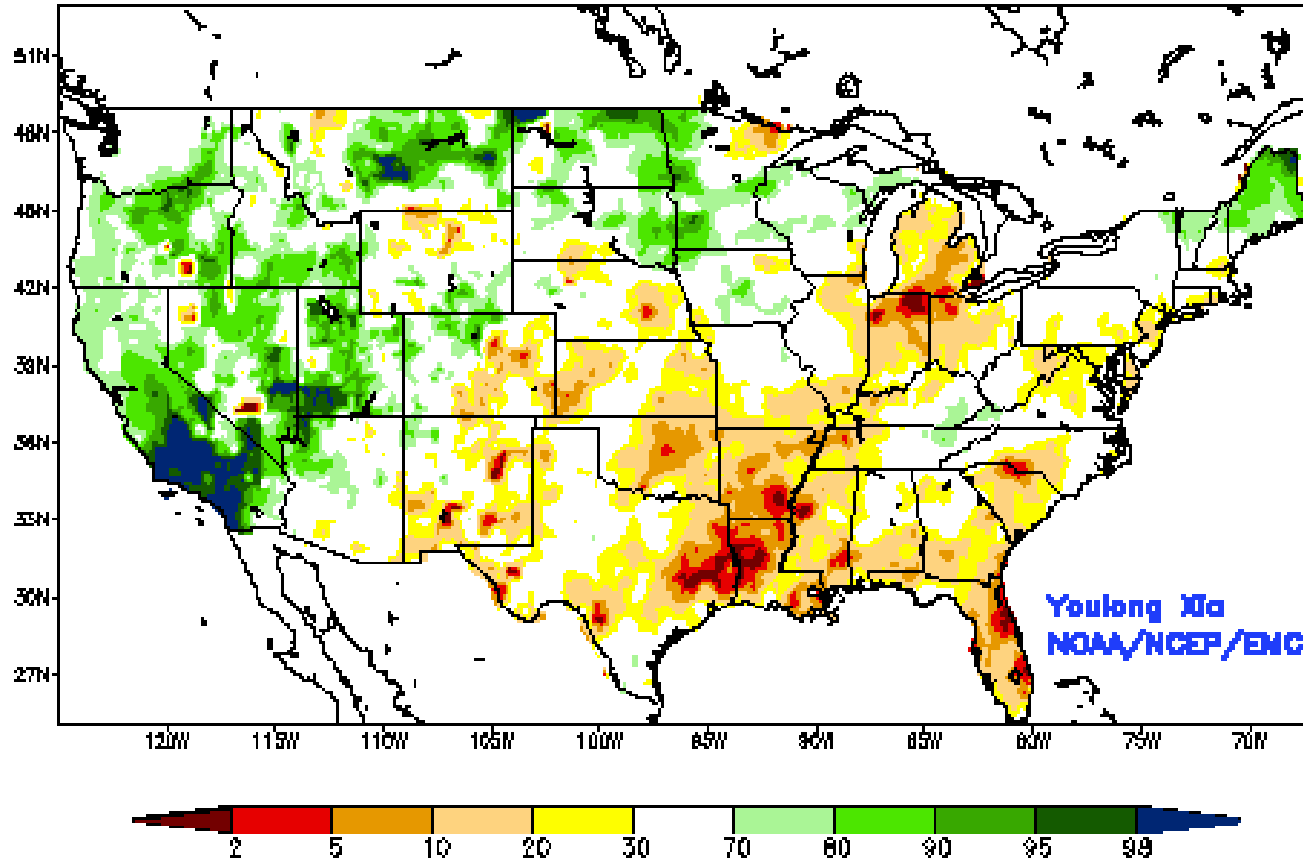


Nash-Sutcliffe Efficiency for two USDM drought categories



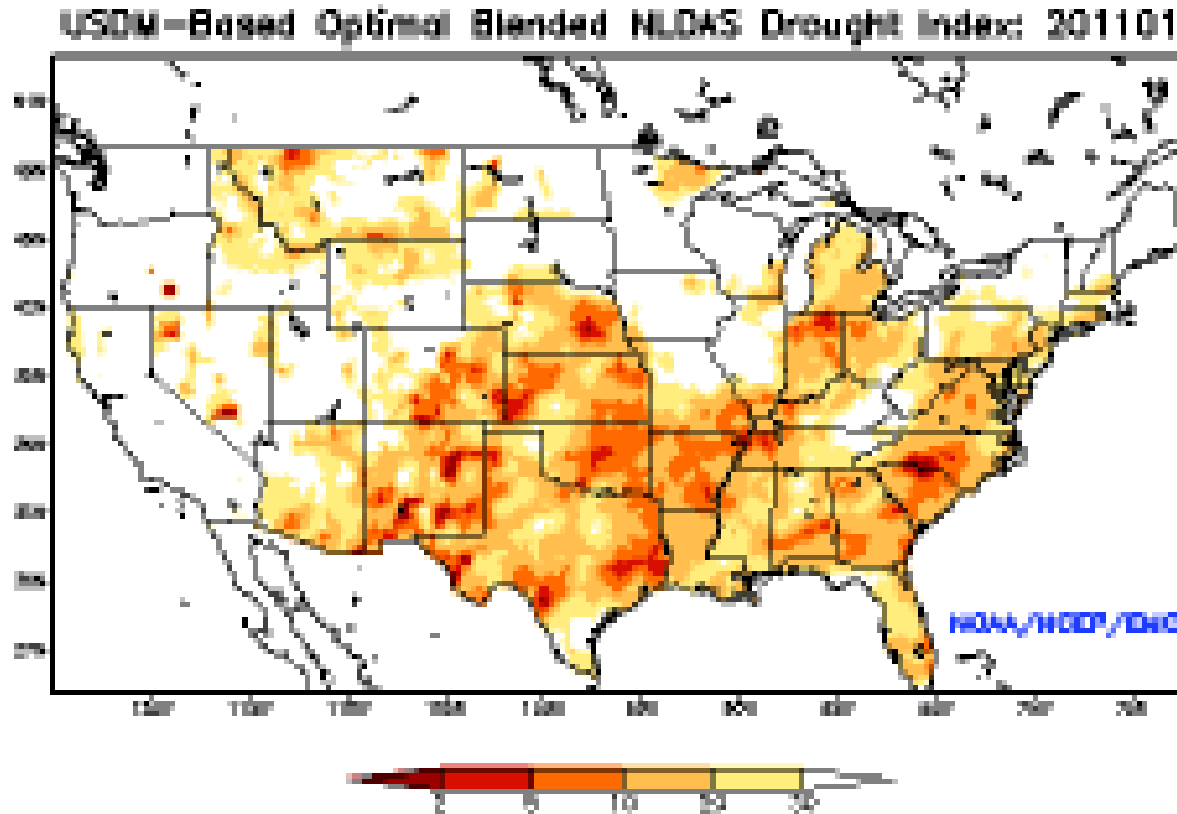
NLDAS: 2011 Texas Drought

Ensemble-Mean – Past Week Total Column Soil Moisture Percentile
NCEP NLDAS Products Valid: JAN 05, 2011



Near real-time weekly 4-model ensemble total soil moisture percentile, 5 Jan – 14 Sept 2011 (D0 yellow/moderate – D4 red/extreme)

NLDAS: 2012 US Drought



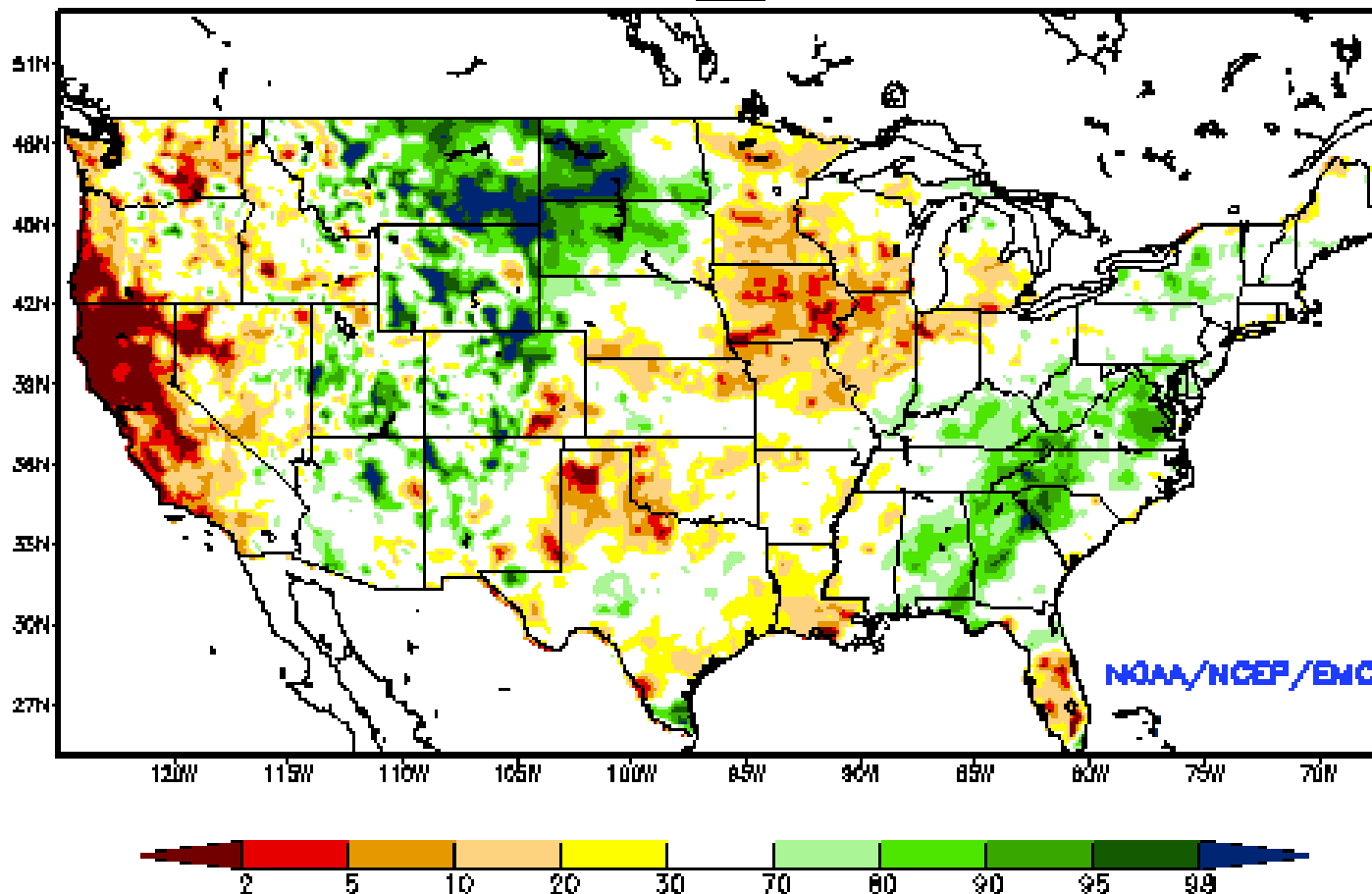
Xia et al., JGR, 2014c

**USDM-based optimally blended NLDAS Drought Index, Jan 2011 – Aug 2012
(D0 yellow/moderate – D4 red/extreme)**

Century California Drought Monitoring

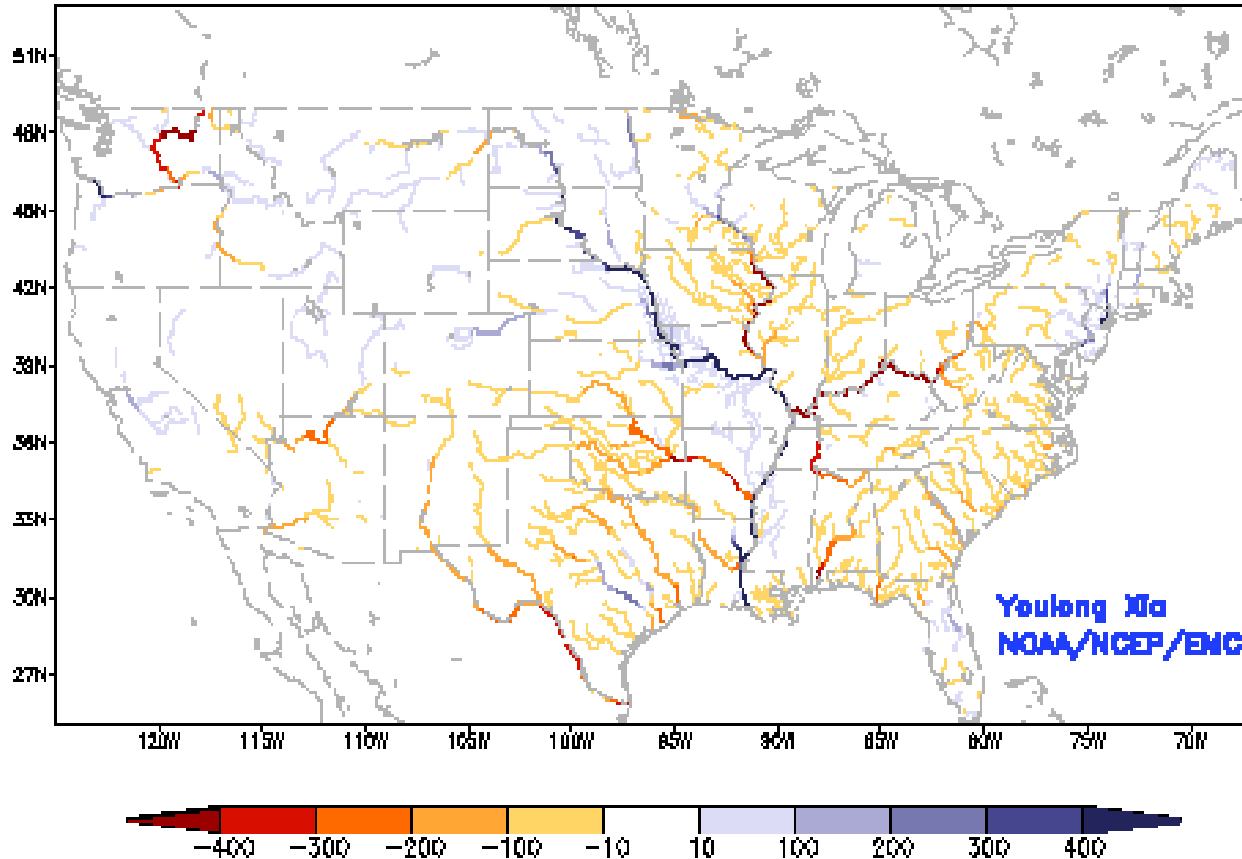
Improvement and Termination of Drought

Ensemble-Mean - Current Total Column Soil Moisture Percentile
NCEP NLDAS Products Valid: JAN 01, 2014



NLDAS: Flood Monitoring

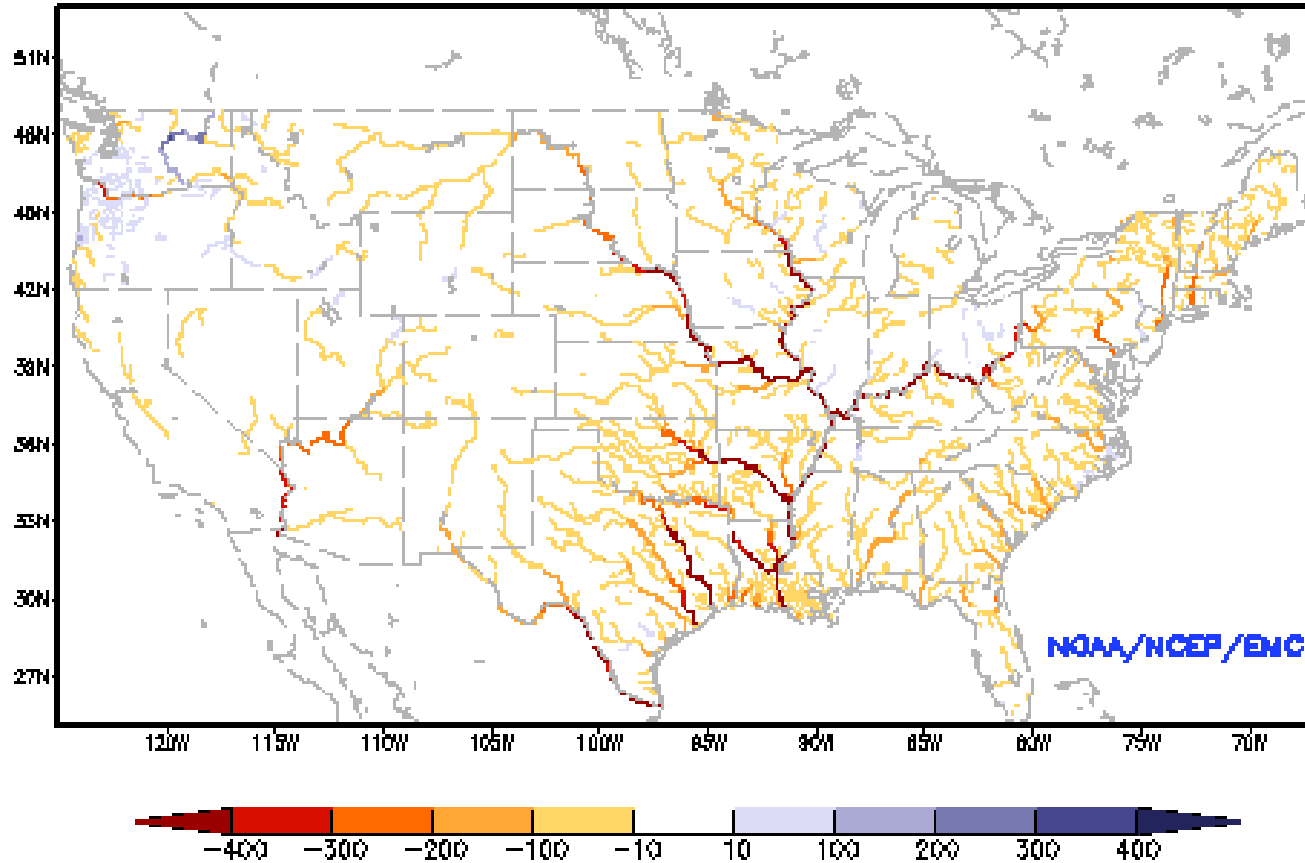
Ensemble-Mean: Current Streamflow Anomaly (m^3/s)
NCEP NLDAS Products Valid: AUG 20, 2011



**Ensemble mean daily streamflow anomaly (m^3/s)
Hurricane Irene and Tropical Storm Lee
20 August – 17 September 2011**

NLDAS: Flood Monitoring

Ensemble-Mean: Current Streamflow Anomaly (m^3/s)
NCEP NLDAS Products__Valid: OCT 29, 2012



**Ensemble mean daily streamflow anomaly (m^3/s)
Superstorm Sandy
29 October – 04 November 2012**

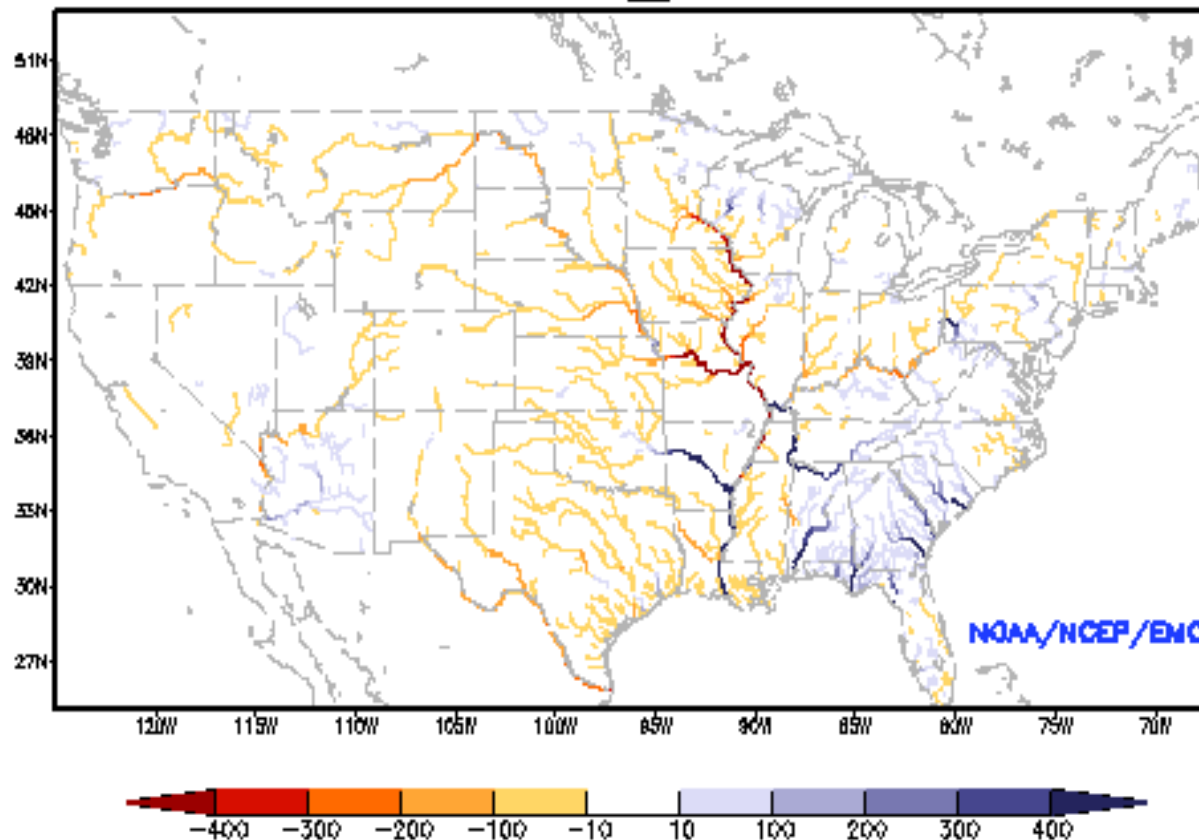
NLDAS Flood Monitoring

Ensemble mean daily streamflow anomaly (m^3/s)

Colorado Front Range Flooding

September 2013

Ensemble-Mean: Current Streamflow Anomaly (m^3/s)
NCEP NLDAS Products __Valid: SEP 01, 2013



NLDAS: Web Site Information

NASA/GSFC NLDAS Website

USGS
science for a changing world

USGS Home
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USGS Geo Data Portal

This page is a catalog of the datasets that have been tested to work well for access with the Geo Data Portal. Select one of the buttons below to see a list of these datasets. At its core, the Geo Data Portal is an advanced Open Geospatial Consortium Web Processing Service that can be used in a wide variety of applications against any web-accessible standards-compliant dataset. If you'd like to see all the datasets that are compatible with one of the processing types the Geo Data Portal can perform, select one of those buttons below.

[For more information about the Geo Data Portal, please visit the Geo Data Portal Documentation Home.](#)

Datasets **Processing**

All Climate Landscape Areal Statistics Data Subsets

Select Dataset

0.125 Degree Hourly Primary Forcing Data for NLDAS-2

North American Land Data Assimilation System Phase 2
0.125 Degree Hourly Primary Forcing Data for NLDAS-2

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. Specifically, this system is intended to reduce the errors in the stores of soil moisture and energy which are often present in numerical weather prediction models, and which degrade the accuracy of forecasts. NLDAS is currently running in near real-time on a 1/8th-degree grid over central North America; retrospective NLDAS datasets and simulations also extend back to January 1979. NLDAS constructs a forcing dataset from gauge-based observed precipitation

NLDAS v1.0.0

Operational Implementation

NLDAS V1.0.0 release note

Computing resource information:

This model system runs only once per day (12Z).

Total runtime is about 50-60 minutes.

All the jobs will be running in serial mode, and the whole system will use at most 3 processors during the runtime period.

Total disk usage is about 700 mb per day.

Dissemination info:

The forcing (only the grib2 format), model output data and the river streamflow data (all in grib2 format) will need to be sent out to the public.

Primary Users:

NIDIS

US Drought Monitor

NCEP Climate Prediction Center

Other external users such as Princeton University, University of Washington, NWS/OHD, NASA/GSFC. COLA, The Climate Corporation.

Archive to HPSS:

All of the output data (including the restart files) will need to be archived to HPSS.

cmp_grib1_grib2.sh

Tempest NLDAS version

/land/noscrub/Youlong.Xia/tempest/Forcing/20140318/2014031823.nldasforce-a.grb
/meso/noscrub/Yuqiu.Zhu/com/nldas/dev/nldas.20140318/nldas.t12z.force-a.grb2f23

Gyre operational NLDAS version

Correlation RMSE

**Standard layer (2-m air T
and q, 10-m wind u, v)**

1:0:TMP:rpn_corr=1:rpn_rms=0.000569198
2:101697:SPFH:rpn_corr=1:rpn_rms=6.76302e-09
3:249402:PRES:rpn_corr=1:rpn_rms=0.0090311
4:463030:UGRD:rpn_corr=1:rpn_rms=3.74821e-05
5:550956:VGRD:rpn_corr=1:rpn_rms=6.96927e-05
6:640489:DLWRF:rpn_corr=1:rpn_rms=0.000540593
7:773083:FRAIN:rpn_corr=1:rpn_rms=2.81174e-09
8:790226:CAPE:rpn_corr=1:rpn_rms=1.63342e-05
9:837219:PEVAP:rpn_corr=1:rpn_rms=1.31782e-06
10:938141:APCPN:rpn_corr=1:rpn_rms=6.76633e-07
11:979810:DSWRF:rpn_corr=1:rpn_rms=0.000150443

cmp_grib1_grib2.sh

Tempest NLDAS run

/land/noscrub/Youlong.Xia/tempest/Forcing/20140318/2014031823.nldasforce-b.grb
/meso/noscrub/Yuqiu.Zhu/com/nldas/dev/nldas.20140318/nldas.t12z.force-b.grb2f23

Gyre operational NLDAS run

Correlation RMSE

**Lowest model
layer(NARR/CDAS)**

1:0:DSWRF:rpn_corr=1:rpn_rms=0.000166549
2:155739:APCPN:rpn_corr=1:rpn_rms=6.85383e-07
3:204393:ACPCP:rpn_corr=1:rpn_rms=9.89816e-10
4:222793:ACOND:rpn_corr=1:rpn_rms=8.52143e-10
5:288843:TMP:rpn_corr=1:rpn_rms=0.000541403
6:390054:SPFH:rpn_corr=1:rpn_rms=6.56439e-09
7:536124:PRES:rpn_corr=1:rpn_rms=0.00915247
8:749996:UGRD:rpn_corr=1:rpn_rms=6.88514e-05
9:835525:VGRD:rpn_corr=1:rpn_rms=6.25758e-05
10:922470:HGT:rpn_corr=1:rpn_rms=0.00077842

Noah model run check

cmp_grib1_grib2.sh

/land/noscrub/Youlong.Xia/tempest/Noah/20140318/2014031823.NOAH.grb

/meso/noscrub/Yuqiu.Zhu/com/nldas/dev/nldas.20140318/noah.t12z.grbf23

Gyre operational NLDAS run

Noah tempest run

1:0:NSWRS:rpn_corr=1:rpn_rms=0.0517488	2:107301:NLWRS:rpn_corr=0.999999:rpn_rms=0.0728654
3:203128:LHTFL:rpn_corr=0.999966:rpn_rms=0.257411	4:309551:SHTFL:rpn_corr=0.999983:rpn_rms=0.436013
5:420496:GFLUX:rpn_corr=0.999911:rpn_rms=0.459802	6:519997:SNOHF:rpn_corr=0.999997:rpn_rms=0.0174482
7:558419:DSWRF:rpn_corr=1:rpn_rms=0.00158718	8:660037:DLWRF:rpn_corr=1:rpn_rms=0.00181701
9:752529:TSNOW:rpn_corr=1:rpn_rms=6.01532e-07	10:784625:ARAIN:rpn_corr=1:rpn_rms=3.49182e-07
11:811721:EVP:rpn_corr=0.999966:rpn_rms=0.000368857	12:922389:SSRUN:rpn_corr=0.999995:rpn_rms=0.00018723
13:966527:BGRUN:rpn_corr=1:rpn_rms=7.82949e-06	14:1039313:SNOM:rpn_corr=0.999998:rpn_rms=0.000176268
15:1087244:AVSFT:rpn_corr=0.999999:rpn_rms=0.0218827	16:1196084:ALBDO:rpn_corr=1:rpn_rms=0.000185237
17:1246877:WEASD:rpn_corr=1:rpn_rms=3.12332e-06	18:1306076:CNWAT:rpn_corr=0.999999:rpn_rms=0.000321533
19:1383512:TSOIL:rpn_corr=0.999995:rpn_rms=0.0323482	20:1493218:TSOIL:rpn_corr=1:rpn_rms=0.00472919
21:1596335:TSOIL:rpn_corr=1:rpn_rms=0.00125454	22:1699739:TSOIL:rpn_corr=1:rpn_rms=0.000490368
23:1802694:SOILM:rpn_corr=1:rpn_rms=0.00394753	24:2037368:SOILM:rpn_corr=1:rpn_rms=0.00410873
25:2275379:SOILM:rpn_corr=1:rpn_rms=0.00409608	26:2499543:SOILM:rpn_corr=0.999999:rpn_rms=0.0160677
27:2617774:SOILM:rpn_corr=1:rpn_rms=0.014158	28:2757331:SOILM:rpn_corr=1:rpn_rms=0.00787381
29:2907437:SOILM:rpn_corr=1:rpn_rms=0.00149378	30:3065999:LSOIL:rpn_corr=0.999992:rpn_rms=0.0260475
31:3255412:LSOIL:rpn_corr=1:rpn_rms=0.0148336	32:3461520:LSOIL:rpn_corr=1:rpn_rms=0.00795174
33:3678248:LSOIL:rpn_corr=1:rpn_rms=0.00148357	34:3906608:MSTAV:rpn_corr=1:rpn_rms=2.57167e-05
35:4004772:MSTAV:rpn_corr=1:rpn_rms=4.69216e-05	36:4103403:EVCW:rpn_corr=0.99999:rpn_rms=0.03424
37:4142965:TRANS:rpn_corr=1:rpn_rms=0.00317595	38:4191492:EVBS:rpn_corr=0.999944:rpn_rms=0.23885
39:4276211:SBSNO:rpn_corr=0.99999:rpn_rms=0.0570834	40:4327327:PEVAP:rpn_corr=0.999994:rpn_rms=1.00592
41:4450937:ACOND:rpn_corr=0.999944:rpn_rms=0.000241783	43:4589841:SNOWC:rpn_corr=0.999999:rpn_rms=0.000616389
42:4520605:SNOD:rpn_corr=1:rpn_rms=4.59293e-05	45:4771181:RCS:rpn_corr=1:rpn_rms=4.14989e-08
44:4612982:CCOND:rpn_corr=1:rpn_rms=4.61228e-07	47:4940808:RCQ:rpn_corr=1:rpn_rms=2.42311e-05
46:4872061:RCT:rpn_corr=1:rpn_rms=3.17372e-05	
48:5012396:RCSOL:rpn_corr=0.999999:rpn_rms=0.000168902	
49:5071754:RSMIN:rpn_corr=1:rpn_rms=8.79038e-06	
50:5220637:LAI:rpn_corr=1:rpn_rms=1.93679e-07	
51:5356027:VEG:rpn_corr=1:rpn_rms=1.69721e-08	

Mosaic run check

cmp_grib1_grib2.sh

/land/noscrub/Youlong.Xia/tempest/Mosaic/20140318/2014031823.grb
/meso/noscrub/Yuqiu.Zhu/com/nldas/dev/nldas.20140318/mosaic.t12z.grbf23

Mosaic model gyre operational run

Mosaic model tempest run

Correlation and RMSE analysis for Mosaic model output

1:0:NSWRS:rpn_corr=1:rpn_rms=0.00108136	2:145540:NLWRS:rpn_corr=1:rpn_rms=0.00420969
3:273180:LHTFL:rpn_corr=1:rpn_rms=0.0110603	4:416206:SHTFL:rpn_corr=1:rpn_rms=0.0252643
5:563051:GFLUX:rpn_corr=0.999999:rpn_rms=0.0341738	6:687619:SNOHF:rpn_corr=0.999998:rpn_rms=0.0139287
7:719092:TSNOW:rpn_corr=1:rpn_rms=6.01423e-07	8:751102:ARAIN:rpn_corr=1:rpn_rms=1.6462e-05
9:777834:EVP:rpn_corr=1:rpn_rms=1.75604e-05	10:891346:SSRUN:rpn_corr=0.999999:rpn_rms=7.60236e-05
11:917503:BGRUN:rpn_corr=0.999998:rpn_rms=0.000126344	12:980328:SBSNO:rpn_corr=0.999998:rpn_rms=0.000131591
13:1011725:AVSFT:rpn_corr=1:rpn_rms=0.000510654	14:1116502:ALBDO:rpn_corr=1:rpn_rms=0.000806937
15:1244646:WEASD:rpn_corr=1:rpn_rms=0.0331815	16:1347519:TSOIL:rpn_corr=1:rpn_rms=0.000217226
17:1450049:SOILM:rpn_corr=1:rpn_rms=0.00739355	18:1686596:SOILM:rpn_corr=1:rpn_rms=0.00713714
19:1901725:SOILM:rpn_corr=1:rpn_rms=0.00576491	20:2128163:SOILM:rpn_corr=1:rpn_rms=0.00184669
21:2321371:SOILM:rpn_corr=1:rpn_rms=0.0053685	22:2531969:SOILM:rpn_corr=1:rpn_rms=0.00802903
23:2765326:MSTAV:rpn_corr=1:rpn_rms=0.000466817	24:2967363:MSTAV:rpn_corr=1:rpn_rms=0.00531109
25:3177197:EVCW:rpn_corr=1:rpn_rms=0.0194823	26:3245325:TRANS:rpn_corr=1:rpn_rms=0.00185669
27:3345616:EVBS:rpn_corr=1:rpn_rms=0.0115827	28:3472932:SBSNO:rpn_corr=1:rpn_rms=0.00425688
29:3538102:ACOND:rpn_corr=1:rpn_rms=7.87498e-06	30:3640968:CCOND:rpn_corr=1:rpn_rms=3.74373
31:3823303:VEG:rpn_corr=1:rpn_rms=0.000691683	32:4002244:LAI:rpn_corr=1:rpn_rms=2.16413e-07
33:4141128:CNWAT:rpn_corr=1:rpn_rms=0.000114699	34:4219473:SNOD:rpn_corr=1:rpn_rms=0.000266041
35:4293466:SNOWC:rpn_corr=1:rpn_rms=5.09718e-05	36:4334156:UGRD:rpn_corr=1:rpn_rms=3.85222e-05
37:4418652:VGRD:rpn_corr=1:rpn_rms=7.16269e-05	38:4504495:TMP:rpn_corr=1:rpn_rms=0.000569735
39:4602303:SPFH:rpn_corr=1:rpn_rms=1.9554e-10	40:4648317:PRES:rpn_corr=1:rpn_rms=0.00301401
41:4750283:DSWRF:rpn_corr=1:rpn_rms=0.00706266	42:4886840:DLWRF:rpn_corr=1:rpn_rms=0.000541786
43:5013892:APCPN:rpn_corr=1:rpn_rms=1.6078e-09	

SAC model run check

cmp_grib1_grib2.sh

SAC model tempest run

/land/noscrub/Youlong.Xia/tempest/SAC/20140318/2014031823.SAC.grb
/meso/noscrub/Yuqiu.Zhu/com/nldas/dev/nldas.20140318/sac.t12z.grbf23

SAC model gyre operational run

Correlation and RMSE Analysis

1:0:ARAIN:rpn_corr=1:rpn_rms=3.49182e-07
2:26723:TSNOW:rpn_corr=1:rpn_rms=6.01532e-07
3:58851:EVP:rpn_corr=0.99999:rpn_rms=0.000423051
4:165955:PEVAP:rpn_corr=0.999995:rpn_rms=0.329297
5:273688:SSRUN:rpn_corr=1:rpn_rms=2.09334e-05
6:322020:BGRUN:rpn_corr=1:rpn_rms=1.80222e-06
7:402589:SOILM:rpn_corr=1:rpn_rms=0.00182474
8:544600:SOILM:rpn_corr=1:rpn_rms=0.000868685
9:589296:SOILM:rpn_corr=1:rpn_rms=0.00105583
10:743782:SOILM:rpn_corr=1:rpn_rms=0.00023138
11:809975:SOILM:rpn_corr=1:rpn_rms=0.00043525
12:931007:SOILM:rpn_corr=1:rpn_rms=0.00232602
13:1087446:SOILM:rpn_corr=1:rpn_rms=0.00259044
14:1245232:SNOM:rpn_corr=1:rpn_rms=6.06631e-05
15:1278811:WEASD:rpn_corr=1:rpn_rms=2.19175e-06
16:1339718:SNOD:rpn_corr=1:rpn_rms=1.49913e-06

VIC model run check

cmp_grib1_grib2.sh

VIC model tempest run

/land/noscrub/Youlong.Xia/tempest/VIC/20140318/2014031823.VIC.grb
/meso/noscrub/Yuqiu.Zhu/com/nldas/dev/nldas.20140318/vic.t12z.grbf23

VIC model gyre operational run

Correlation and RMSE Analysis for VIC output

1:0:NSWRS:rpn_corr=1:rpn_rms=0.0676232
3:213807:LHTFL:rpn_corr=0.999956:rpn_rms=0.295993
5:434643:GFLUX:rpn_corr=0.999998:rpn_rms=0.0518071
7:586807:DSWRF:rpn_corr=1:rpn_rms=0.00178282
9:788045:TSNOW:rpn_corr=1:rpn_rms=6.01423e-07
11:846946:EVP:rpn_corr=0.99987:rpn_rms=0.000729768
13:990354:BGRUN:rpn_corr=1:rpn_rms=2.80676e-06
15:1114033:SNOT:rpn_corr=0.999389:rpn_rms=0.181234
17:1262322:RADT:rpn_corr=0.999991:rpn_rms=0.0493852
19:1484947:WEASD:rpn_corr=1:rpn_rms=0.00269208
21:1646068:TSOIL:rpn_corr=0.999997:rpn_rms=0.023467
23:1855529:TSOIL:rpn_corr=1:rpn_rms=0.000189012
25:2187489:SOILM:rpn_corr=1:rpn_rms=0.00279199
27:2642231:SOILM:rpn_corr=1:rpn_rms=0.00335408
29:3043792:SOILM:rpn_corr=1:rpn_rms=0.00295705
31:3459537:LSOIL:rpn_corr=1:rpn_rms=0.00174501
33:3894769:MSTAV:rpn_corr=1:rpn_rms=0.000543052
35:4229253:EVCW:rpn_corr=0.989605:rpn_rms=0.00167994
37:4264087:EVBS:rpn_corr=1:rpn_rms=0
39:4294602:ACOND:rpn_corr=1:rpn_rms=6.52771e-09
41:4500496:SNOD:rpn_corr=1:rpn_rms=0.000119043
43:4622262:SALBD:rpn_corr=0.999998:rpn_rms=0.0698244

2:111540:NLWRS:rpn_corr=0.999994:rpn_rms=0.205884
4:319533:SHTFL:rpn_corr=0.999995:rpn_rms=0.301886
6:529635:SNOHF:rpn_corr=0.999978:rpn_rms=0.121072
8:690270:DLWRF:rpn_corr=0.999969:rpn_rms=0.291681
10:819997:ARAIN:rpn_corr=1:rpn_rms=3.49119e-07
12:957357:SSRUN:rpn_corr=0.999973:rpn_rms=0.000226958
14:1081440:SNOM:rpn_corr=0.999961:rpn_rms=0.000916093
16:1153991:AVSFT:rpn_corr=0.99999:rpn_rms=0.0452243
18:1371708:ALBDO:rpn_corr=0.999999:rpn_rms=0.0347287
20:1590969:CNWAT:rpn_corr=0.998339:rpn_rms=0.0043754
22:1752645:TSOIL:rpn_corr=1:rpn_rms=0.000652019
24:1957305:SOILM:rpn_corr=1:rpn_rms=0.00279405
26:2418926:SOILM:rpn_corr=1:rpn_rms=0.00273515
28:2833268:SOILM:rpn_corr=1:rpn_rms=0.00336611
30:3268500:LSOIL:rpn_corr=1:rpn_rms=0.00170056
32:3670061:LSOIL:rpn_corr=1:rpn_rms=0.000643589
34:4060787:MSTAV:rpn_corr=1:rpn_rms=0.000542267
36:4243898:TRANS:rpn_corr=0.999977:rpn_rms=0.000356705
38:4277928:SBSNO:rpn_corr=0.999609:rpn_rms=0.000595401
40:4376107:LAI:rpn_corr=1:rpn_rms=1.00863e-07
42:4583288:SNOWC:rpn_corr=0.999999:rpn_rms=0.0452108

Strategy for checking NCO 30-day test run:

- (1) Yuqiu Zhu will run her NLDAS on production machine and compared her run with NCO run.**
- (2) Youlong Xia will compared tempest run and NCO run using two simple methods:**
 - (2a) run common script to check as shown above.**
 - (2b) randomly make difference plot to check for some specific variables.**

NLDAS: Future

Post-operational implementation of NLDAS drought monitoring over CONUS

- Run NLDAS under NASA Land Information System (parallel environment, latest land model versions, land data assimilation and validation tools).
- NLDAS seasonal hydrological prediction using VIC land model with CFS/other seasonal climate forcing.
- Improve atmospheric and observational precipitation forcing; data sets (e.g. land use, soils, greenness).
- Improve land model physics (e.g. Noah land model).
- Land data assimilation of e.g. snow, soil moisture.
- Higher res/downscaling, enhance land model spinup.
- Extend NLDAS domain (entire North America, eventually global); initial land cond. for NAM, GFS. ⁴⁰