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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

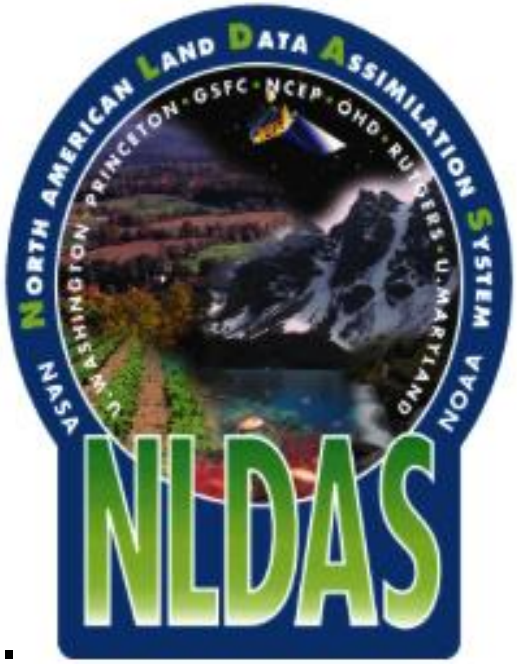
NLDAS: Partners

- NLDAS, Data Sets, Land Model Developent:
  - 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 Maintainance and Operational Transition:
  - Y. Xia (NCEP/EMC)
- NLDAS Products Application:
  - K. Mo, L.-C. Chen (NCEP/CPC)
  - E. Luebhusen, U.S.D.M. Author Group (USDA)

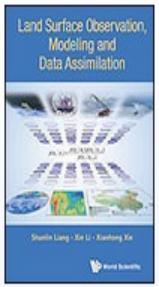
NLDAS V1.0.0 SET UP

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.).



This Chapter



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

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PDF (4,857 KB)

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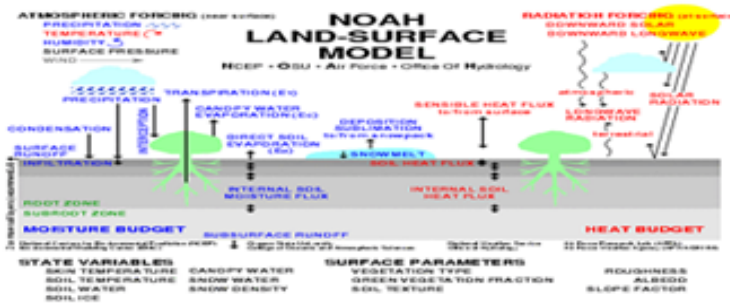
Justin Sheffield
Department of Environmental and Civil Engineering, Princeton University, Princeton, NJ, USA

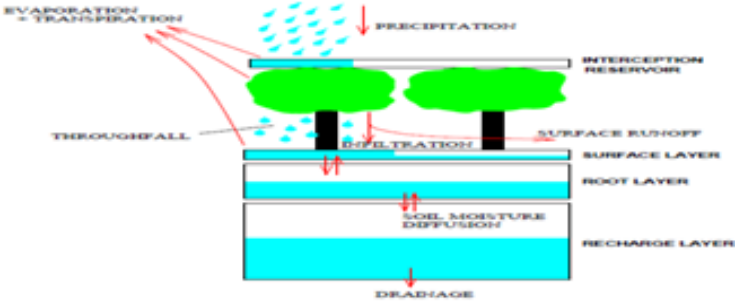
NLDAS: Land Models

Atmospheric Community



Noah

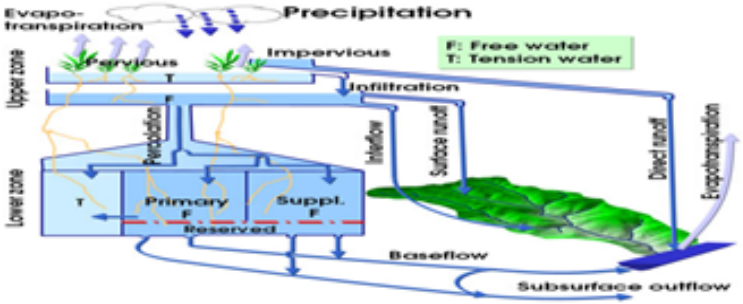
NCEP operational land model



Mosaic

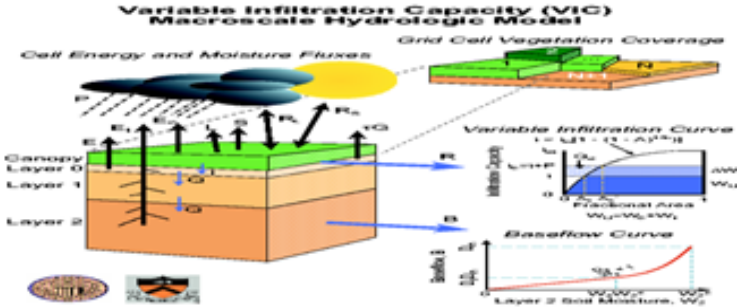
NASA GSFC

Hydrology Community



SAC

NWS operational hydrological model

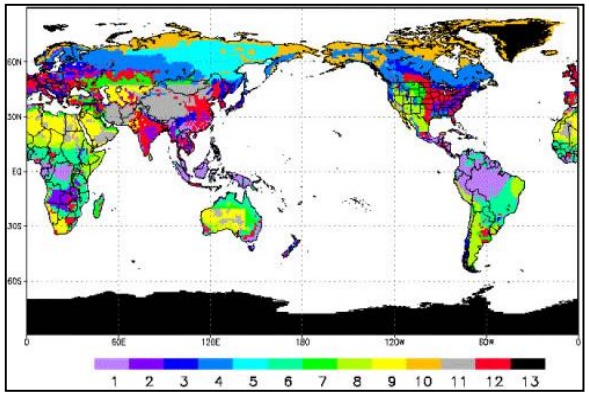


VIC

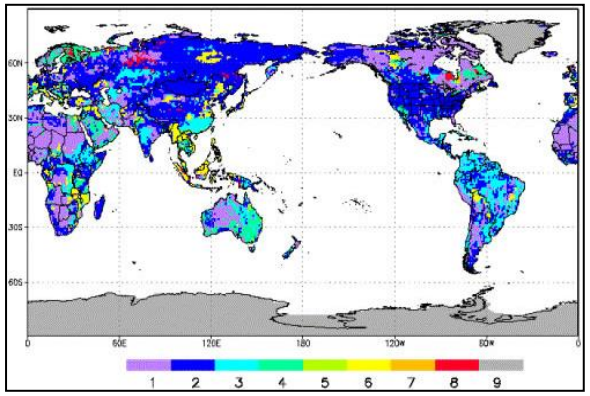
Princeton & U. Washington

4

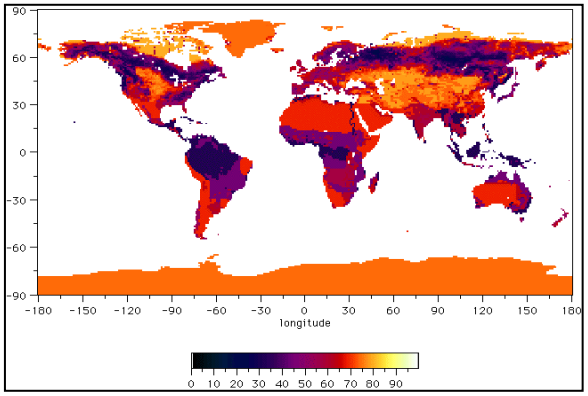
NLDAS: Land Data Sets



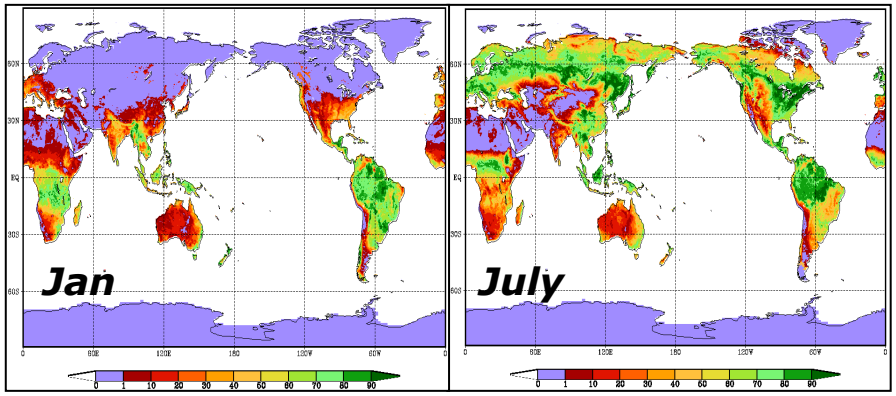
Vegetation Type
(1-deg, UMD)



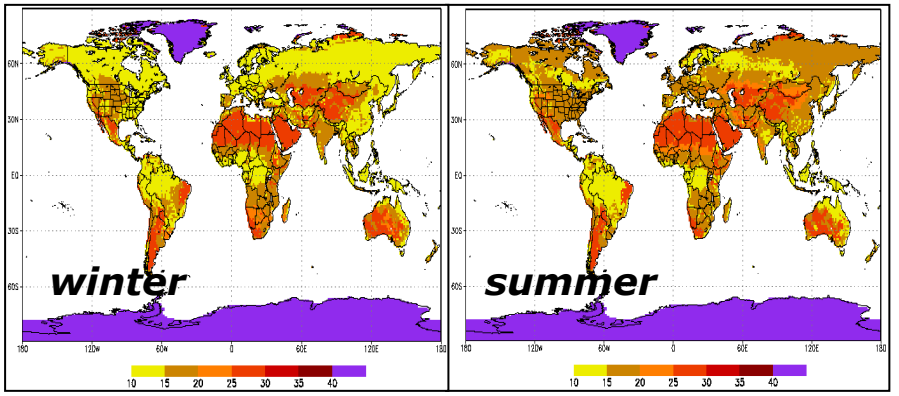
Soil Type
(1-deg, Zobler)



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



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

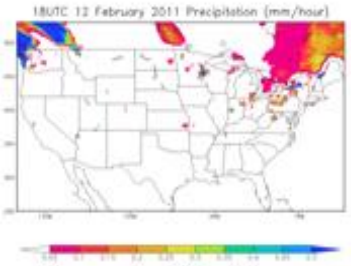


Snow-Free Albedo
(seasonal, 1-deg, Matthews)

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

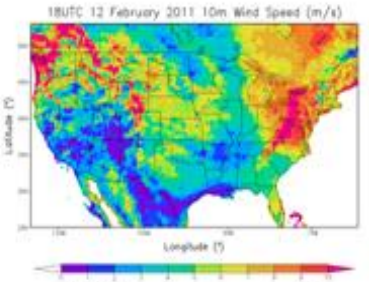
NLDAS: Atmospheric Forcing

- 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).

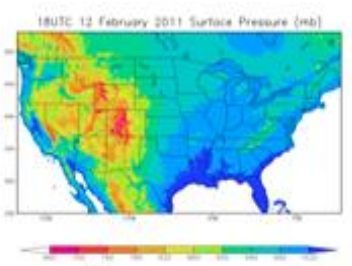


Precipitation

Incoming solar

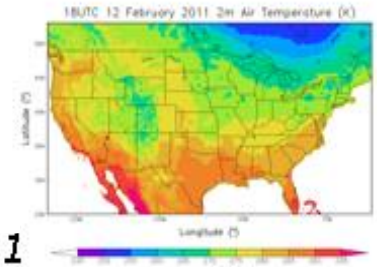


Wind speed

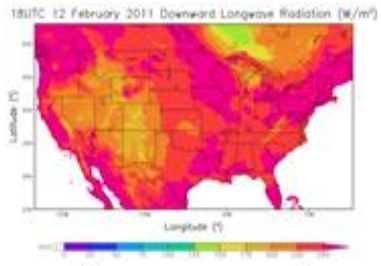


Pressure

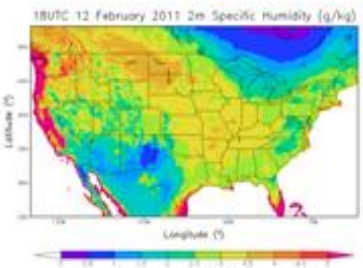
12 Feb 2011



Air temperature



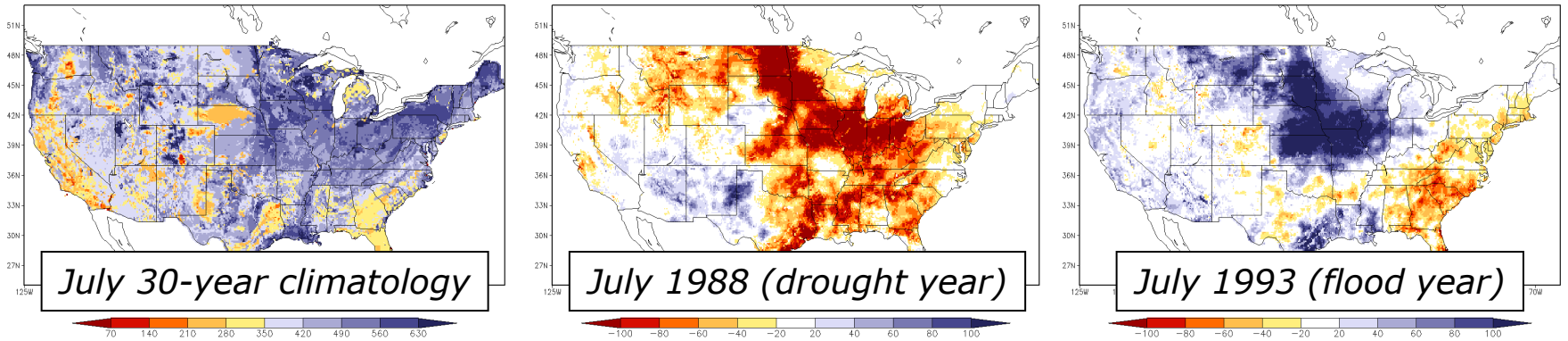
Downward longwave



Specific humidity

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.

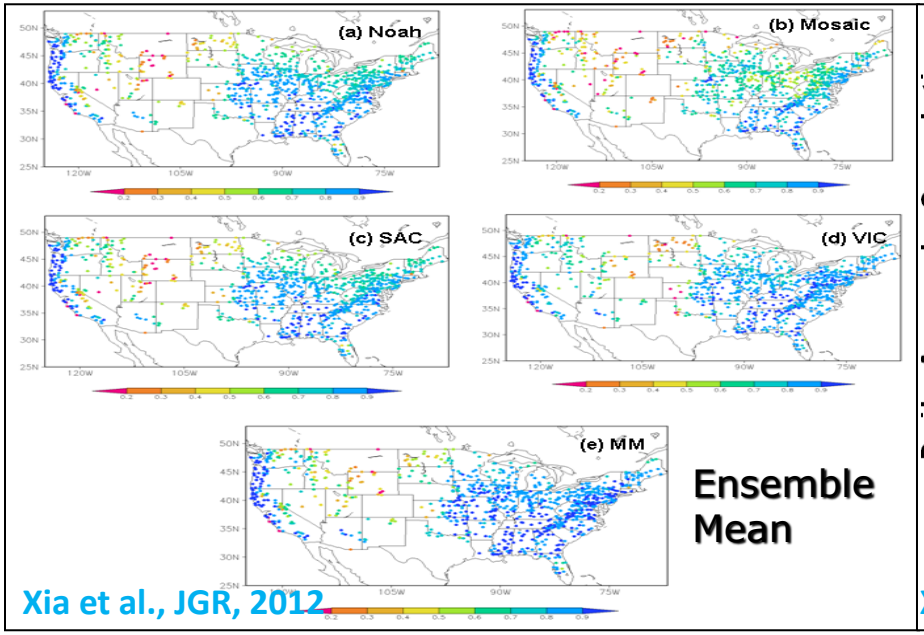


*NLDAS four-model ensemble monthly **soil moisture** anomaly*

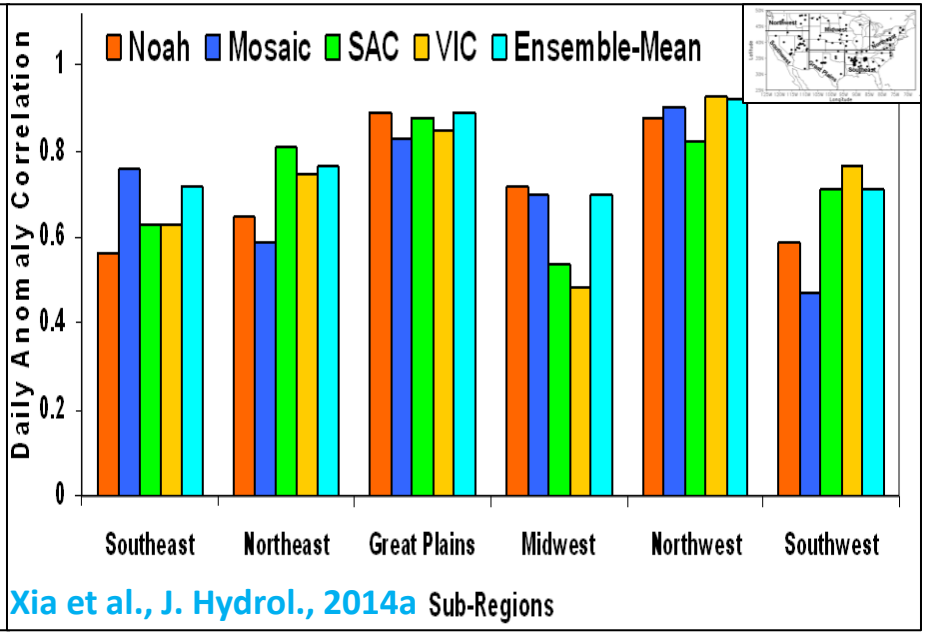
NLDAS V1.0.0 Products: Evaluation and Validation

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.



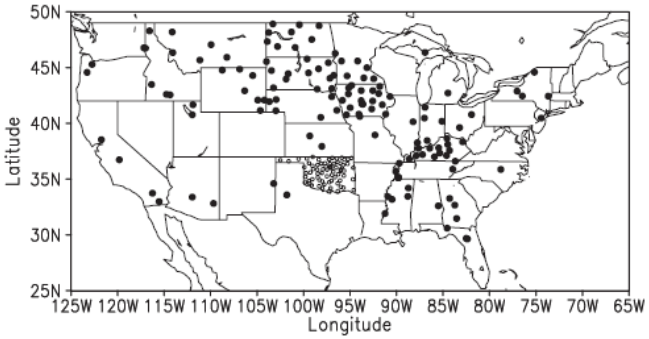
Monthly streamflow anomaly correlation (1979-2007 USGS measured streamflow)

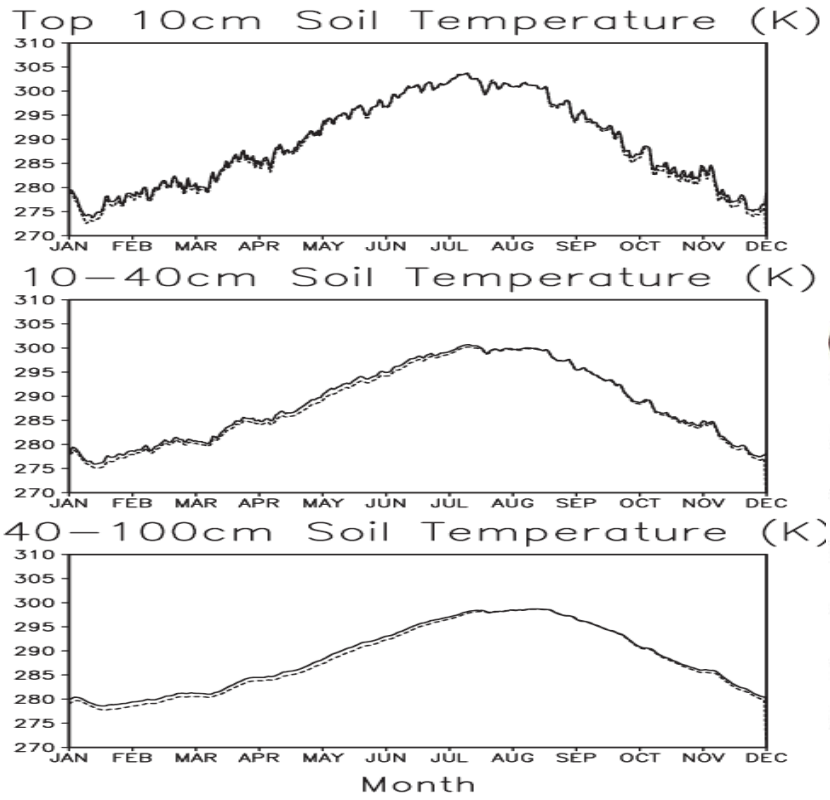


Daily top 1m soil moisture anomaly correlation (2002-2009 US SCAN Network)

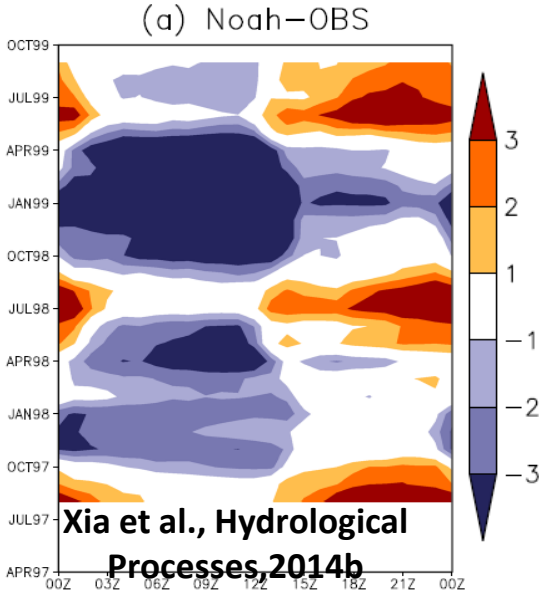
NLDAS: Evaluation (continue)

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



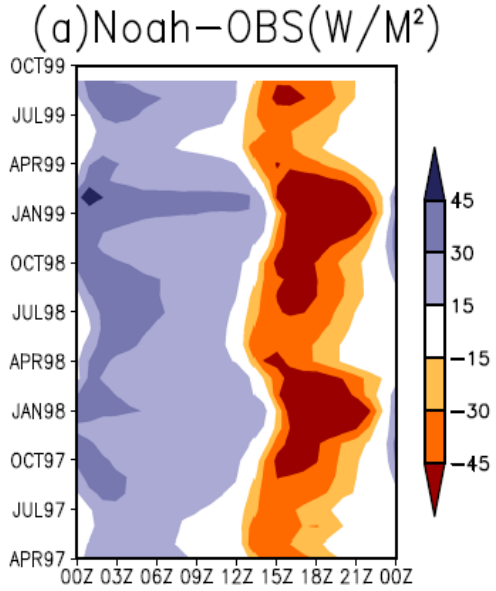


Land Skin Temperature in ARM/CART

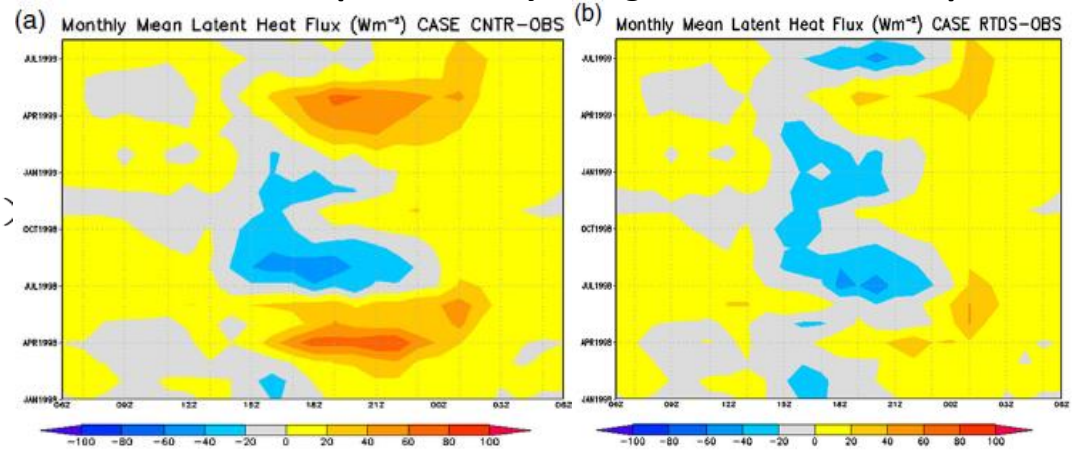


Xia et al., Hydrological Processes,2014b

Ground Heat Flux in ARM/CART



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

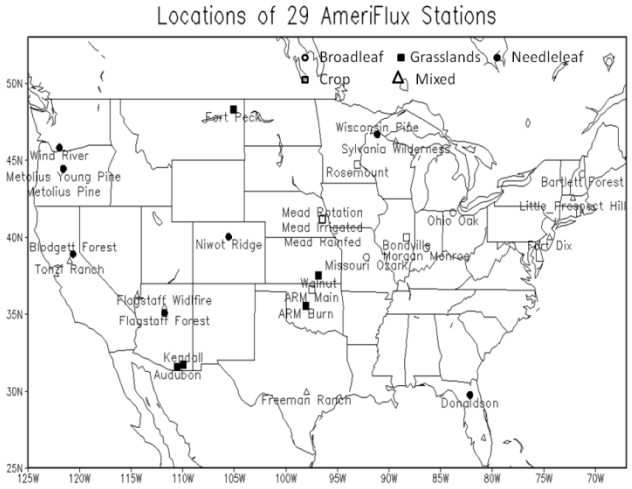


NLDAS-1 NLDAS-2

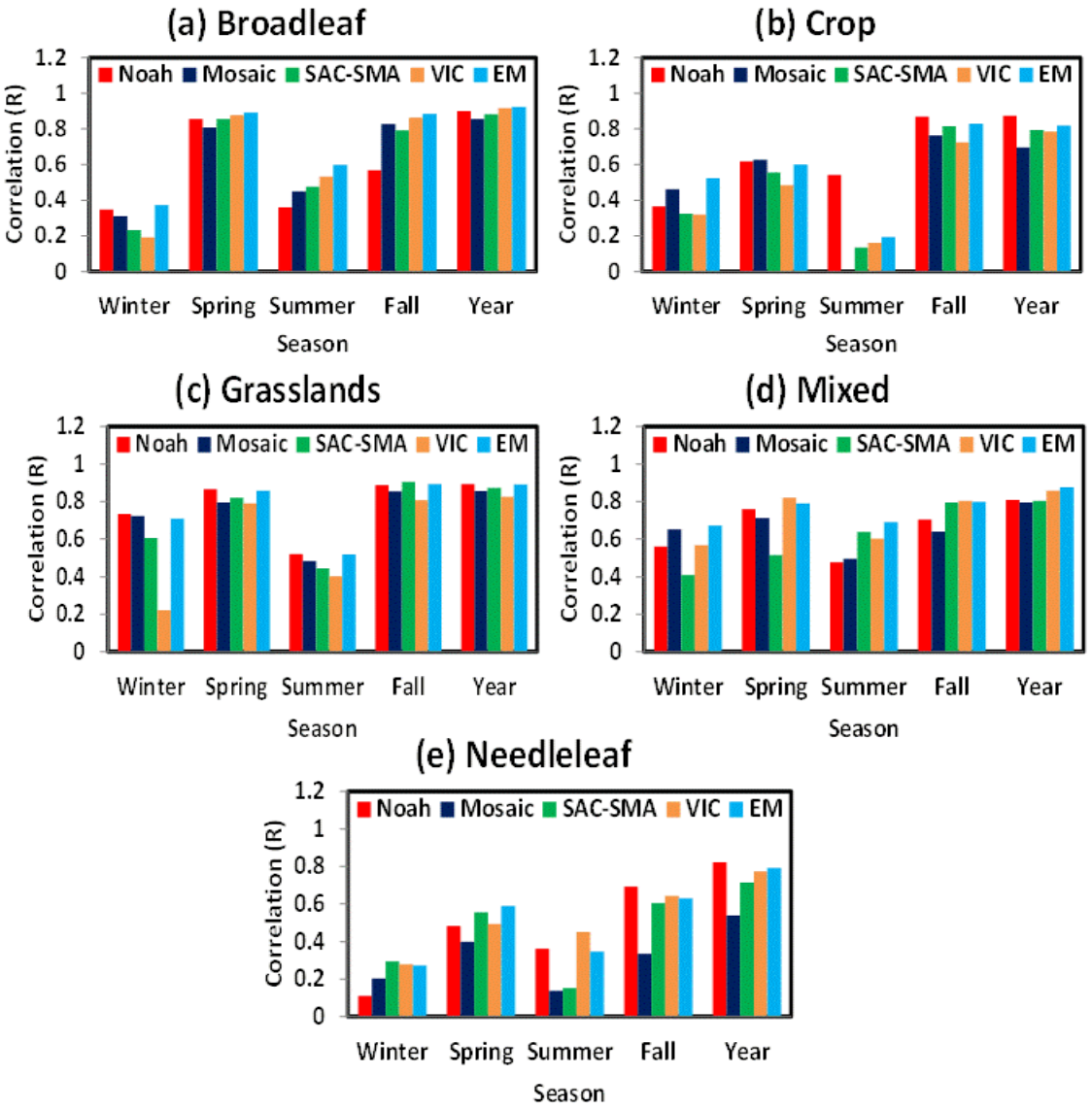
To Evaluate NLDAS v1.0 ET Products Using Tower Observations

Xia, Hobbins, Mu, and Ek, Hydrological Processes (in revision)

Variability Validation



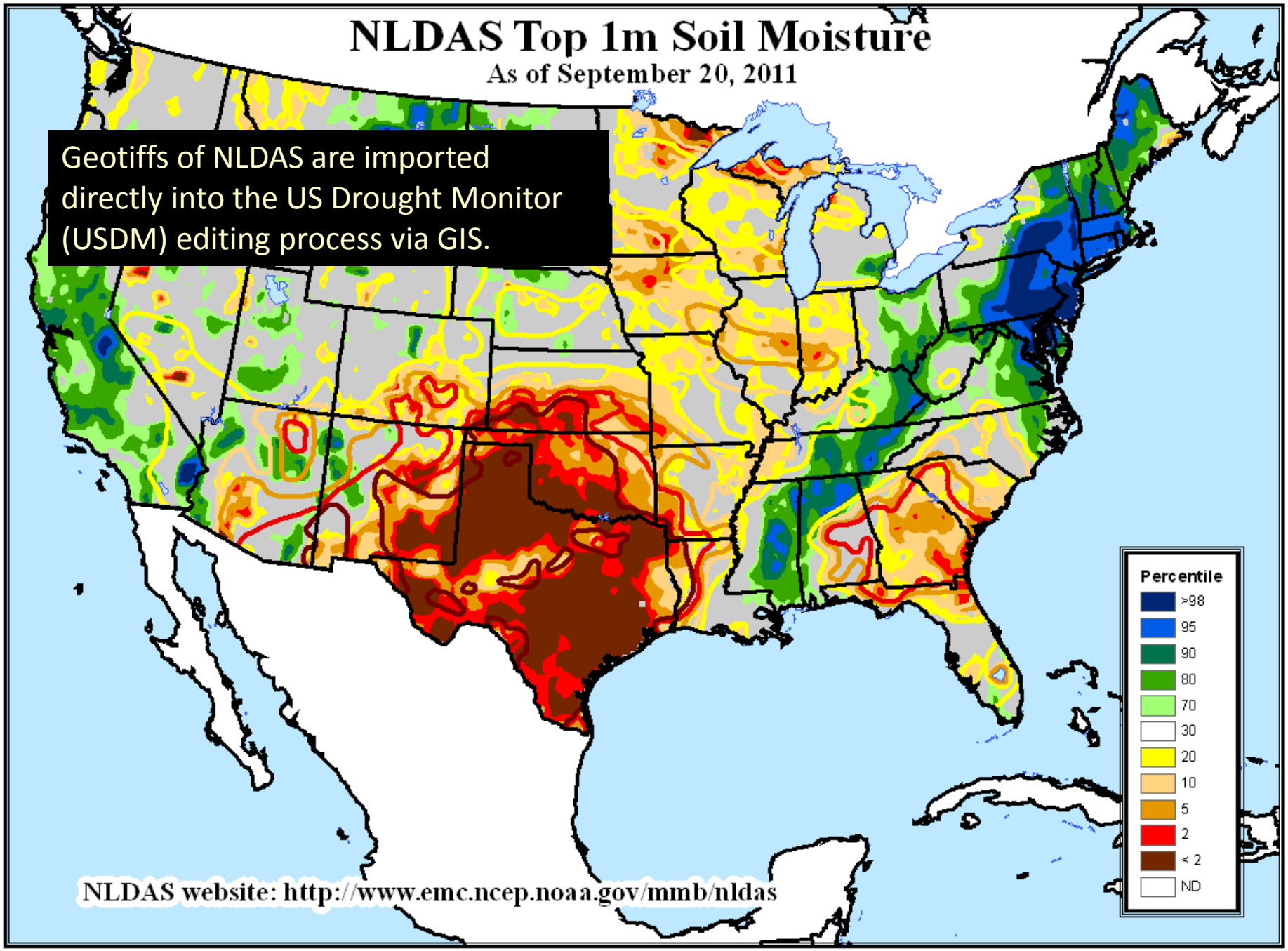
The data are grouped based on vegetation types (Mo et al., 2010). Daily value with 3 months are polled for several years. The correlation may be overestimated in spring and fall due to seasonal cycle (ET sharply increases in spring and sharply decreases in fall).

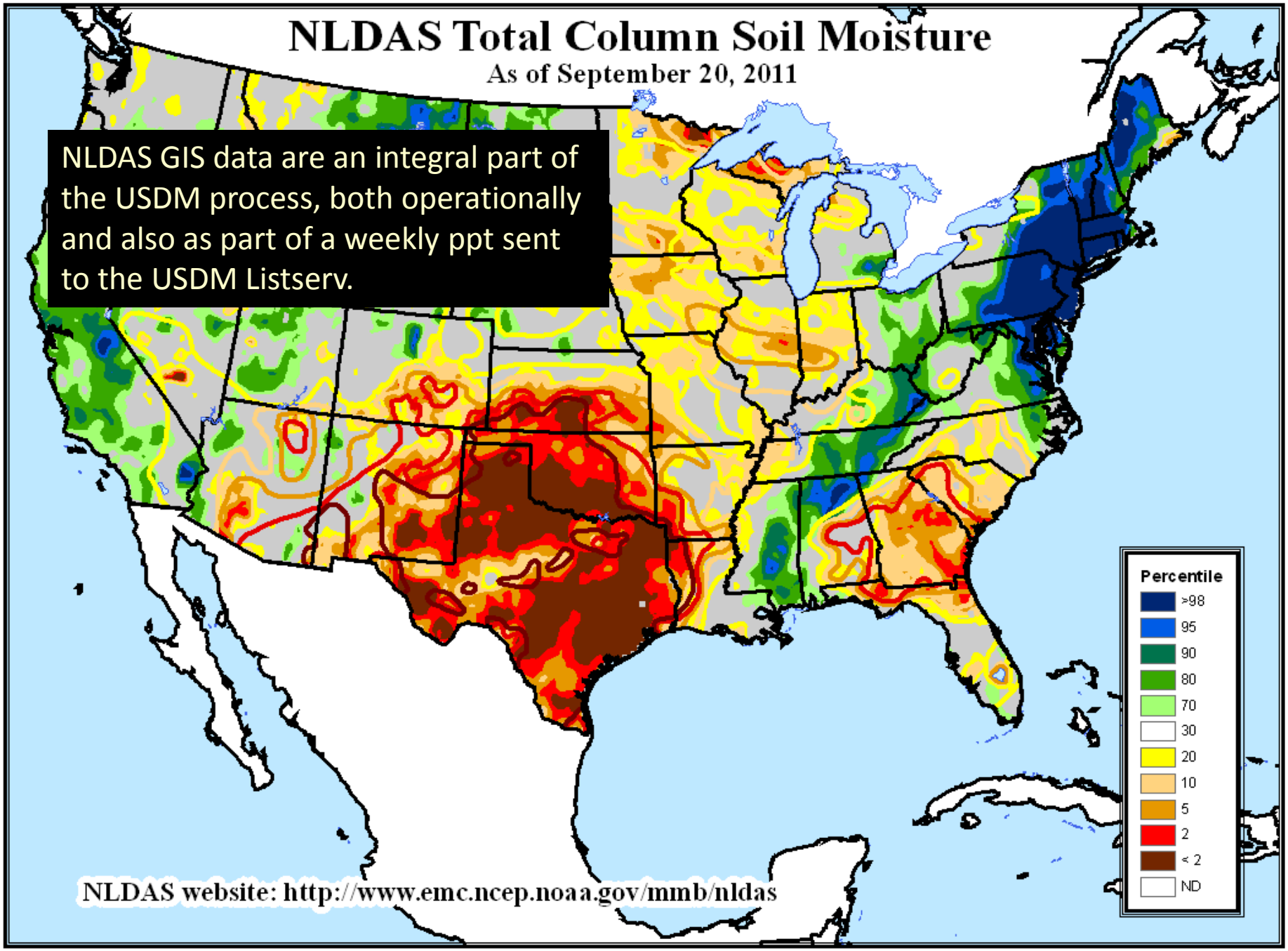


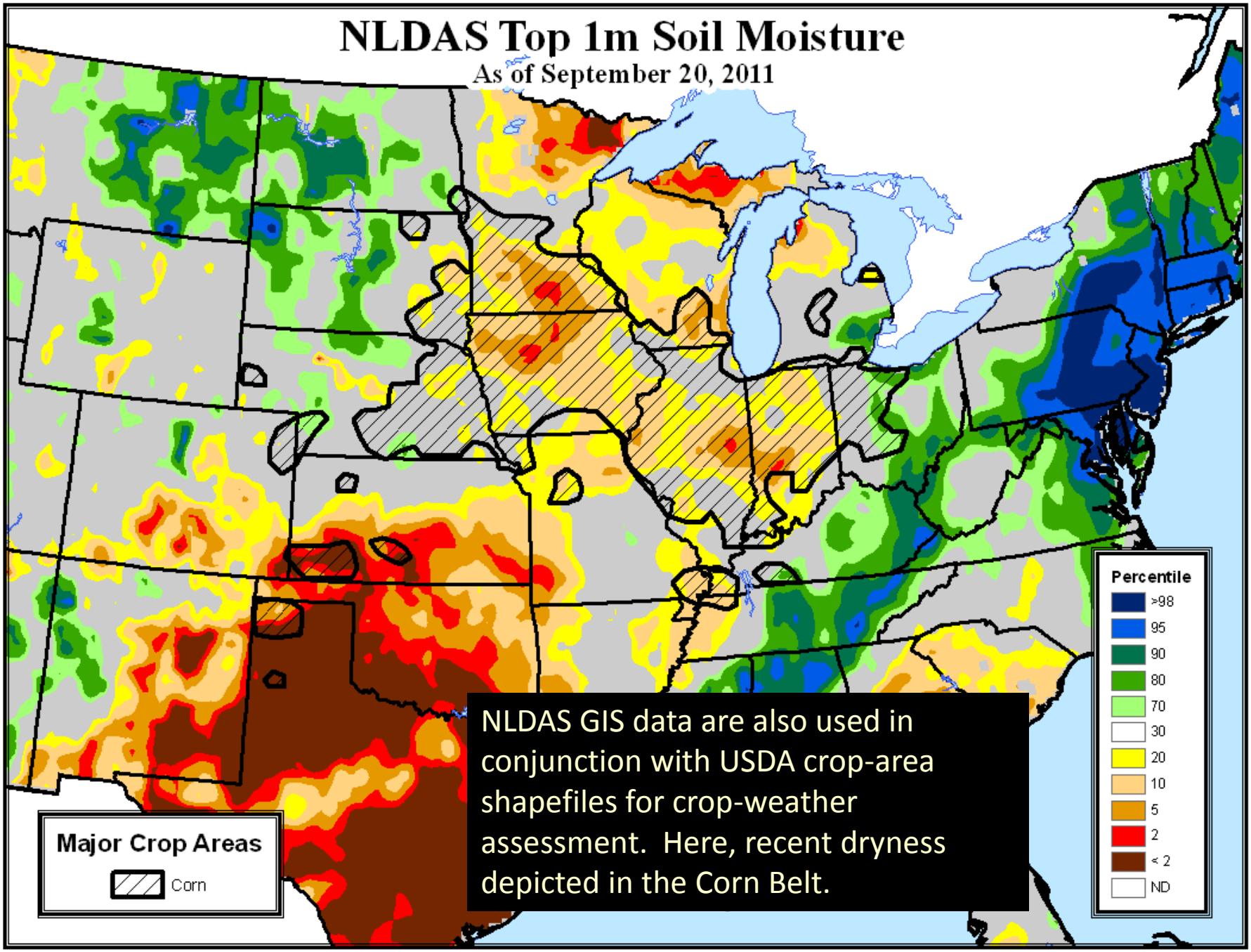
NLDAS v1.0.0 Products: Users and Applications

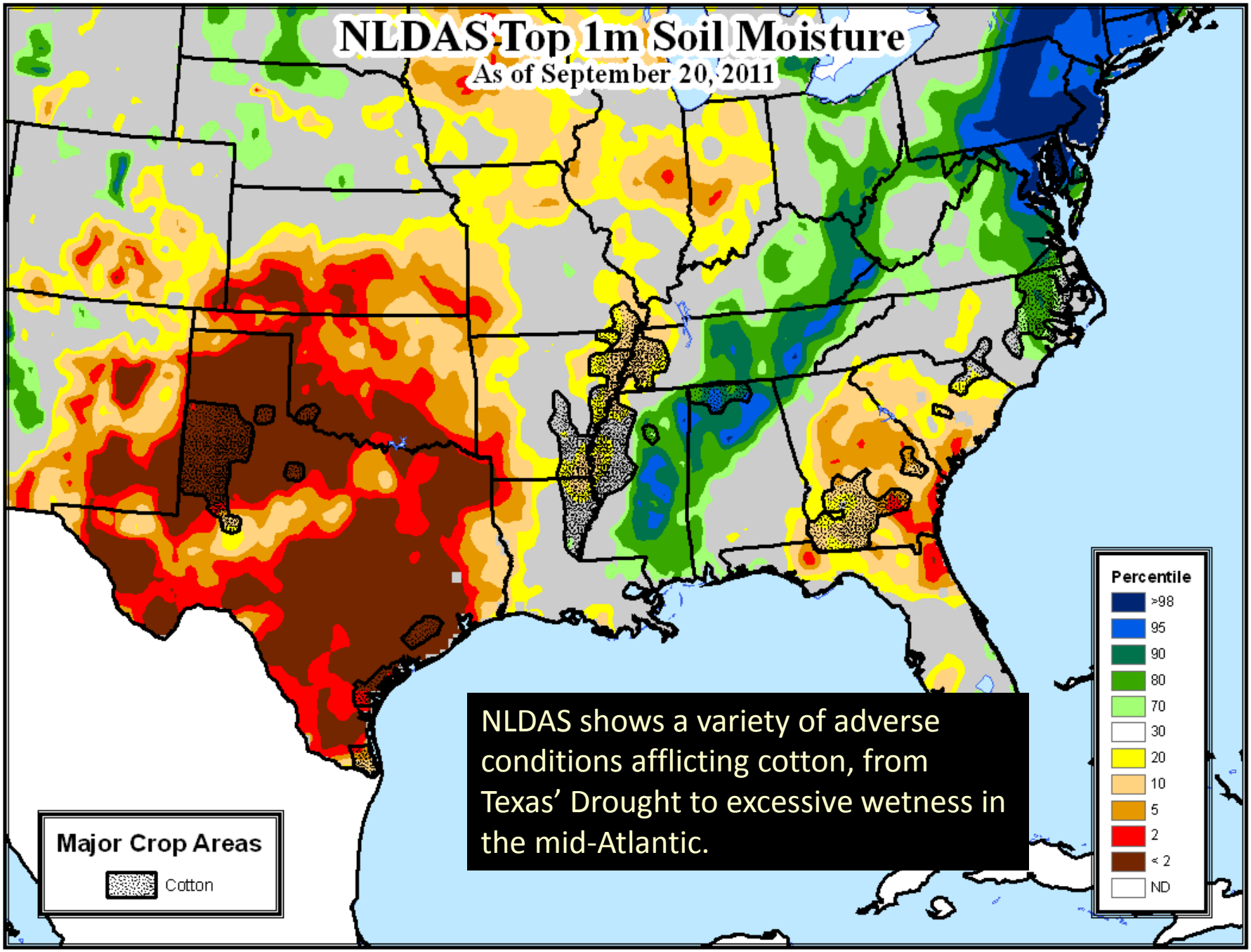
NLDAS: Users

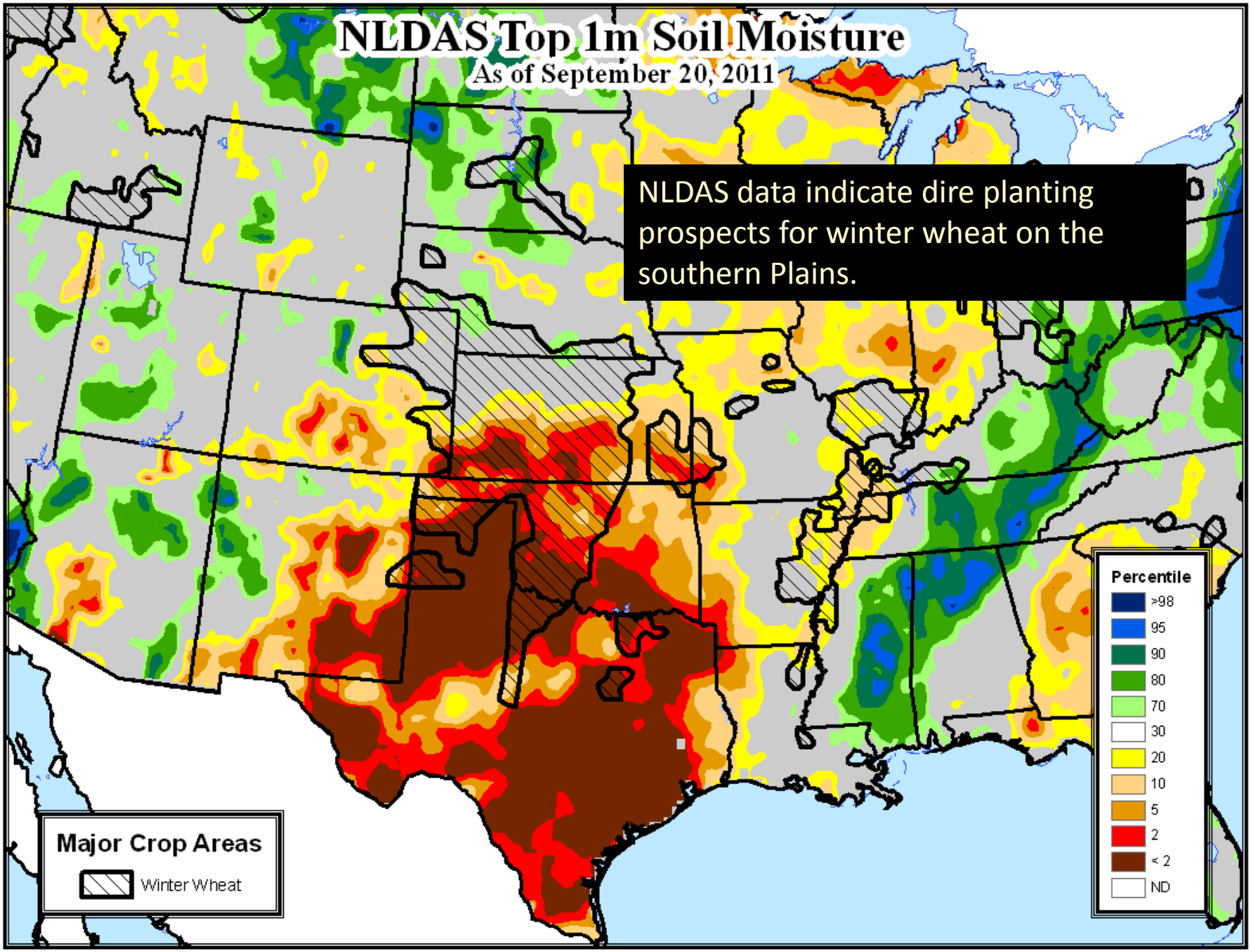
- NCEP/CPC Drought Monitoring & Drought Outlook (www.cpc.ncep.noaa.gov/products/Drought)
- US Drought Monitor (www.droughtmonitor.unl.edu)
- US Drought Portal/National Integrated Drought Information System (NIDIS) (www.drought.gov)
- Other government, academic, private users.


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.
Percentile
>98
95
90
80
70
30
20
10
5
2
< 2
ND
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.
Percentile
>98
95
90
80
70
30
20
10
5
2
< 2
ND
NLDAS website: http://www.emc.ncep.noaa.gov/mmb/nldas


NLDAS Top 1m Soil Moisture
As of September 20, 2011
Percentile
>98
95
90
80
70
30
20
10
5
2
< 2
ND
Major Crop Areas
Corn
NLDAS GIS data are also used in conjunction with USDA crop-area shapefiles for crop-weather assessment. Here, recent dryness depicted in the Corn Belt.


NLDAS Top 1m Soil Moisture
As of September 20, 2011
Percentile
>98
95
90
80
70
30
20
10
5
2
< 2
ND
Major Crop Areas
Cotton
NLDAS shows a variety of adverse conditions afflicting cotton, from Texas' Drought to excessive wetness in the mid-Atlantic.


NLDAS Top 1m Soil Moisture
As of September 20, 2011
NLDAS data indicate dire planting prospects for winter wheat on the southern Plains.
Percentile
>98
95
90
80
70
30
20
10
5
2
< 2
ND
Major Crop Areas
Winter Wheat

Application for West Wide Drought Tracker

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

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WestWideDroughtTracker

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Overview:

What is WestWide Drought Tracker?

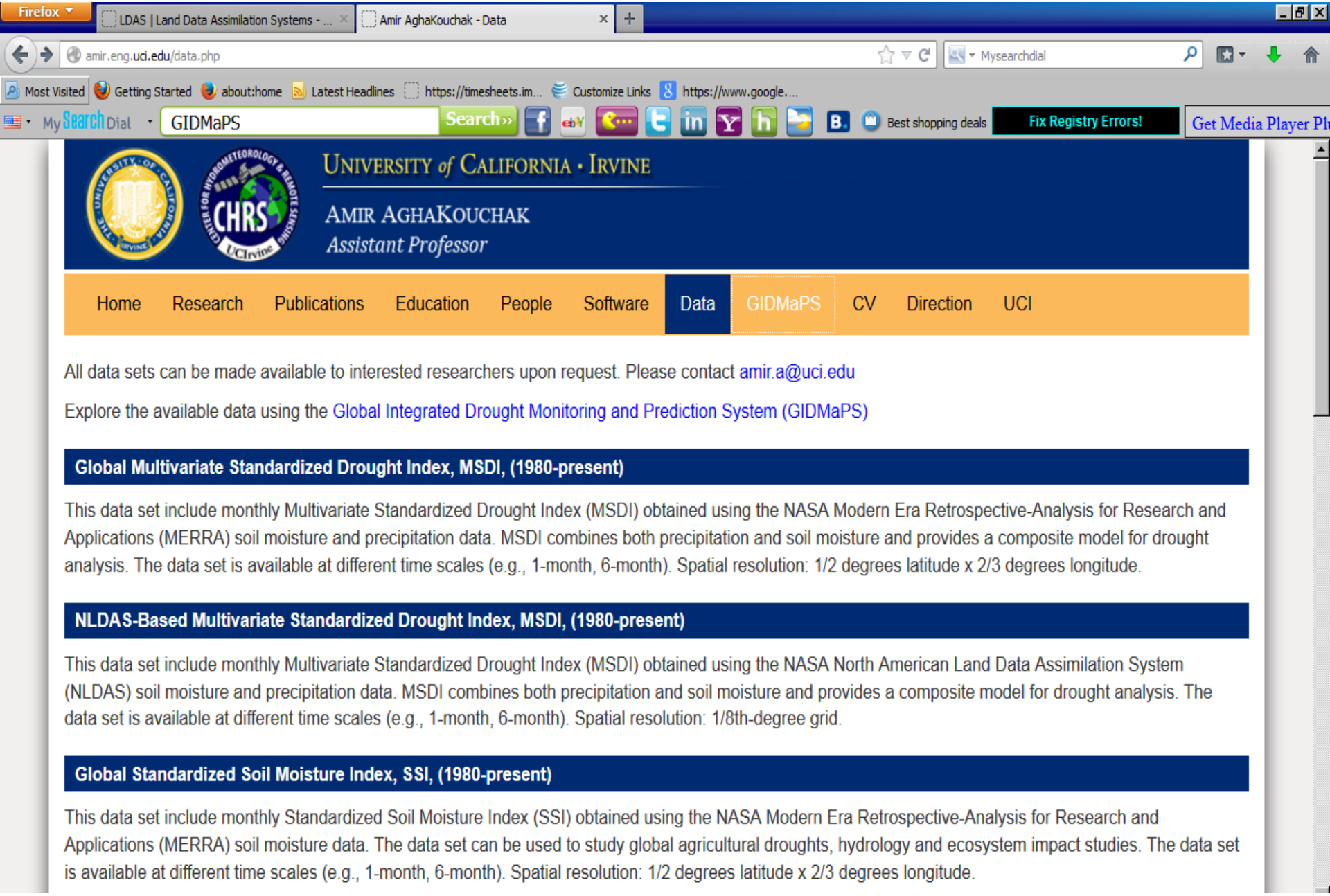
The western United States consists of complex terrain where local precipitation and temperature can vary dramatically across short distances, which in turn impact local drought conditions. The goal of WestWide Drought Tracker (WWDT) is to provide easy access to fine-scale drought monitoring and climate 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)



NLDAS to support other Government Agencies and Academia

NCAR | UCAR ClimateDataGuide

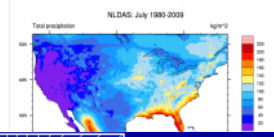
CLIMATE DATA | ANALYSIS TOOLS | MODEL EVALUATION | EXPERT CONTRIBUTORS

Climate Data

NLDAS: NORTH AMERICAN LAND DATA ASSIMILATION SYSTEM: MONTHLY CLIMATOLOGIES

NCAR/UCAR

Summary | Metadata | Data Access | References



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

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CDC WONDER

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North America Land Data Assimilation System (NLDAS) Daily

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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

And By: None

And By: None

And By: None

And By: None

Select a temperature: Fahrenheit | Ce

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

Daily Max Air Temperature (F):
- [x] 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:

National Weather Service

Climate Prediction Center

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Search the CPC: Go

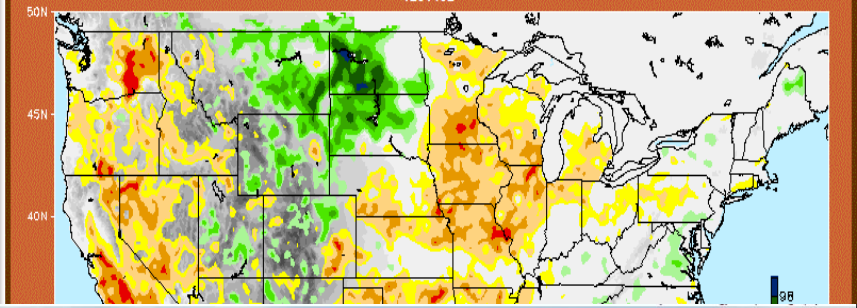
HOME > U.S. Drought > Drought Indices: Soil Moisture Percentiles

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

Drought Indices
Soil Moisture Percentiles

Recent Analyses

1201402



Home
Monitoring
- Precipitation
- Temperature
- Streamflow
- Drought

Weekly Forecast
- 1-Month SPI
- 3-Month SPI
- 6-Month SPI
- Weekly Soil Moisture
- Monthly Soil Moisture
- Soil Moisture Time Series

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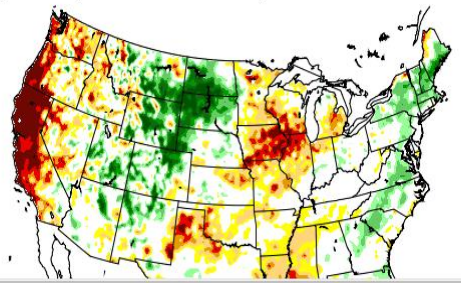
Acknowledgement
Today's Weather

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

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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 indices
- To reconstruct long-term OBNDI

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

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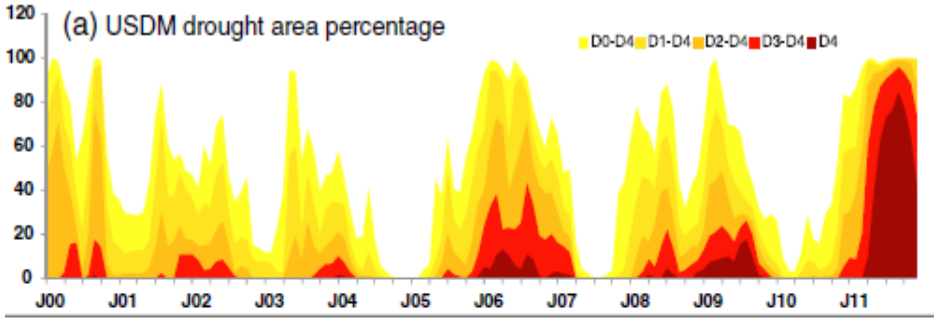
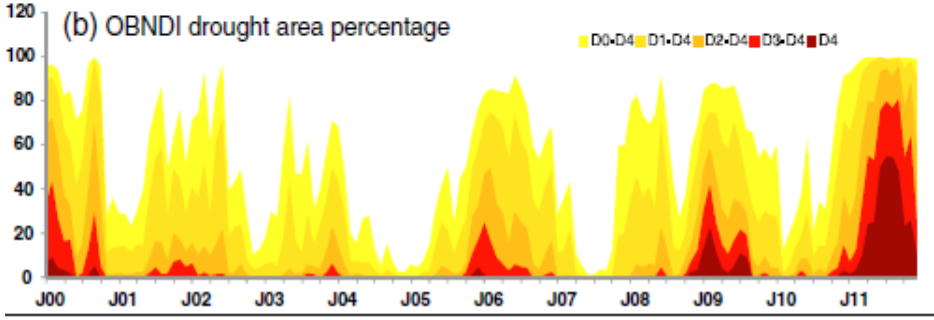
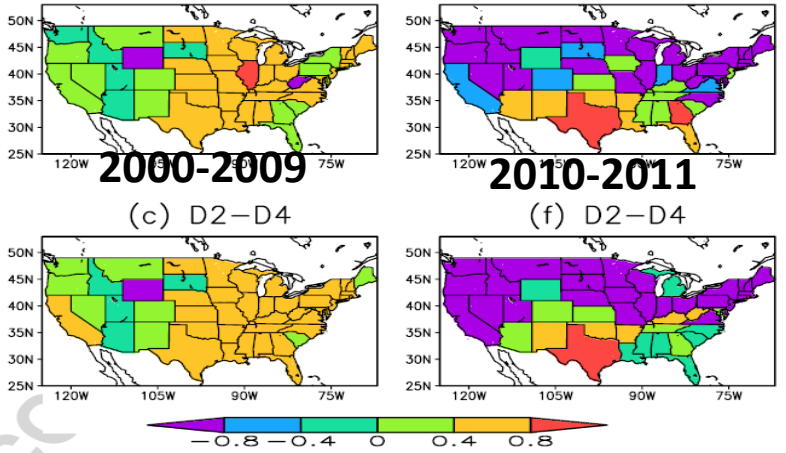
Abstract This study performs three experiments to calibrate the drought area percentages in the continental United States (CONUS), six U.S. Drought Monitor (USDM) regions, and 48 states downloaded from the USDM archive website. The corresponding three experiments are named CONUS, Region, and State, respectively. 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

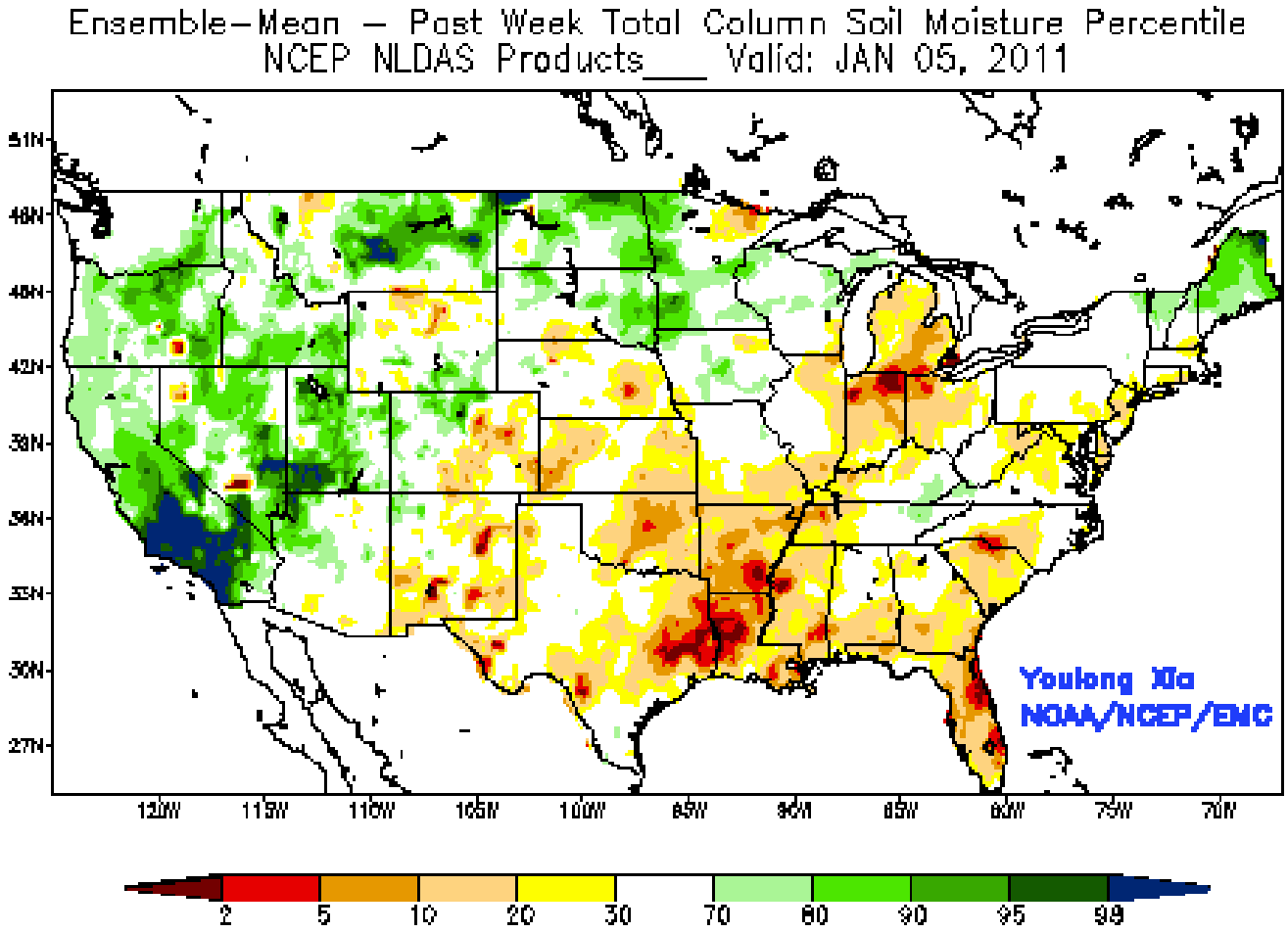




Nash-Sutcliffe Efficiency for two USDM drought categories

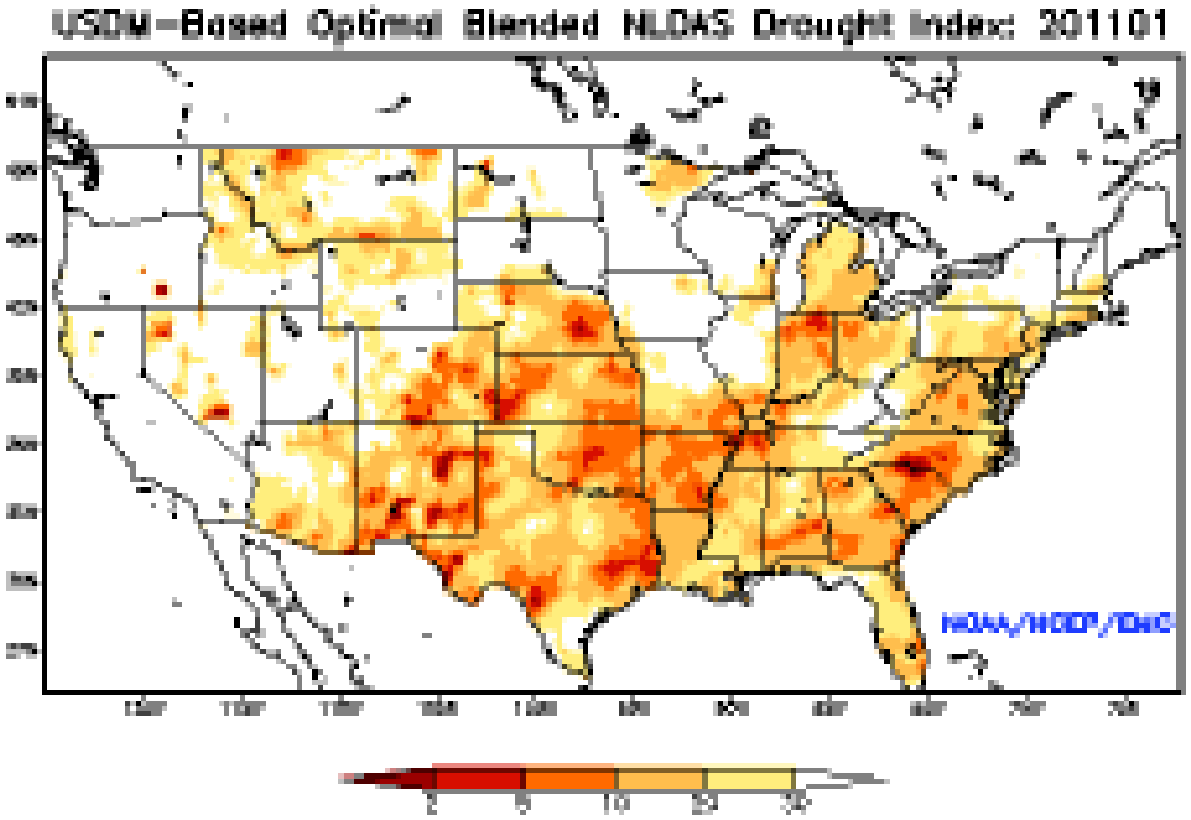


NLDAS: 2011 Texas Drought



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

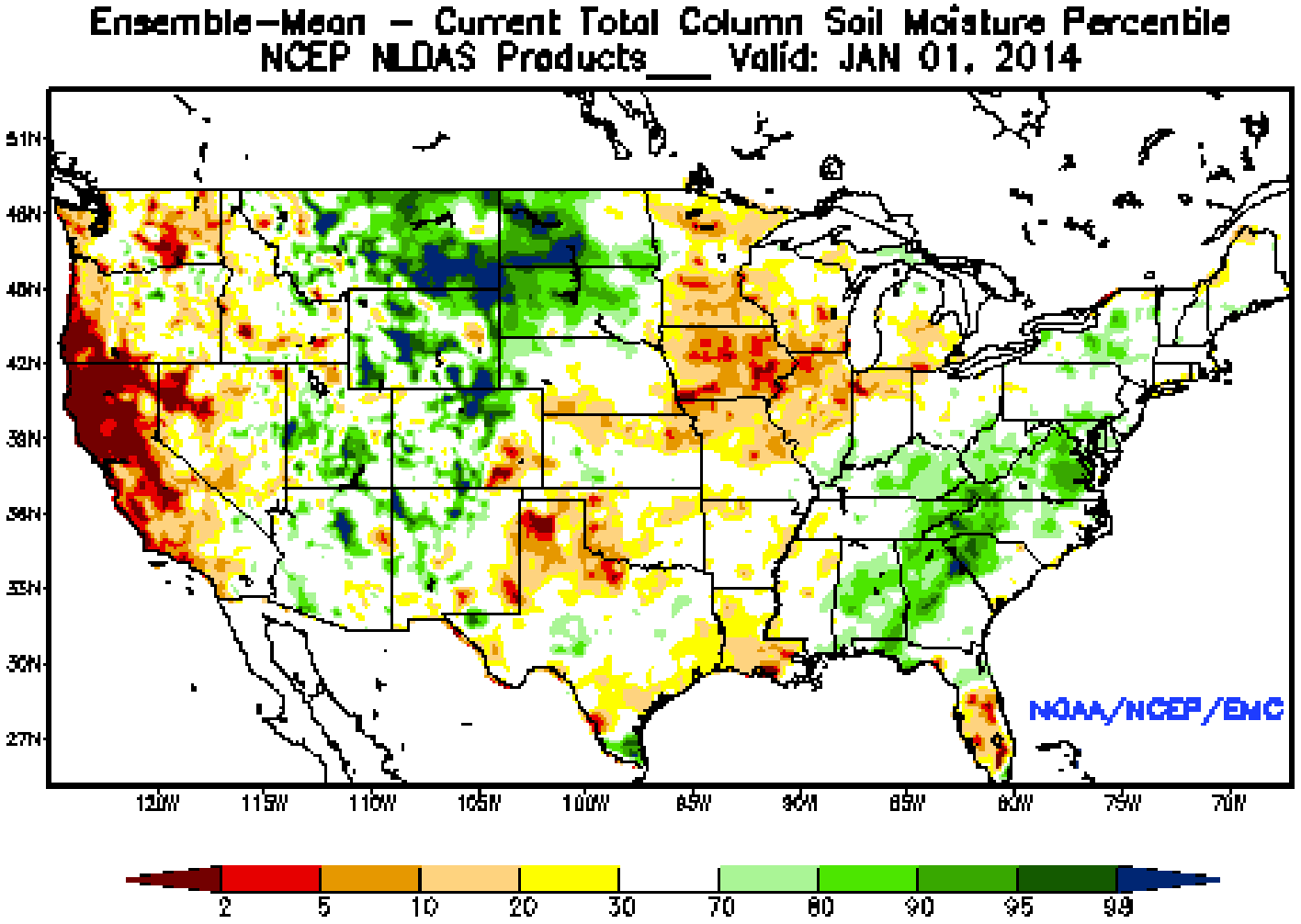


Xia et al., JGR, 2014c

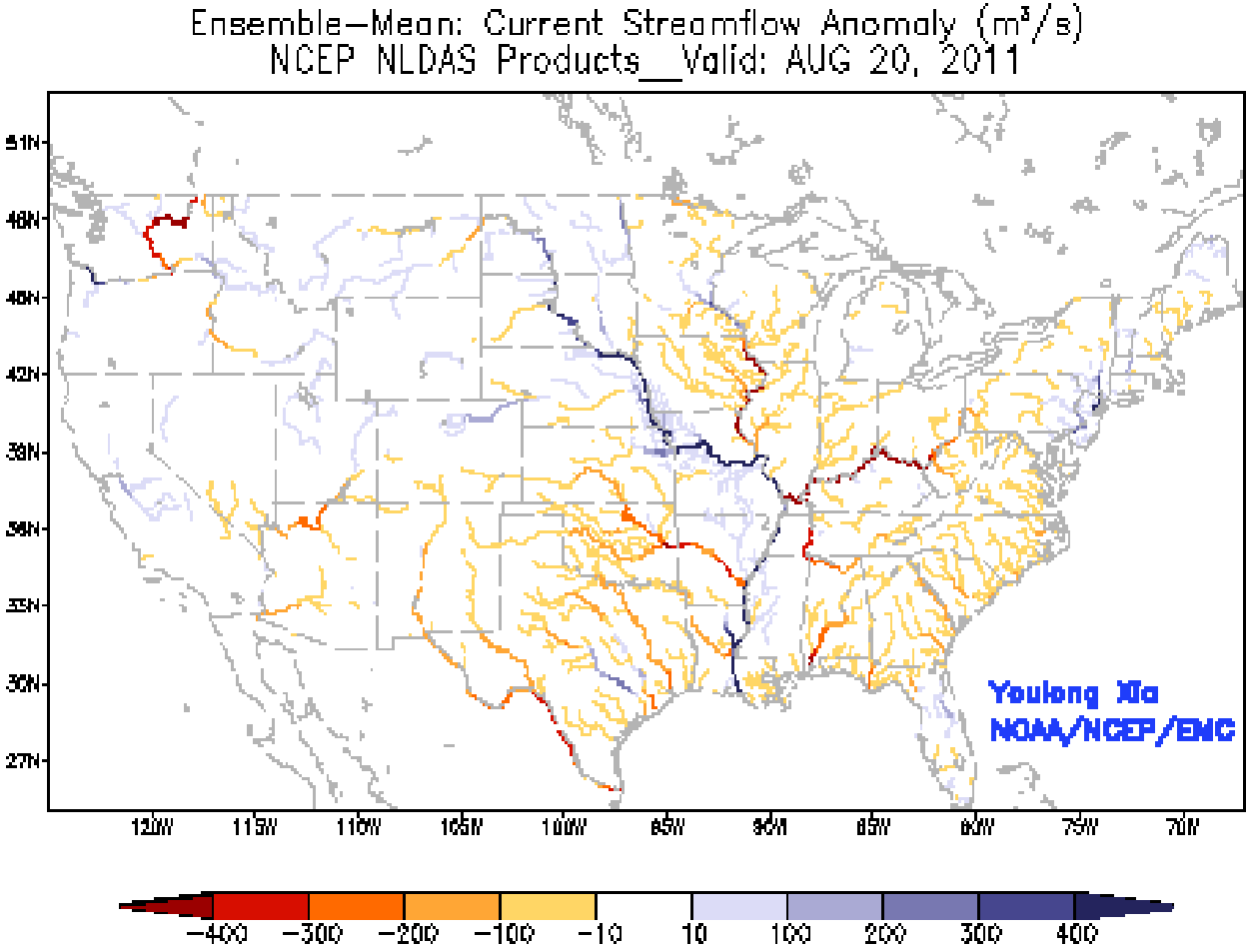
USDM-based optimally blended NLDAS Drought Index, Jan 2011 – Aug 2012 (D0 yellow/moderate – D4 red/extreme)

Century California Drought Monitoring

Improvement and Termination of Drought

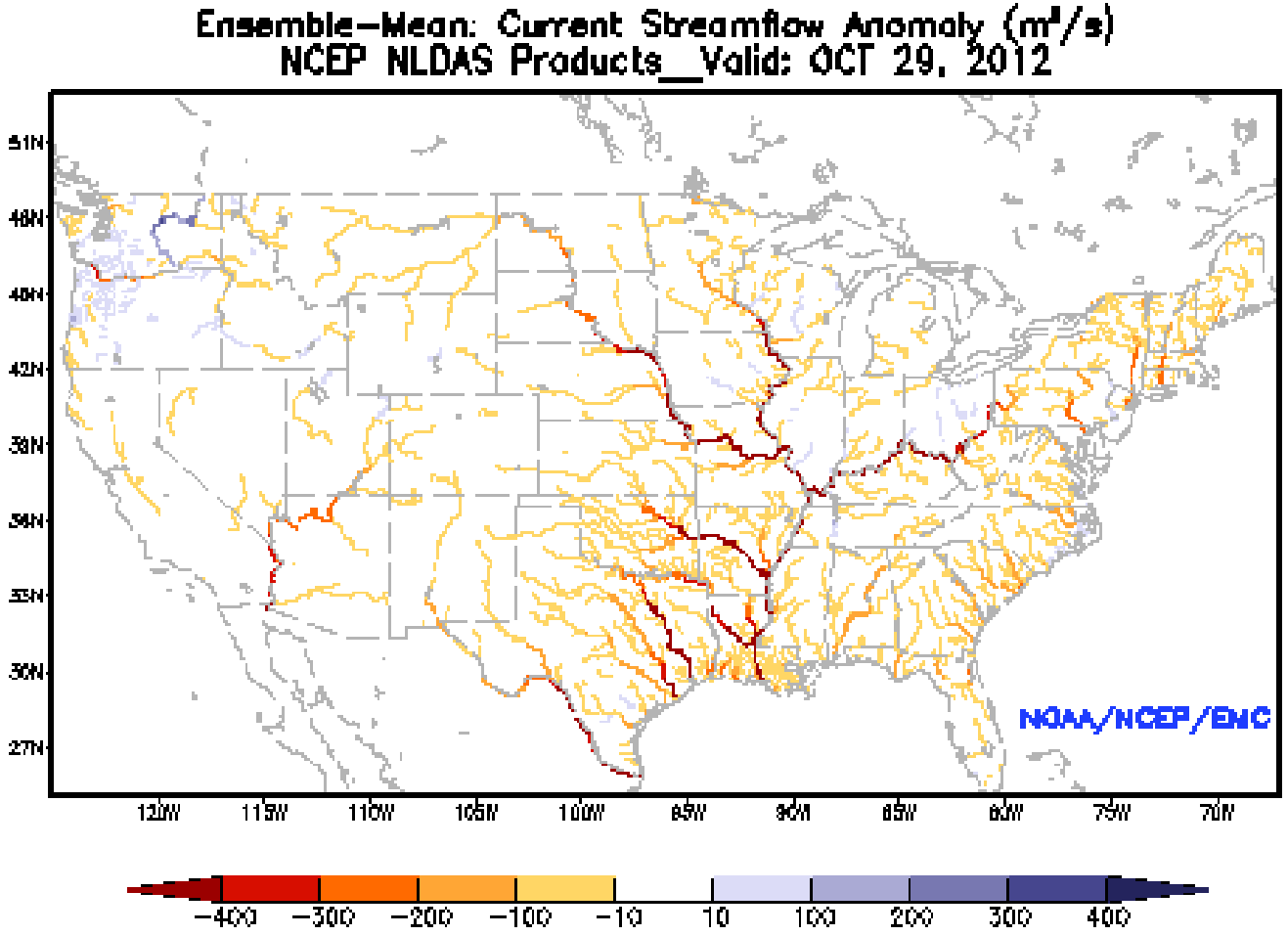


NLDAS: Flood Monitoring



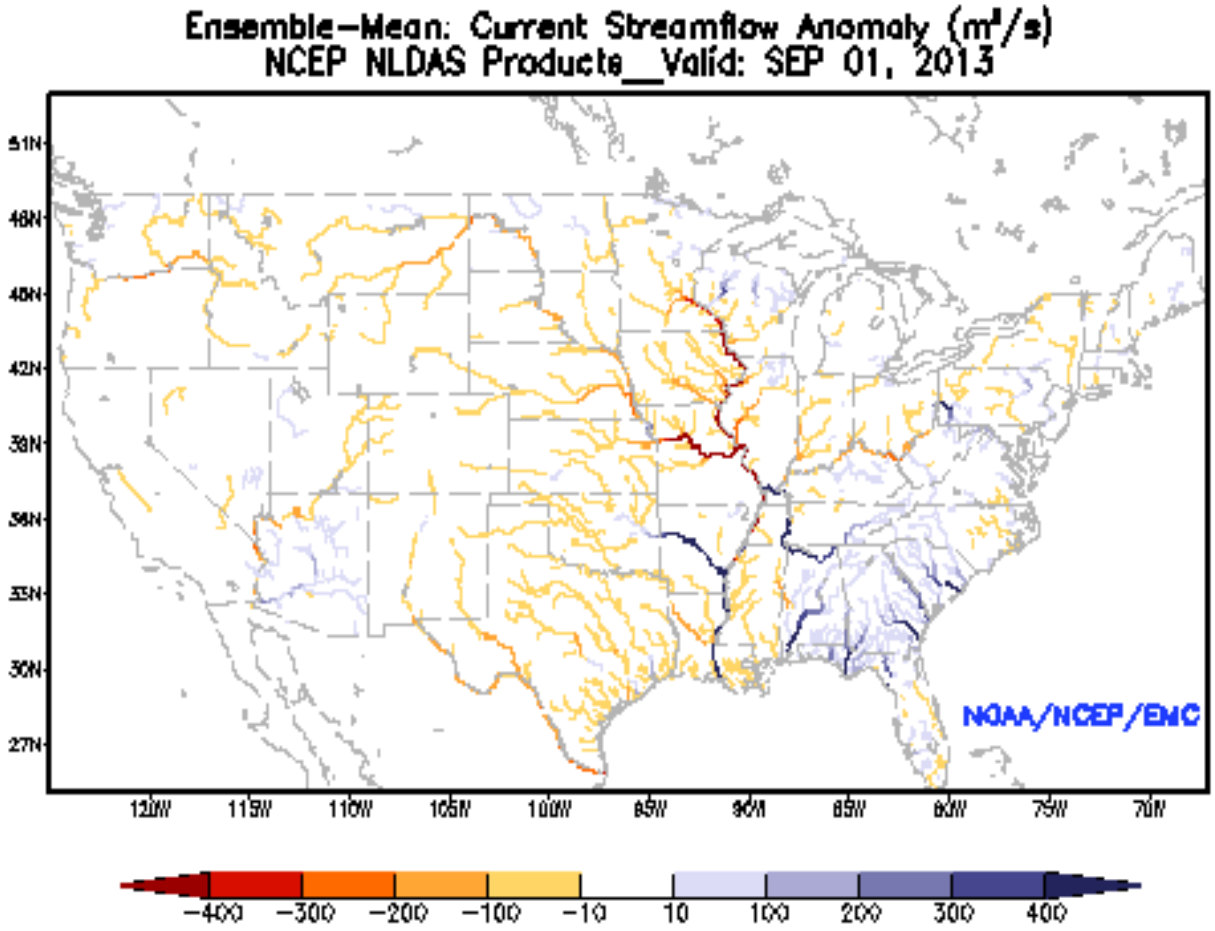
Ensemble mean daily streamflow anomaly (m^3/s)
Hurricane Irene and Tropical Storm Lee
20 August – 17 September 2011

NLDAS: Flood Monitoring

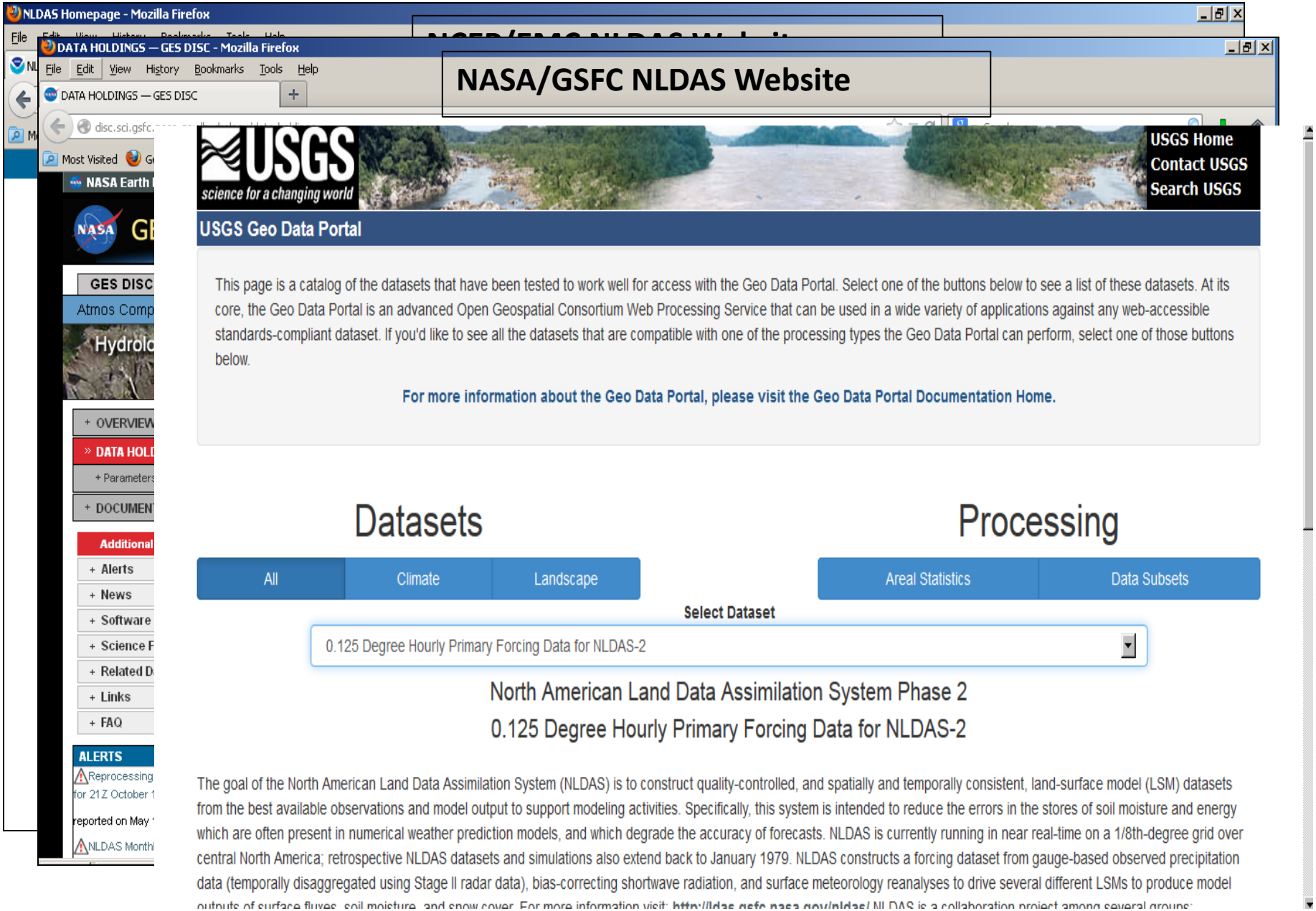


Ensemble mean daily streamflow anomaly (m^3/s)
Superstorm Sandy
29 October – 04 November 2012

NLDAS Flood Monitoring
Ensemble mean daily streamflow anomaly (m^3/s)
Colorado Front Range Flooding
September 2013



NLDAS: Web Site Information



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

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

Correlation RMSE

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

Lowest model layer(NARR/CDAS)

Correlation RMSE

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

Noah tempest run

/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

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
42:4520605:SNOD:rpn_corr=1:rpn_rms=4.59293e-05
43:4589841:SNOWC:rpn_corr=0.999999:rpn_rms=0.000616389
44:4612982:CCOND:rpn_corr=1:rpn_rms=4.61228e-07
45:4771181:RCS:rpn_corr=1:rpn_rms=4.14989e-08
46:4872061:RCT:rpn_corr=1:rpn_rms=3.17372e-05
47:4940808:RCQ:rpn_corr=1:rpn_rms=2.42311e-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 **Mosaic model tempest run**

/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

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
2:111540:NLWRS:rpn_corr=0.999994:rpn_rms=0.205884
3:213807:LHTFL:rpn_corr=0.999956:rpn_rms=0.295993
4:319533:SHTFL:rpn_corr=0.999995:rpn_rms=0.301886
5:434643:GFLUX:rpn_corr=0.999998:rpn_rms=0.0518071
6:529635:SNOHF:rpn_corr=0.999978:rpn_rms=0.121072
7:586807:DSWRF:rpn_corr=1:rpn_rms=0.00178282
8:690270:DLWRF:rpn_corr=0.999969:rpn_rms=0.291681
9:788045:TSNOW:rpn_corr=1:rpn_rms=6.01423e-07
10:819997:ARAIN:rpn_corr=1:rpn_rms=3.49119e-07
11:846946:EVP:rpn_corr=0.99987:rpn_rms=0.000729768
12:957357:SSRUN:rpn_corr=0.999973:rpn_rms=0.000226958
13:990354:BGRUN:rpn_corr=1:rpn_rms=2.80676e-06
14:1081440:SNOM:rpn_corr=0.999961:rpn_rms=0.000916093
15:1114033:SNOT:rpn_corr=0.999389:rpn_rms=0.181234
16:1153991:AVSFT:rpn_corr=0.99999:rpn_rms=0.0452243
17:1262322:RADT:rpn_corr=0.999991:rpn_rms=0.0493852
18:1371708:ALBDO:rpn_corr=0.999999:rpn_rms=0.0347287
19:1484947:WEASD:rpn_corr=1:rpn_rms=0.00269208
20:1590969:CNWAT:rpn_corr=0.998339:rpn_rms=0.0043754
21:1646068:TSOIL:rpn_corr=0.999997:rpn_rms=0.023467
22:1752645:TSOIL:rpn_corr=1:rpn_rms=0.000652019
23:1855529:TSOIL:rpn_corr=1:rpn_rms=0.000189012
24:1957305:SOILM:rpn_corr=1:rpn_rms=0.00279405
25:2187489:SOILM:rpn_corr=1:rpn_rms=0.00279199
26:2418926:SOILM:rpn_corr=1:rpn_rms=0.00273515
27:2642231:SOILM:rpn_corr=1:rpn_rms=0.00335408
28:2833268:SOILM:rpn_corr=1:rpn_rms=0.0033661 1
29:3043792:SOILM:rpn_corr=1:rpn_rms=0.00295705
30:3268500:LSOIL:rpn_corr=1:rpn_rms=0.0017005 6
31:3459537:LSOIL:rpn_corr=1:rpn_rms=0.00174501
32:3670061:LSOIL:rpn_corr=1:rpn_rms=0.000643589
33:3894769:MSTAV:rpn_corr=1:rpn_rms=0.000543052
34:4060787:MSTAV:rpn_corr=1:rpn_rms=0.000542267
35:4229253:EVCW:rpn_corr=0.989605:rpn_rms=0.00167994
36:4243898:TRANS:rpn_corr=0.999977:rpn_rms=0.000356705
37:4264087:EVBS:rpn_corr=1:rpn_rms=0
38:4277928:SBSNO:rpn_corr=0.999609:rpn_rms=0.000595401
39:4294602:ACOND:rpn_corr=1:rpn_rms=6.52771e-09
40:4376107:LAI:rpn_corr=1:rpn_rms=1.00863e-07
41:4500496:SNOD:rpn_corr=1:rpn_rms=0.000119043
42:4583288:SNOWC:rpn_corr=0.999999:rpn_rms=0.0452108
43:4622262:SALBD:rpn_corr=0.999998:rpn_rms=0.0698244

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.