

“Current and Future Applications of Tools for U.S. Seasonal Drought Outlook”

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NOAA/NWS/NCEP/Climate Prediction Center

*37th Climate Diagnostics & Prediction Workshop
Hilton Fort Collins
Ft. Collins, Colorado
Thursday, October 25, 2012*



U.S. Drought Outlook Outline

- ❑ History/Background;
- ❑ Production (including Tools Used);
- ❑ Verification;
- ❑ Short-Term Modifications (Ongoing);
- ❑ Long-Term Improvements (Development/Research);
- ❑ USDO Author Wish List;



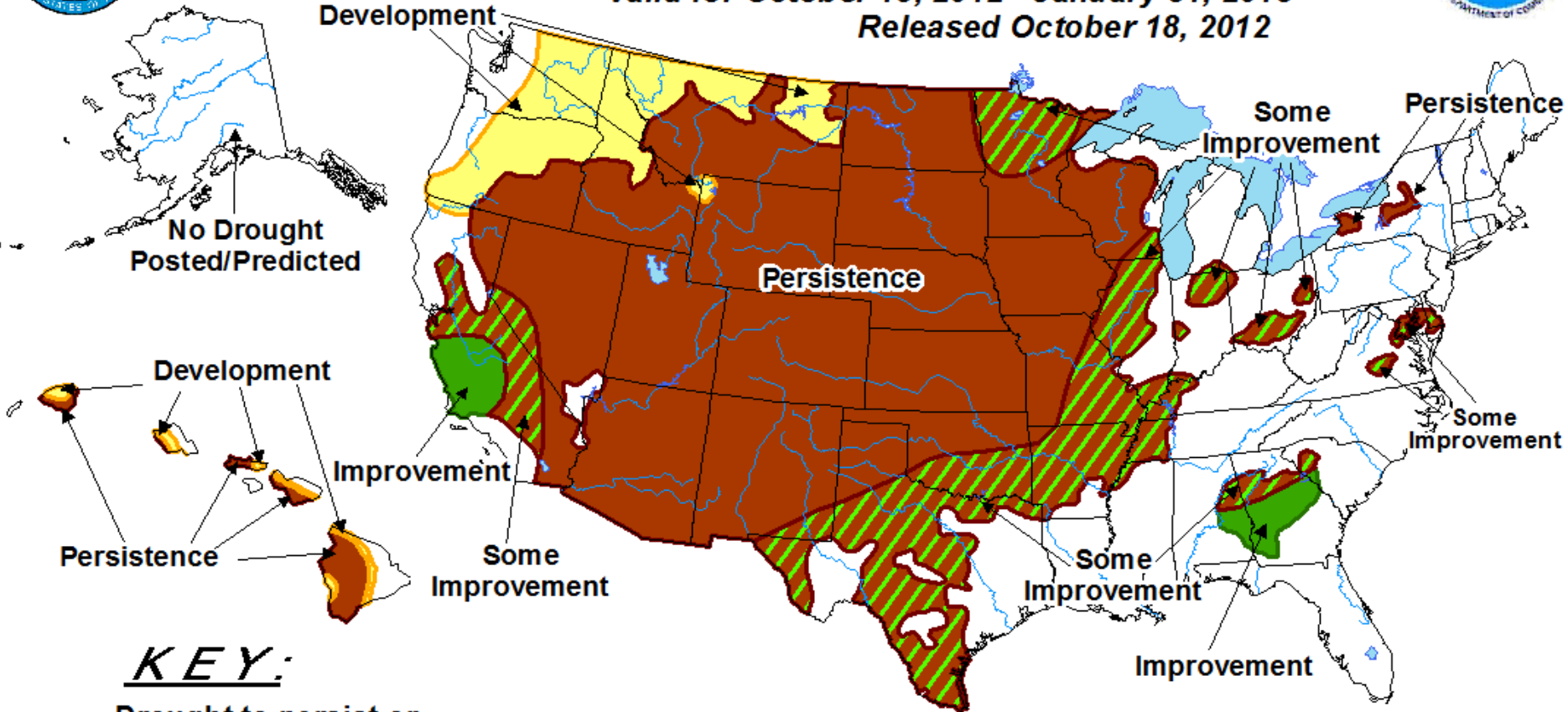


U.S. Seasonal Drought Outlook





Drought Tendency During the Valid Period

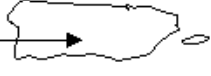
Valid for October 18, 2012 - January 31, 2013

Released October 18, 2012



KEY:

-  Drought to persist or intensify
-  Drought ongoing, some improvement
-  Drought likely to improve, impacts ease
-  Drought development likely

No Drought Posted/Predicted 

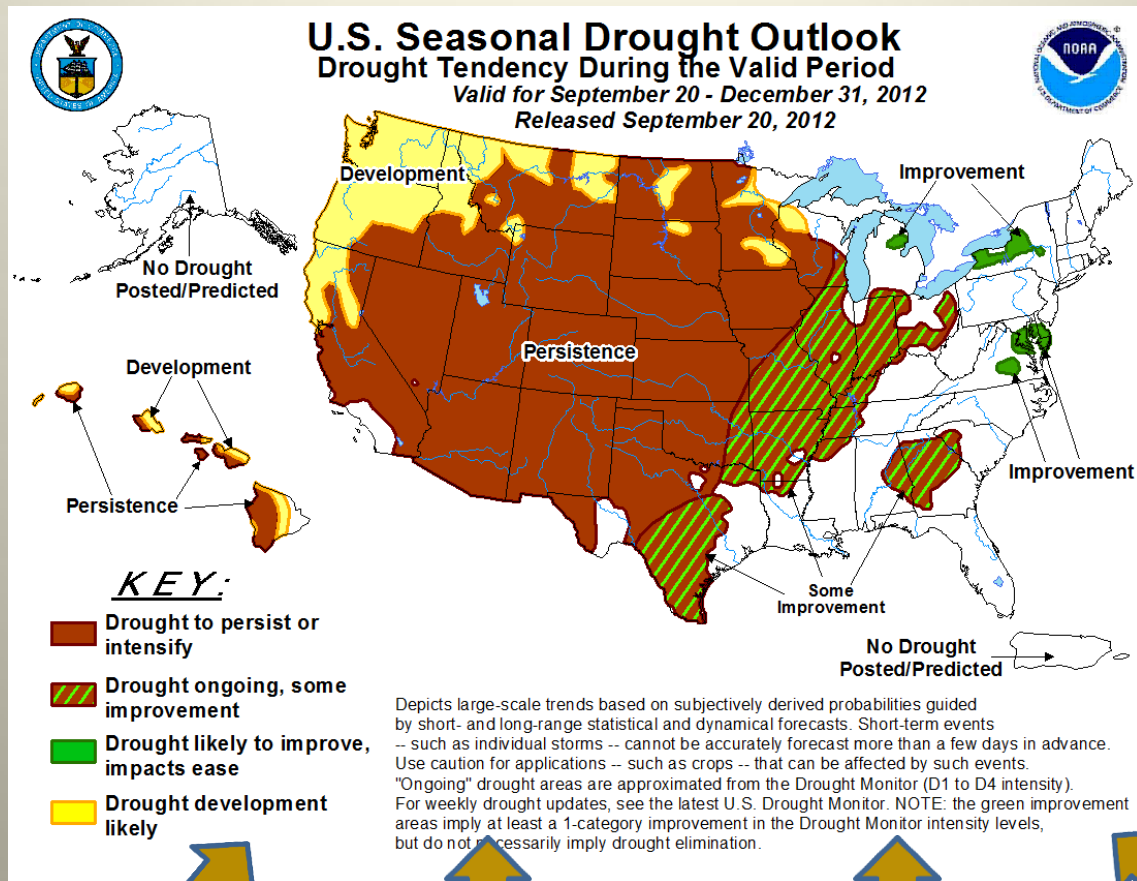
Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Short-term events -- such as individual storms -- cannot be accurately forecast more than a few days in advance. Use caution for applications -- such as crops -- that can be affected by such events. "Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4 intensity). For weekly drought updates, see the latest U.S. Drought Monitor. NOTE: the green improvement areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply drought elimination.

U.S. Drought Outlook History

- Originated in August 1999 (shortly after the US Drought Monitor became operational)—went public in March 2000;
- Intent is to present a simple national picture of where drought will improve, persist, or develop;
- Issued twice per 3-month forecast, with **Initial outlook released 3rd Thursday** and **Updated outlook released 1st Thursday of next month**, by one of 5 CPC forecasters;



Drought Forecasting: Short & Long-Term Forecasts and Analog/Climo Contributions



Start with latest U.S. Drought Monitor D1 areas

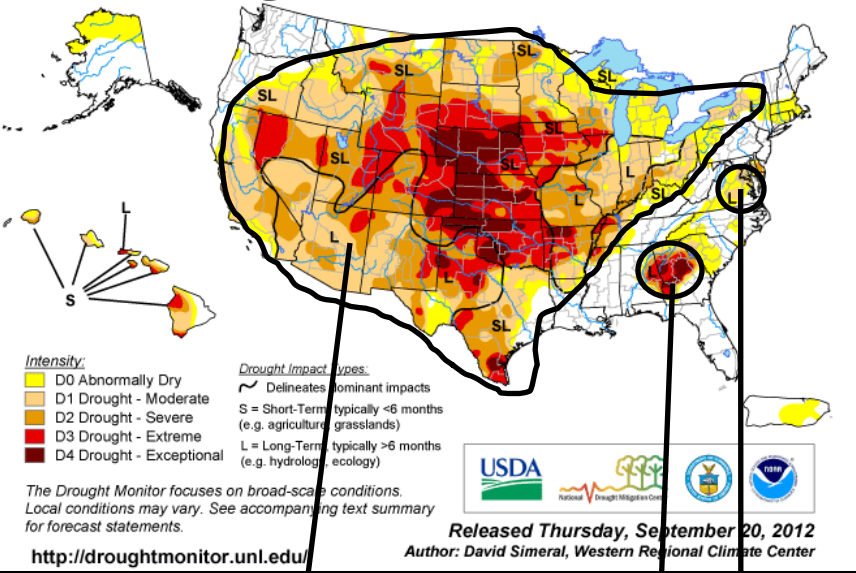
Short-Term Forecasts: (less than 1-Month)

Long-Range Forecasts: (1- to 3-Months)

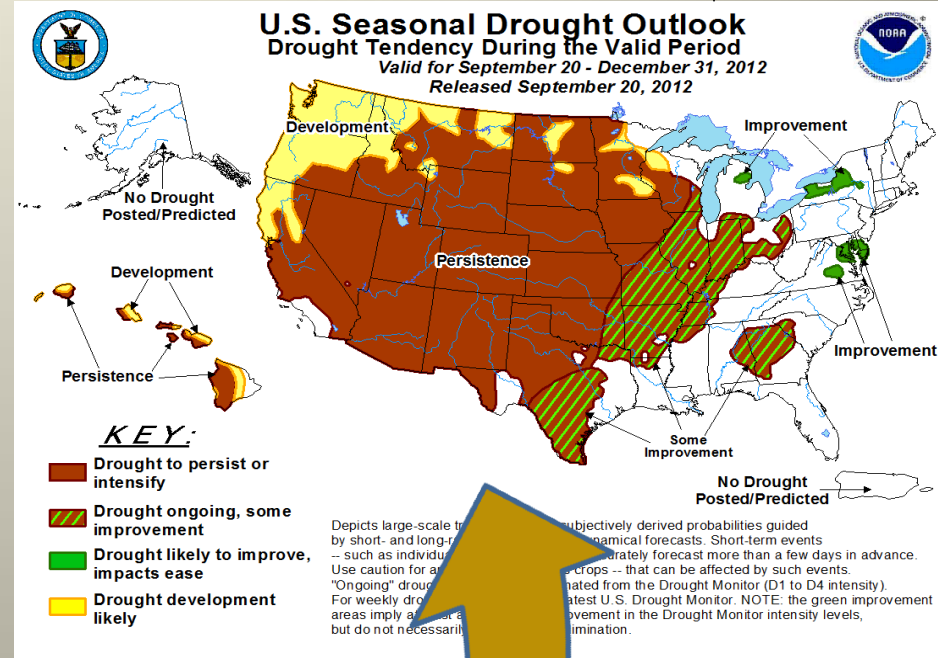
Climatology/ Analogs (N-Months)

(Note ENSO Status & Other Atmospheric/Oceanic Indicators)

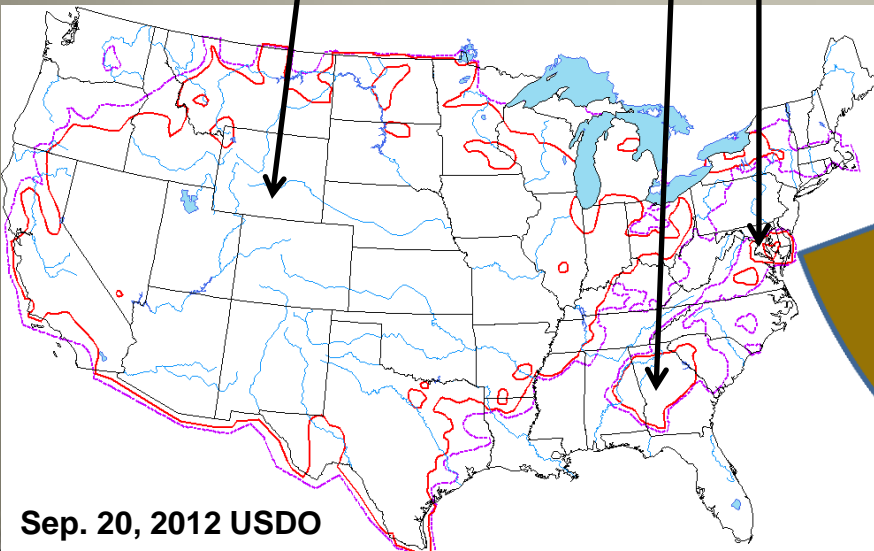
← Start with Sep. 18 US Drought Monitor



Initial OND'12
U.S. Drought Outlook
(released Sep. 20)



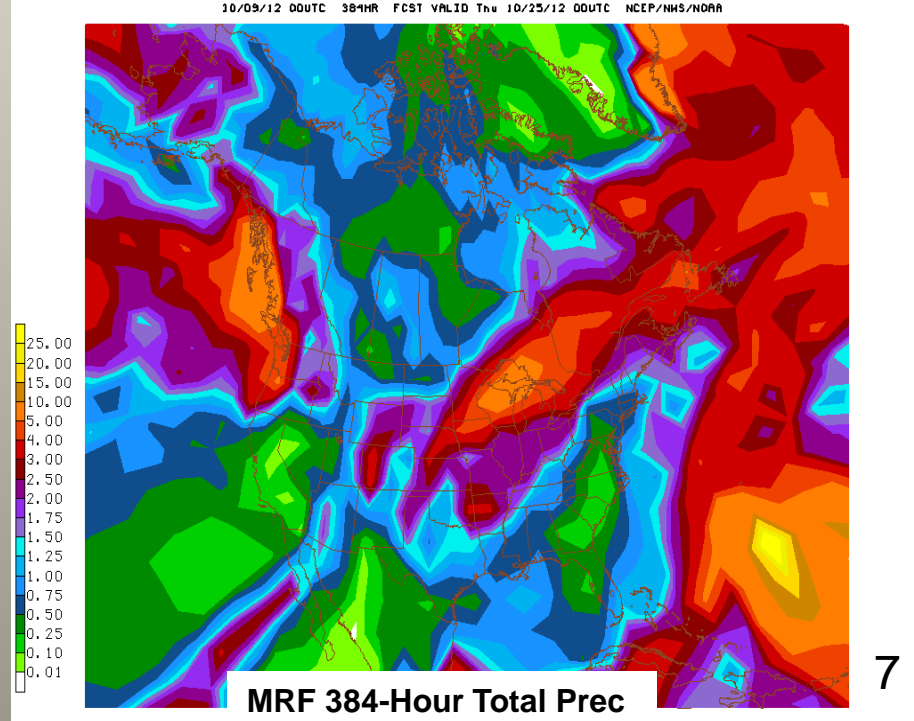
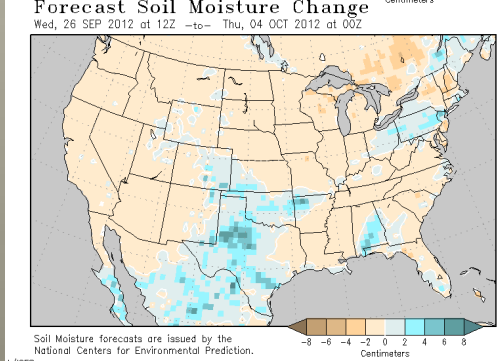
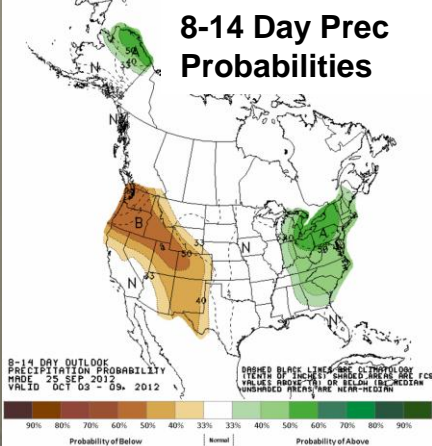
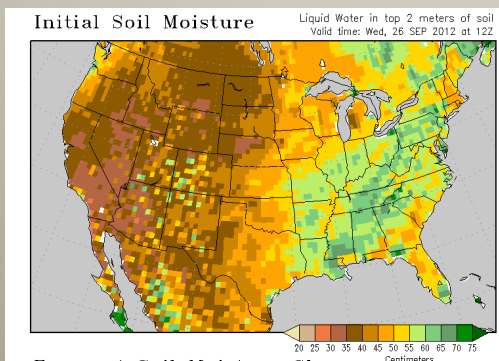
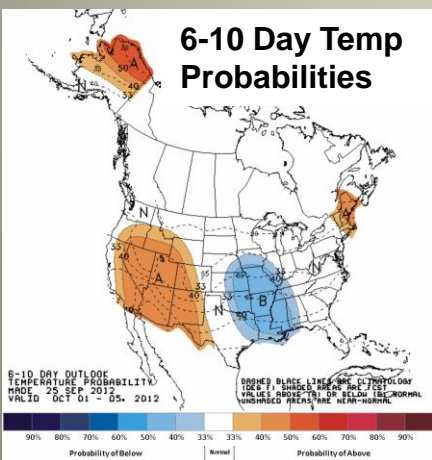
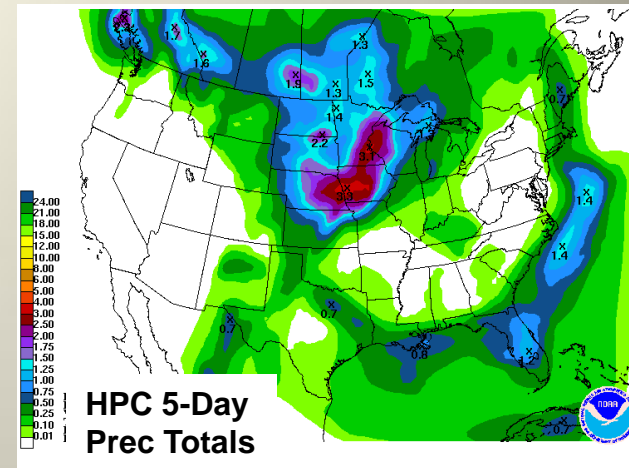
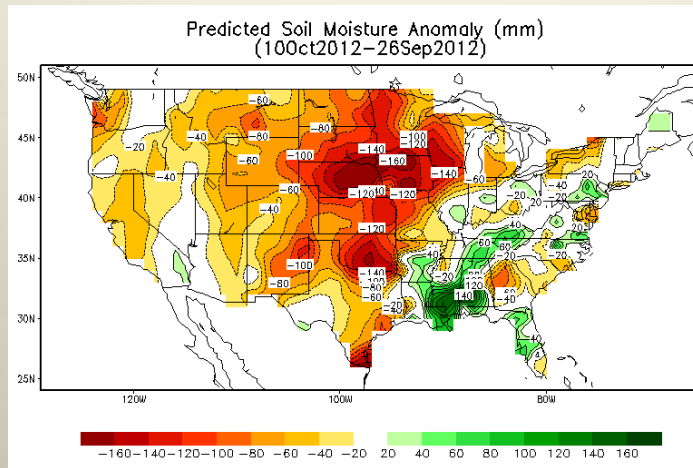
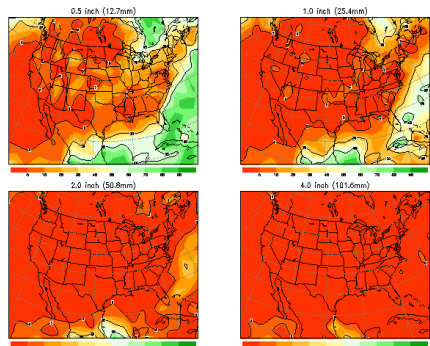
Use the latest U.S. Drought Monitor
D0 & D1 shape file areas



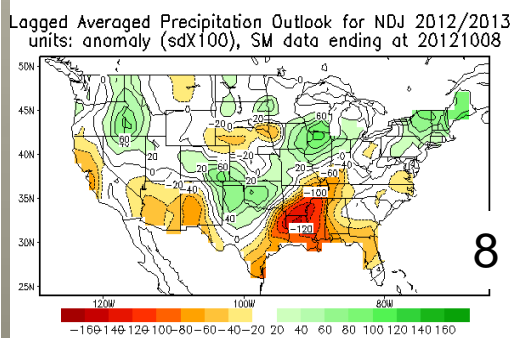
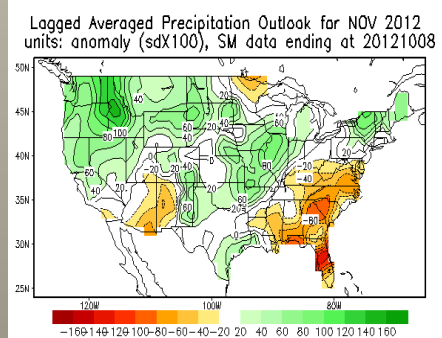
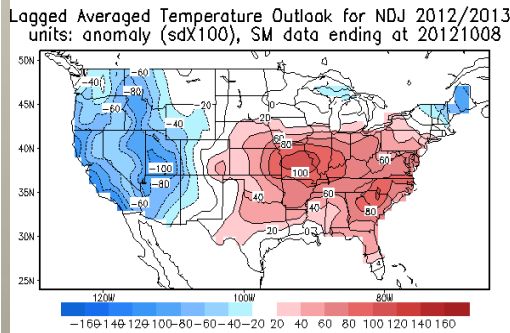
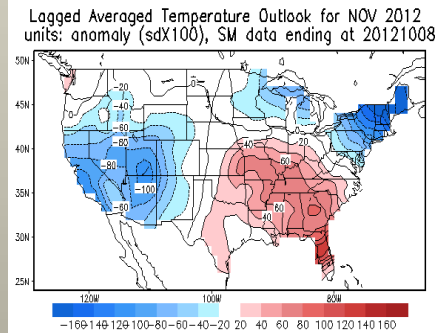
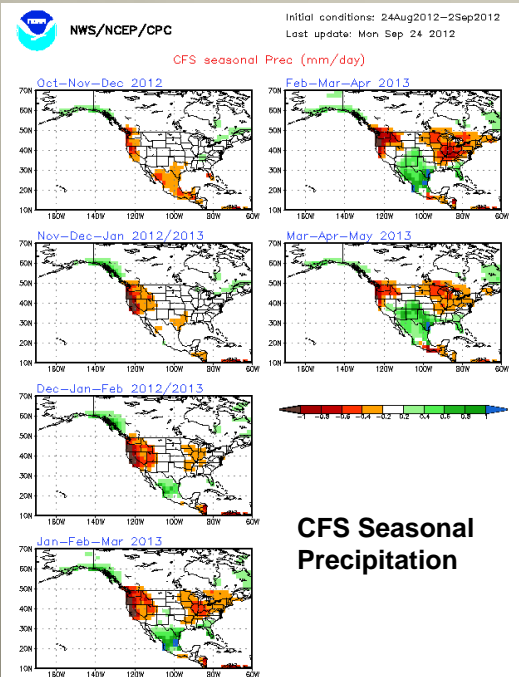
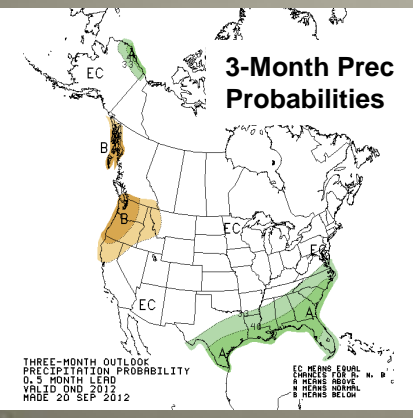
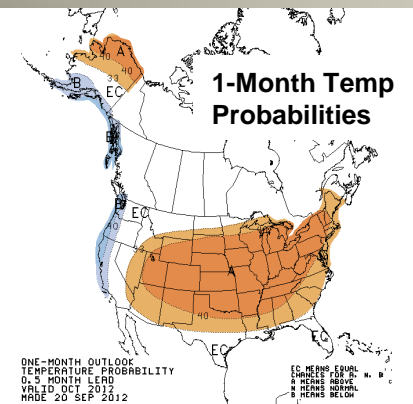
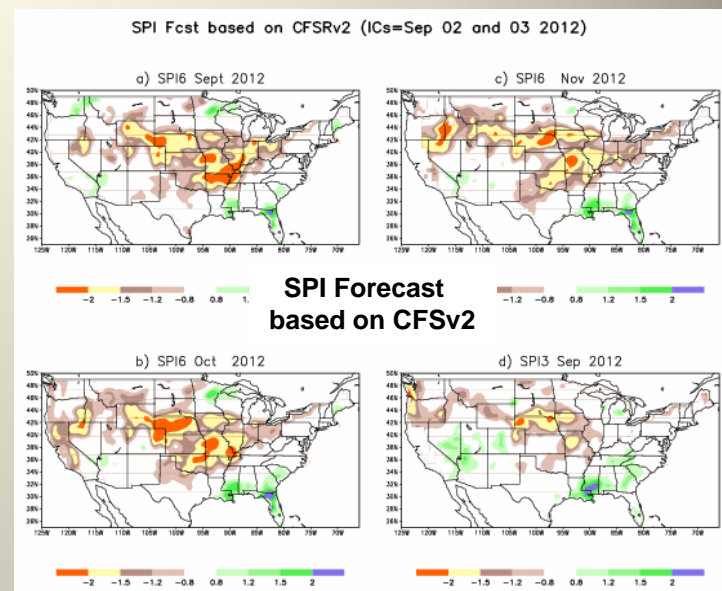
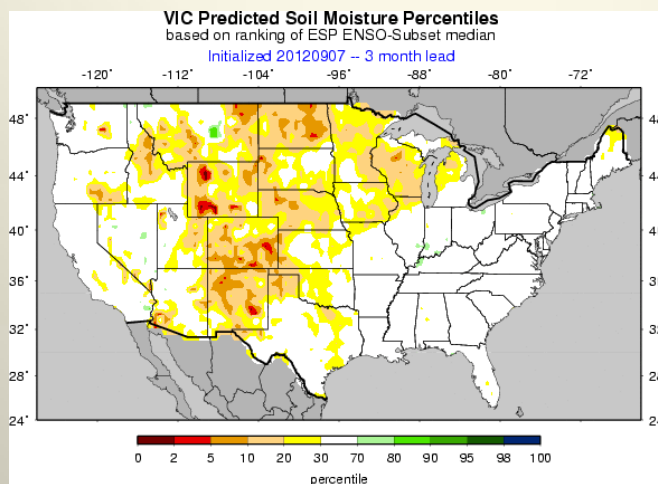
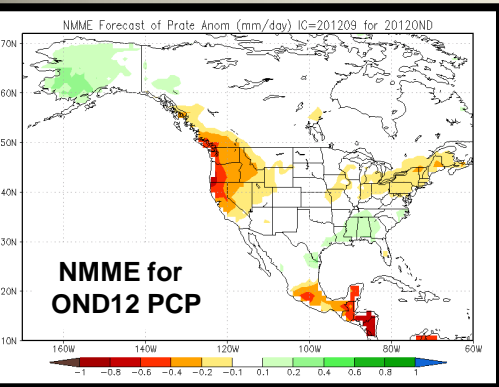
Determine if D1 areas will: *Persist*,
Improve, or show *Some Improvement*;
and if D0 areas will *Develop*

Primary Drought Outlook Inputs – Short Term

Ini time:2012091600 Valid Forecast Period:180 – 348 hours
Ensemble based probability of precip. amount exceeding

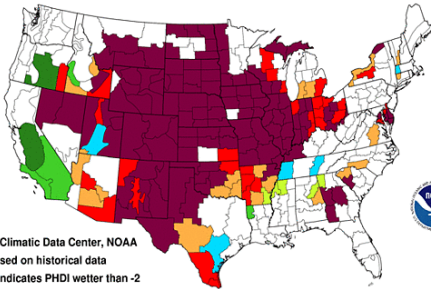


Primary Drought Outlook Inputs – Long Term

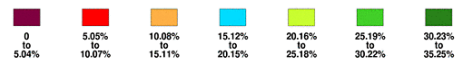


Primary Drought Outlook Inputs – Climos & Analogs

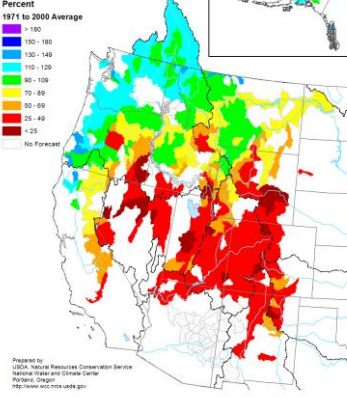
Probability of Precipitation Required to End Current Drought Conditions in Four Months August 2012



National Climatic Data Center, NOAA
Based on historical data
White indicates PHDI wetter than -2

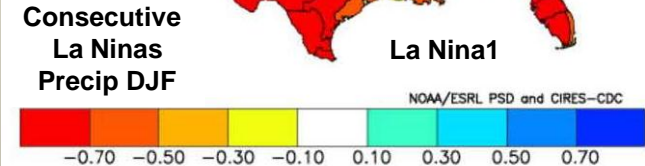
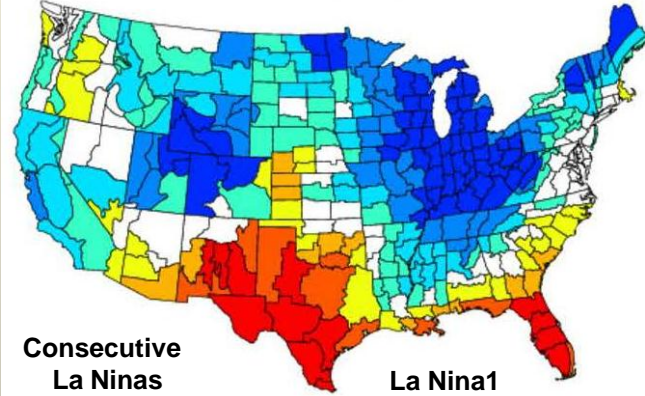


Spring and Summer Streamflow Forecasts as of May 1, 2012

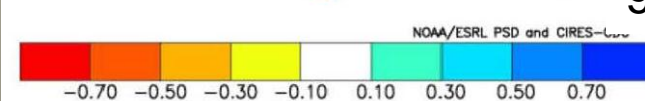
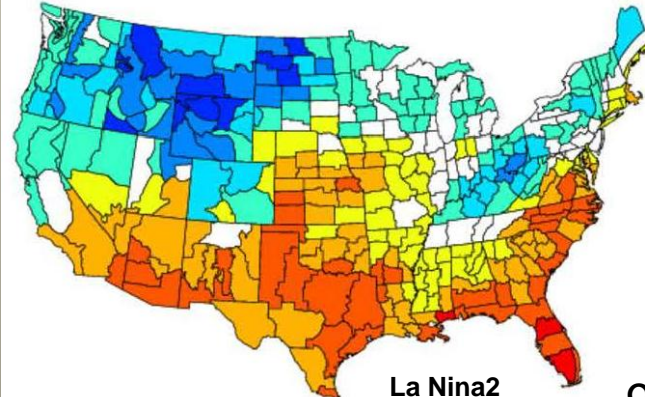


Prepared by
Cedric G. Hill, Water Resources Conservation Service
National Water and Climate Center
Portland, Oregon
http://www.wcc.nrcs.usda.gov

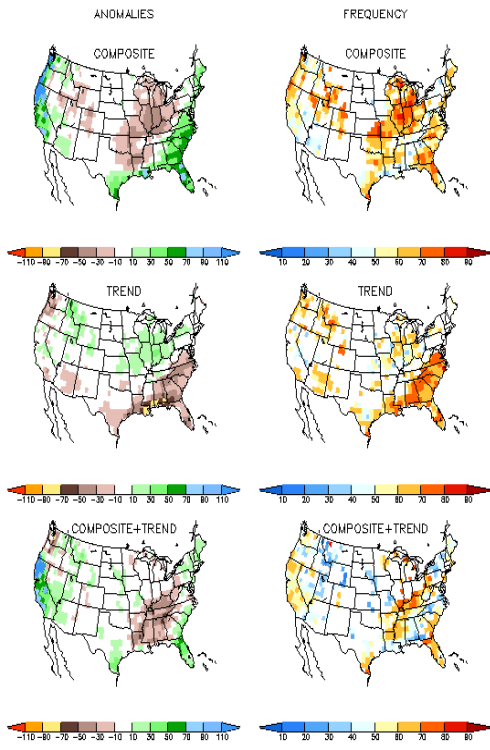
Composite Standardized Precipitation Anomalies Versus 1950-1995 Longterm Average
Dec to Feb 1908-09, 1916-17, 1921-22, 1949-50, 1954-55, 1961-62, 1970-71, 1973-74, 1998-99, 2007-08,



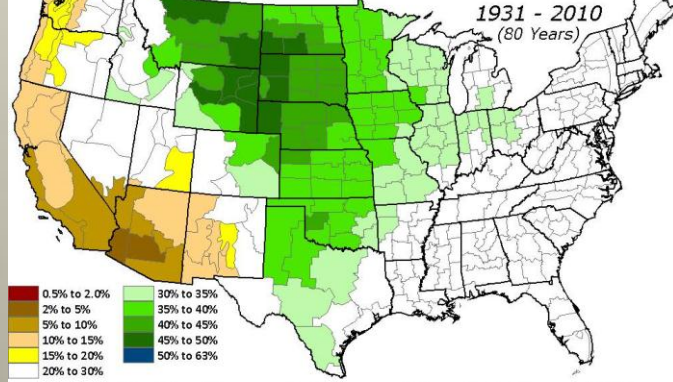
Composite Standardized Precipitation Anomalies Versus 1950-1995 Longterm Average
Dec to Feb 1909-10, 1917-18, 1922-23, 1950-51, 1955-56, 1962-63, 1971-72, 1974-75, 1999-00, 2008-09,



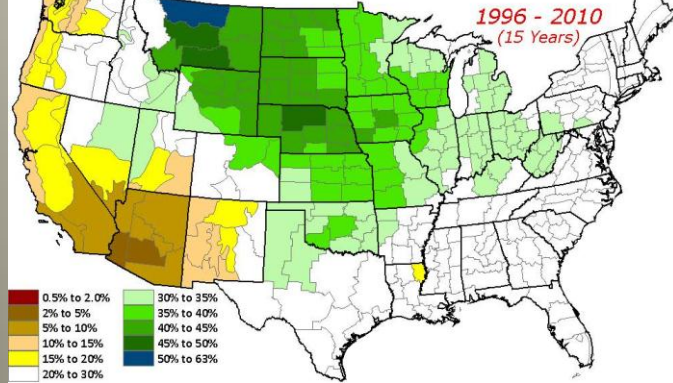
JFM EL NINO PRECIPITATION ANOMALIES (MM) AND FREQUENCY OF OCCURRENCE (%)



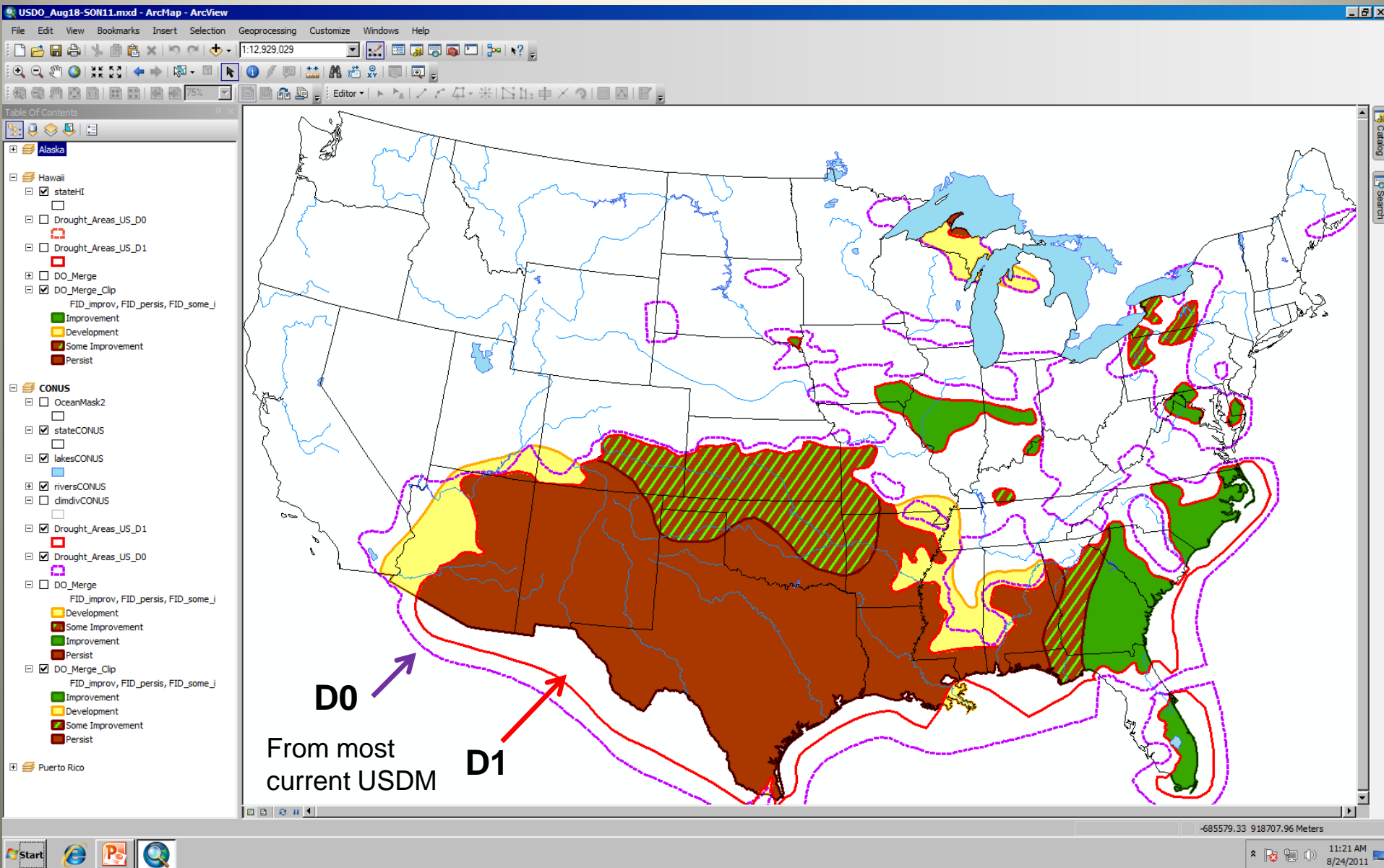
Median Percent of Annual Precipitation -- AMJ



Median Percent of Annual Precipitation -- AMJ



Using ArcMap (GIS) to create the US Drought Outlooks



ArcGIS/ArcMap10, the Latest & Greatest Drought Tool

usdm-110705.mxd - ArcMap - ArcView

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

1:2,515,464

Table Of Contents

- Puerto Rico
 - Drought_Impacts_Type
 - Drought_Impacts_Callou
 - cntryPR
 - maskPR
 - Drought_Areas_US_D0
- Alaska
 - Drought_Impacts_Type
 - riversAK
 - counties
 - stateAK
 - maskAK
 - Drought_Areas_US_D0
- Hawaii**
 - Drought_Impacts_Type
 - Drought_Impacts_Callou
 - ndmc_conus_cnties
 - stateHI
 - maskHI
 - Drought_Impacts_US
 - Drought_Areas_US_D4
 - Drought_Areas_US_D3
 - Drought_Areas_US_D2
 - Drought_Areas_US_D1
 - Drought_Areas_US_D0
- CONUS
 - Drought_Impacts_Type
 - Drought_Impacts_Callou
 - lakesCONUS
 - stateCONUS
 - riversCONUS
 - maskCONUS
 - Drought_Impacts_US
 - climdivCONUS
 - counties
 - ndmc_conus_cnties

We plan on making the USDO similar to our USDM GIS set-up on our server. So what follows is USDM GIS examples -

A AH

... although we expect the USDO will be like this soon ...

-160.86 19.39 Decimal Degrees

USDM_DATA_PULL

Computer > DM (\\cpc-s-gis) (R:) > Scripts > USDM_DATA_PULL

Name	Date modified	Type	Size
VegData.bat	12/20/2011 1:11 PM	Windows Batch File	3 KB
USGS_StreamFlow.bat	12/19/2011 4:39 PM	Windows Batch File	2 KB
SPI.bat	12/19/2011 5:10 PM	Windows Batch File	3 KB
PriorDays.bat	10/18/2011 2:58 PM	Windows Batch File	2 KB
NRCS.bat	12/13/2011 1:16 PM	Windows Batch File	3 KB
NLDAS.bat	9/16/2011 1:49 PM	Windows Batch File	2 KB
GRACEData.bat	10/14/2011 2:10 PM	Windows Batch File	1 KB
Get_USDM_Data.bat	12/20/2011 10:58 AM	Windows Batch File	5 KB
Get_OldShapes.bat	12/12/2011 12:01 PM	Windows Batch File	4 KB
CPC.bat	10/11/2011 1:45 PM	Windows Batch File	9 KB
AHPS.bat	12/21/2011 10:47 AM	Windows Batch File	15 KB
VegDataLog.txt	12/21/2011 10:54 AM	Text Document	25 KB
USGSStrmflowlog.txt	12/21/2011 10:43 AM	Text Document	10 KB
USDM_GetDataLog.txt	12/21/2011 11:00 AM	Text Document	1 KB
SPIlog.txt	12/21/2011 10:43 AM	Text Document	6 KB
SPIBlendLog.txt	12/21/2011 11:00 AM	Text Document	2 KB
OldShapelog.txt	12/22/2011 9:00 AM	Text Document	13 KB
NRCSlog.txt	12/21/2011 10:43 AM	Text Document	9 KB
NLDASlog.txt	12/21/2011 10:53 AM	Text Document	14 KB
NASA_GracePreProcessLog.txt	12/20/2011 12:19 PM	Text Document	3 KB
GRACEDataLog.txt	12/20/2011 12:09 PM	Text Document	3 KB
CpcPreProcessLog.txt	12/21/2011 10:59 AM	Text Document	1 KB
CPCDataLog.txt	12/21/2011 10:53 AM	Text Document	19 KB
AHPSlog.txt	12/21/2011 10:53 AM	Text Document	345 KB
AHPS_PreProcessLog.txt	12/21/2011 10:59 AM	Text Document	9 KB
USDM-GIS.docx	12/8/2010 4:55 PM	Microsoft Word Document	15 KB

Get_USDM_Data.bat Date modified: 12/20/2011 10:58 AM Date created: 3/9/2011 2:30 PM Offline status: Online
Windows Batch File Size: 4.46 KB Offline availability: Not available

```

Get_USDM_Data.bat - Notepad
File Edit Format View Help
set LOG="R:\Scripts\USDM_DATA_PULL\USDM_GetDataLog.txt"
echo Starting USDM data grab at %date% %time% > %LOG%

:-----
: These variables cascade to the windows batch jobs further down.
: Do not remove these lines.
:-----
set WGetPath="R:\utilities\wget\bin\wget.exe"
set SevenZipPath="R:\utilities\sevenzip\7-Zip\7z.exe"
set LocalDataDir=R:\Scripts\USDM_DATA_PULL
set PreProcessDir=R:\Scripts\USDM_PreProcess

:-----
: Data Pull/unzip section
:-----
:-----
: SPI - pulls most recent data - Input data dated 3 days ago if the current time is before 11, 2 days if
: SPI - QC and production of SPI takes 1 full day, and SPI isnt updated till 11am local.
:-----
START /WAIT /MIN R:\Scripts\USDM_DATA_PULL\SPI.bat

:-----
: Streamflows - No date dependence
:-----
START /WAIT /MIN R:\Scripts\USDM_DATA_PULL\USGS_StreamFlow.bat

:-----
: NRCS - No date dependence
:-----
START /WAIT /MIN R:\Scripts\USDM_DATA_PULL\NRCS.bat

:-----
: AHPS - Pulls in the latest available. Input files dated yesterday if before 12, dated today if after
: AHPS - If Wednesday, and after 12, will exit, as USDM only wants data through 12z Tuesday.
:-----
START /WAIT /MIN R:\Scripts\USDM_DATA_PULL\AHPS.bat

:-----
: NLDAS - No date dependence
:-----
START /WAIT /MIN R:\Scripts\USDM_DATA_PULL\NLDAS.bat

:-----
: CPC - Pulls in data from 2 days ago.
:-----
START /WAIT /MIN R:\Scripts\USDM_DATA_PULL\CPC.bat

:-----
: Vegetation - Pulls in vegDRI and Vegetation Health Index.
:-----
START /WAIT /MIN R:\Scripts\USDM_DATA_PULL\VegData.bat

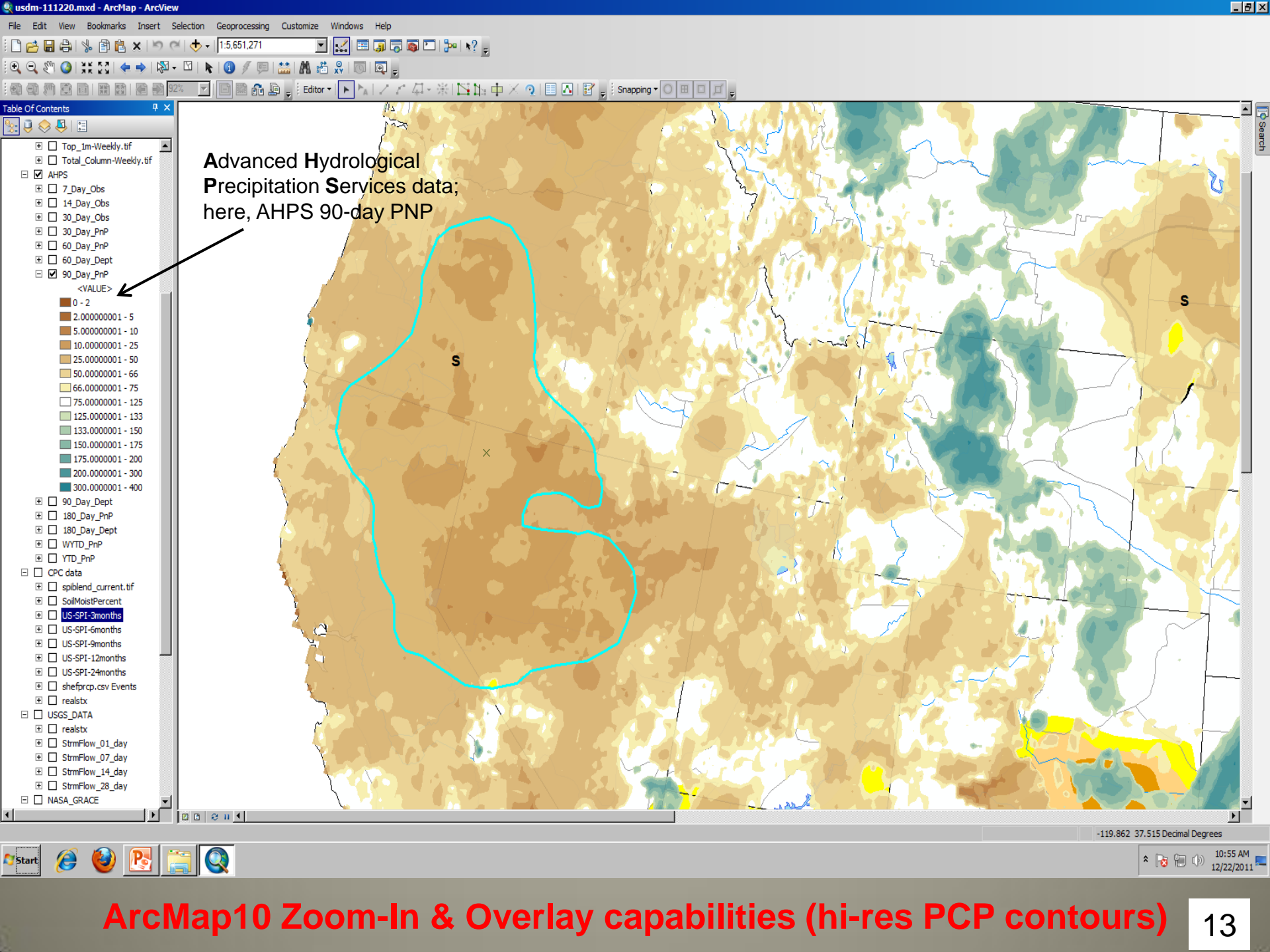
:-----
: GRACE Enhanced LDAS - If Tuesday, pulls in GRACE data. LDAS is run on Monday.
if %date:~0,3%==Tue START /WAIT /MIN R:\Scripts\USDM_DATA_PULL\GRACEData.bat

:-----
: AHPS Processing section
START /WAIT /MIN "C:\Python26\ArcGIS10.0\python.exe" %PreProcessDir%\PreProcessAHPS.py
:Next line is to clean up files once the python script releases them.
rd %USERPROFILE%\Temp\AHPSProcess /S /Q >> %LOG%

:-----
: CPC Precipitation Processing

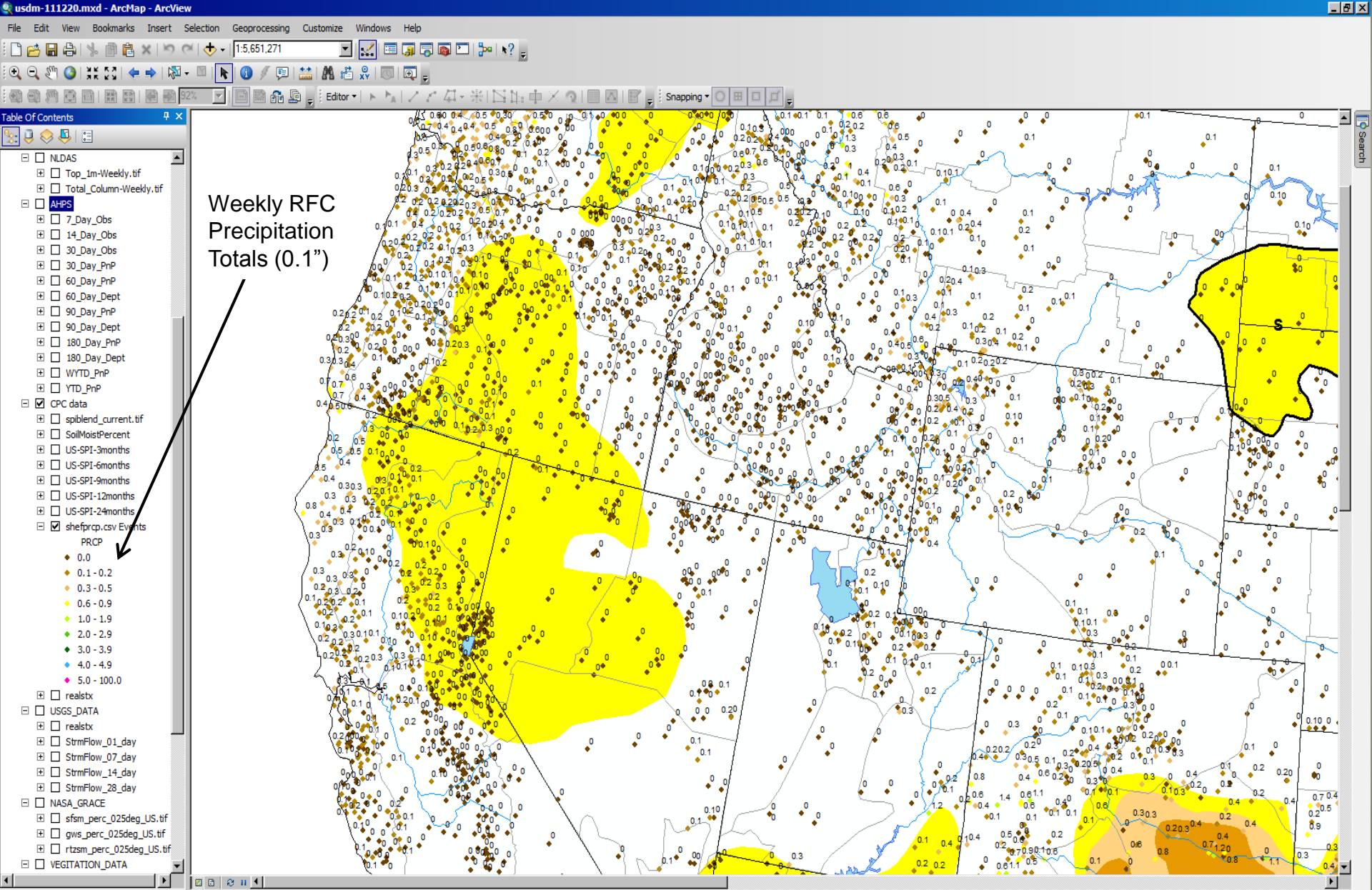
```

Scripts for Getting, Saving, & Processing data and products

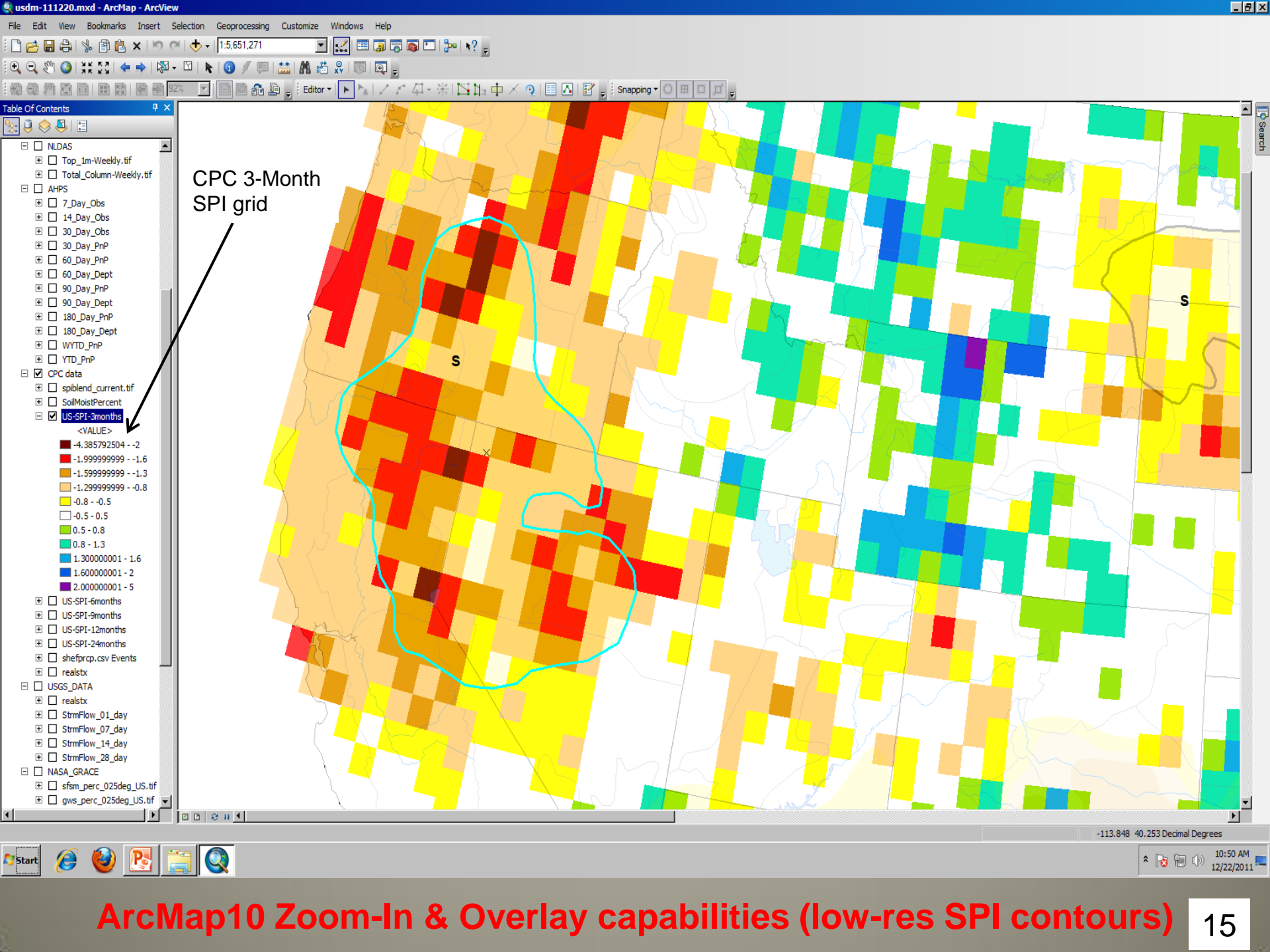


Advanced Hydrological
Precipitation Services data;
here, AHPS 90-day PnP

- Top_1m-Weekly.tif
- Total_Column-Weekly.tif
- AHPS
 - 7_Day_Obs
 - 14_Day_Obs
 - 30_Day_Obs
 - 30_Day_PnP
 - 60_Day_PnP
 - 60_Day_Dept
 - 90_Day_PnP
- <VALUE>
 - 0 - 2
 - 2.000000001 - 5
 - 5.000000001 - 10
 - 10.000000001 - 25
 - 25.000000001 - 50
 - 50.000000001 - 66
 - 66.000000001 - 75
 - 75.000000001 - 123
 - 125.000000001 - 133
 - 133.000000001 - 150
 - 150.000000001 - 175
 - 175.000000001 - 200
 - 200.000000001 - 300
 - 300.000000001 - 400
- 90_Day_Dept
- 180_Day_PnP
- 180_Day_Dept
- WYTD_PnP
- YTD_PnP
- CPC data
 - spblend_current.tif
 - SoilMoistPercent
 - US-SPI-3months
 - US-SPI-6months
 - US-SPI-9months
 - US-SPI-12months
 - US-SPI-24months
- shefprcp.csv Events
- realstx
- USGS_DATA
 - realstx
 - StrmFlow_01_day
 - StrmFlow_07_day
 - StrmFlow_14_day
 - StrmFlow_28_day
- NASA_GRACE



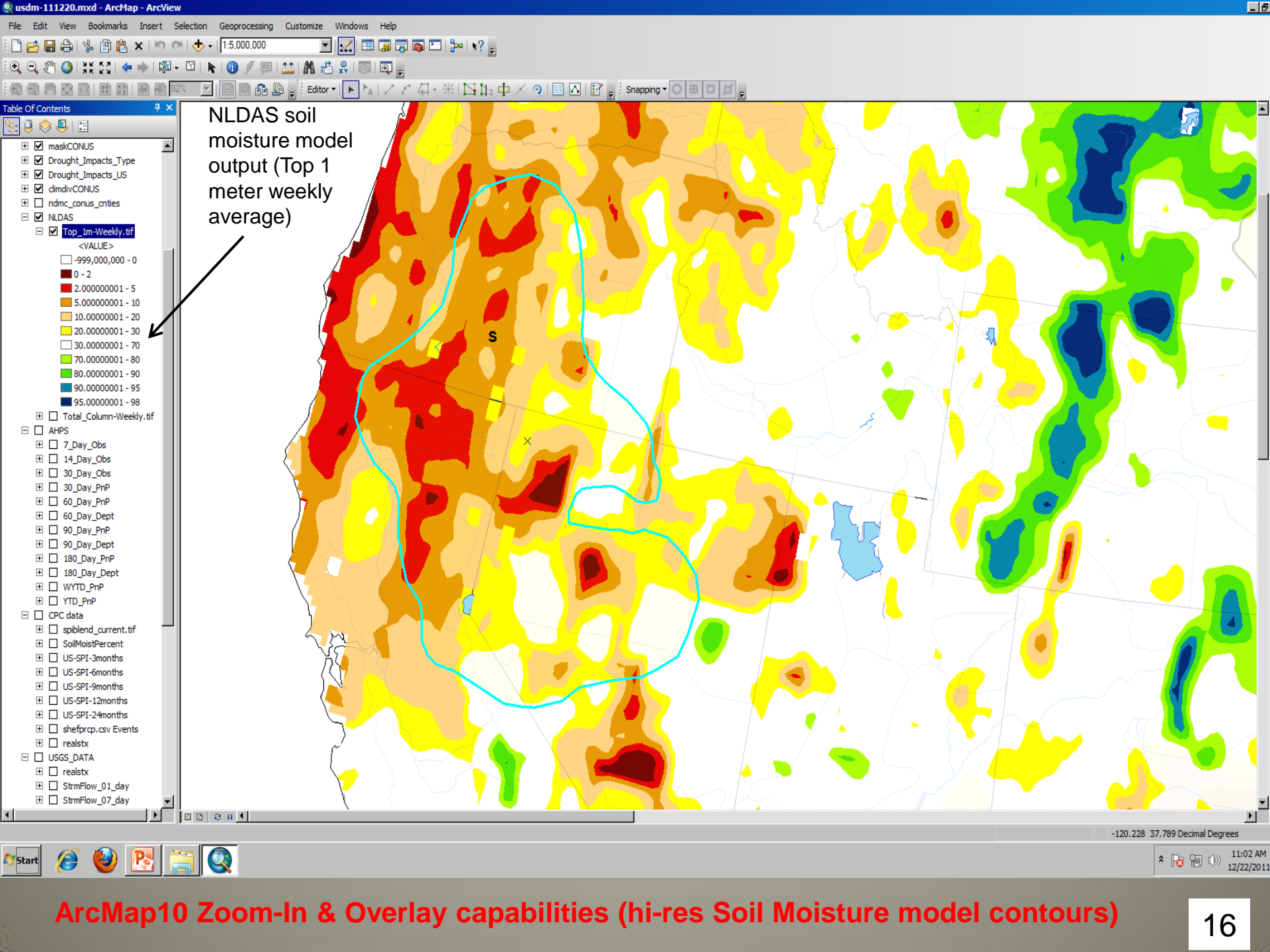
ArcMap10 Zoom-In & Overlay capabilities (station PCP data)



CPC 3-Month
SPI grid

- Table Of Contents
- [-] NLDAS
 - Top_1m-Weekly.tif
 - Total_Column-Weekly.tif
- [-] APFS
 - 7_Day_Obs
 - 14_Day_Obs
 - 30_Day_PnP
 - 60_Day_PnP
 - 60_Day_Dept
 - 90_Day_PnP
 - 90_Day_Dept
 - 180_Day_PnP
 - 180_Day_Dept
 - WYTD_PnP
 - YTD_PnP
- CPC data
 - spiblend_current.tif
 - SoilMoistPercent
 - US-SPI-3months
 - <VALUE>
 - 4.385792504 - -2
 - 1.999999999 - -1.6
 - 1.599999999 - -1.3
 - 1.299999999 - -0.8
 - 0.8 - -0.5
 - 0.5 - 0.5
 - 0.5 - 0.8
 - 0.8 - 1.3
 - 1.300000001 - 1.6
 - 1.600000001 - 2
 - 2.000000001 - 5
 - US-SPI-6months
 - US-SPI-9months
 - US-SPI-12months
 - US-SPI-24months
 - shefprcp.csv Events
 - realstx
- [-] USGS_DATA
 - realstx
 - StrmFlow_01_day
 - StrmFlow_07_day
 - StrmFlow_14_day
 - StrmFlow_28_day
- [-] NASA_GRACE
 - sfsm_perc_025deg_US.tif
 - gws_perc_025deg_US.tif

ArcMap10 Zoom-In & Overlay capabilities (low-res SPI contours)



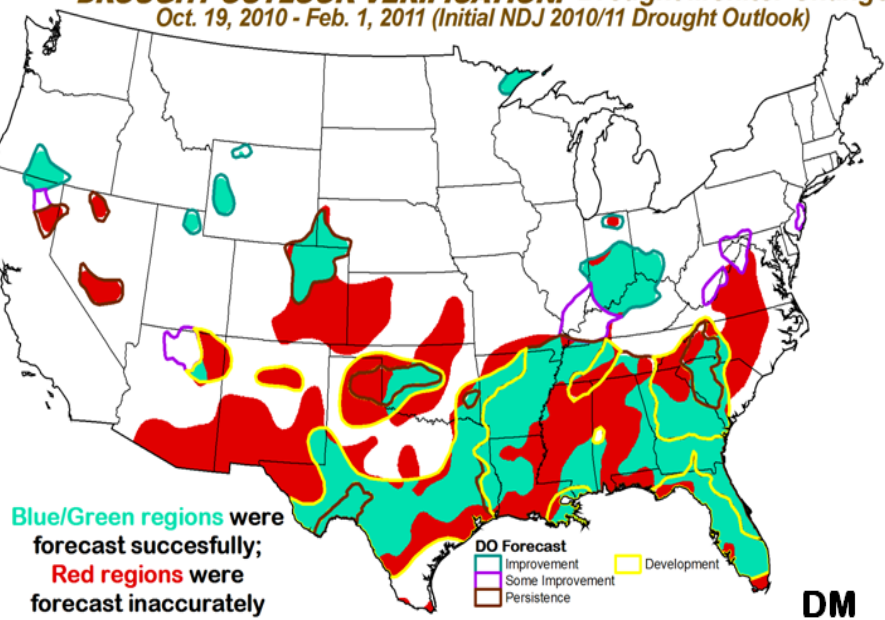
NLDAS soil moisture model output (Top 1 meter weekly average)

- masiCONUS
- Drought_Impacts_Type
- Drought_Impacts_US
- dimdivCONUS
- ndmc_conus_cnties
- NLDAS
 - Top_1m-Weekly.tif
 - <VALUE>
 - 999,000,000 - 0
 - 0 - 2
 - 2.000000001 - 5
 - 5.000000001 - 10
 - 10.000000001 - 20
 - 20.000000001 - 30
 - 30.000000001 - 40
 - 40.000000001 - 50
 - 50.000000001 - 60
 - 60.000000001 - 70
 - 70.000000001 - 80
 - 80.000000001 - 90
 - 90.000000001 - 95
 - 95.000000001 - 98
- Total_Column-Weekly.tif
- AHPS
 - 7_Day_Obs
 - 14_Day_Obs
 - 30_Day_Obs
 - 30_Day_PnP
 - 60_Day_PnP
 - 60_Day_Dept
 - 90_Day_PnP
 - 90_Day_Dept
 - 180_Day_PnP
 - 180_Day_Dept
 - WYTD_PnP
 - YTD_PnP
- CPC data
 - spblend_current.tif
 - SoilMoistPercent
 - US-SPI-3months
 - US-SPI-6months
 - US-SPI-9months
 - US-SPI-12months
 - US-SPI-24months
- shefprcp.csv Events
- realstx
- USGS_DATA
 - realstx
 - StrmFlow_01_day
 - StrmFlow_07_day

How Are We Doing?



DROUGHT OUTLOOK VERIFICATION: Drought Monitor Change
 Oct. 19, 2010 - Feb. 1, 2011 (Initial NDJ 2010/11 Drought Outlook)



Blue/Green regions were forecast successfully; Red regions were forecast inaccurately

DO Forecast
 Improvement
 Some Improvement
 Persistence

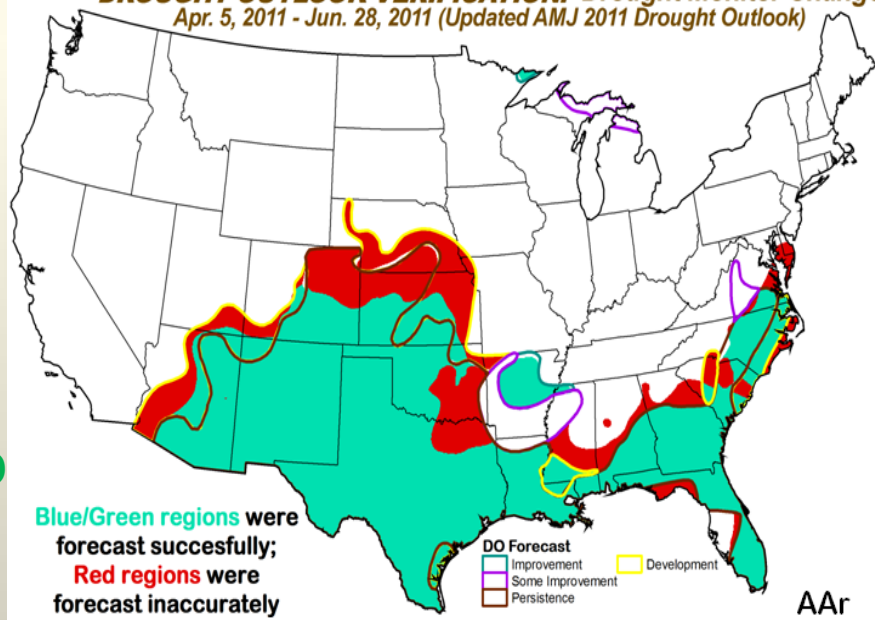
Development

DM

4-KM GRID

FORECAST	HIT	MISS
Improvement	8,759	437
Persistence	33,049	20,537
Development	30,686	58,999
TOTAL	73,494	79,973
SCORE	47.9%	
PERSISTENCE FORECAST BASELINE	35,039	108,616
PERSISTENCE FORECAST SCORE	24.4%	
"SKILL" (forecast score) minus (persistence score)	+23.5	

DROUGHT OUTLOOK VERIFICATION: Drought Monitor Change
 Apr. 5, 2011 - Jun. 28, 2011 (Updated AMJ 2011 Drought Outlook)



Blue/Green regions were forecast successfully; Red regions were forecast inaccurately

DO Forecast
 Improvement
 Some Improvement
 Persistence

Development

AAr

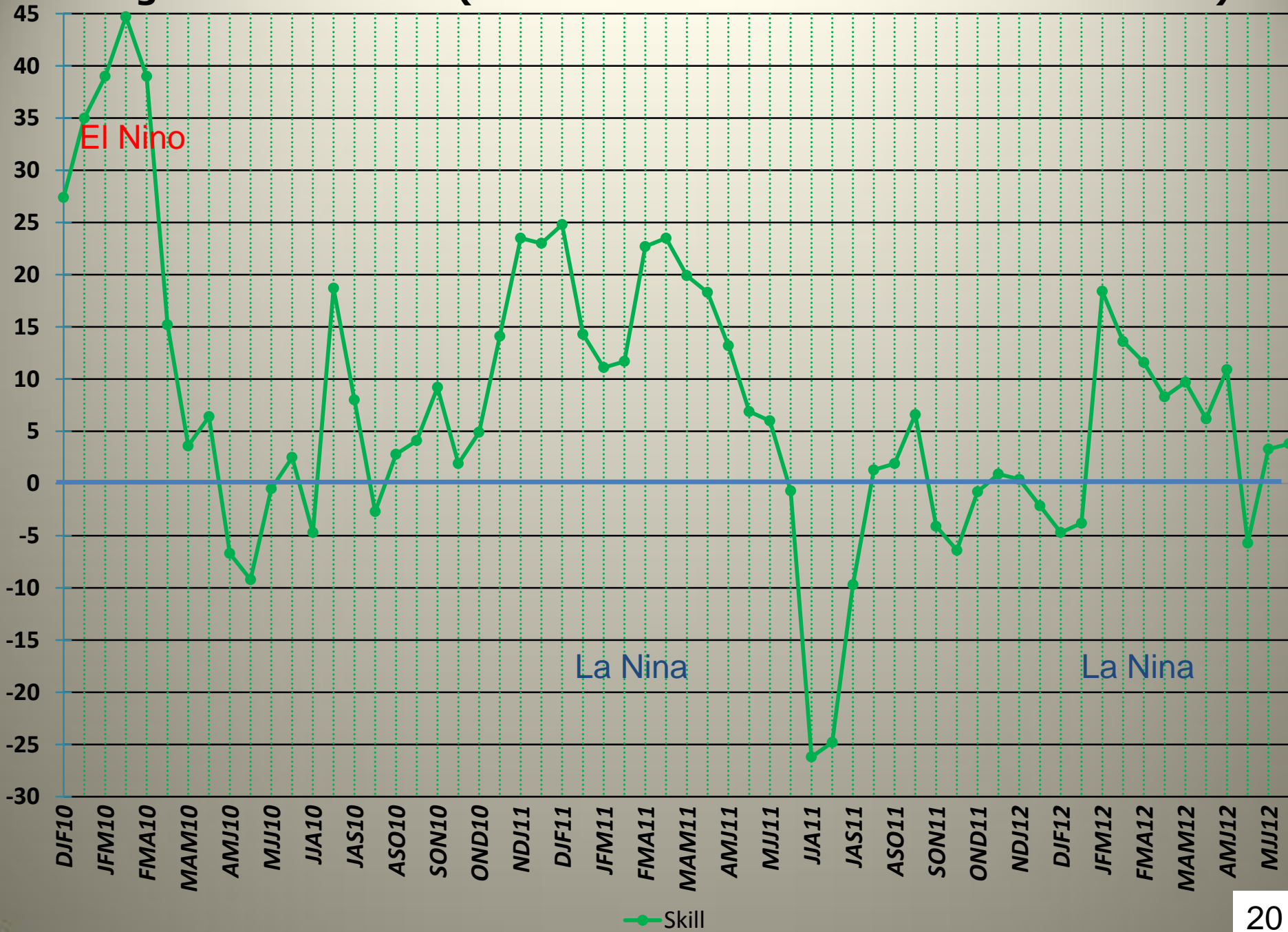
FORECAST	HIT	MISS
Improvement	3,413	0
Persistence	110,621	14,884
Development	12,146	23,034
TOTAL	126,180	37,918
SCORE	76.9	
PERSISTENCE FORECAST BASELINE	111,810	47,981
PERSISTENCE FORECAST SCORE	70.0	
"SKILL" (forecast score) minus (persistence score)	+6.9	

Not so good Forecasts during Summer & ENSO Neutral

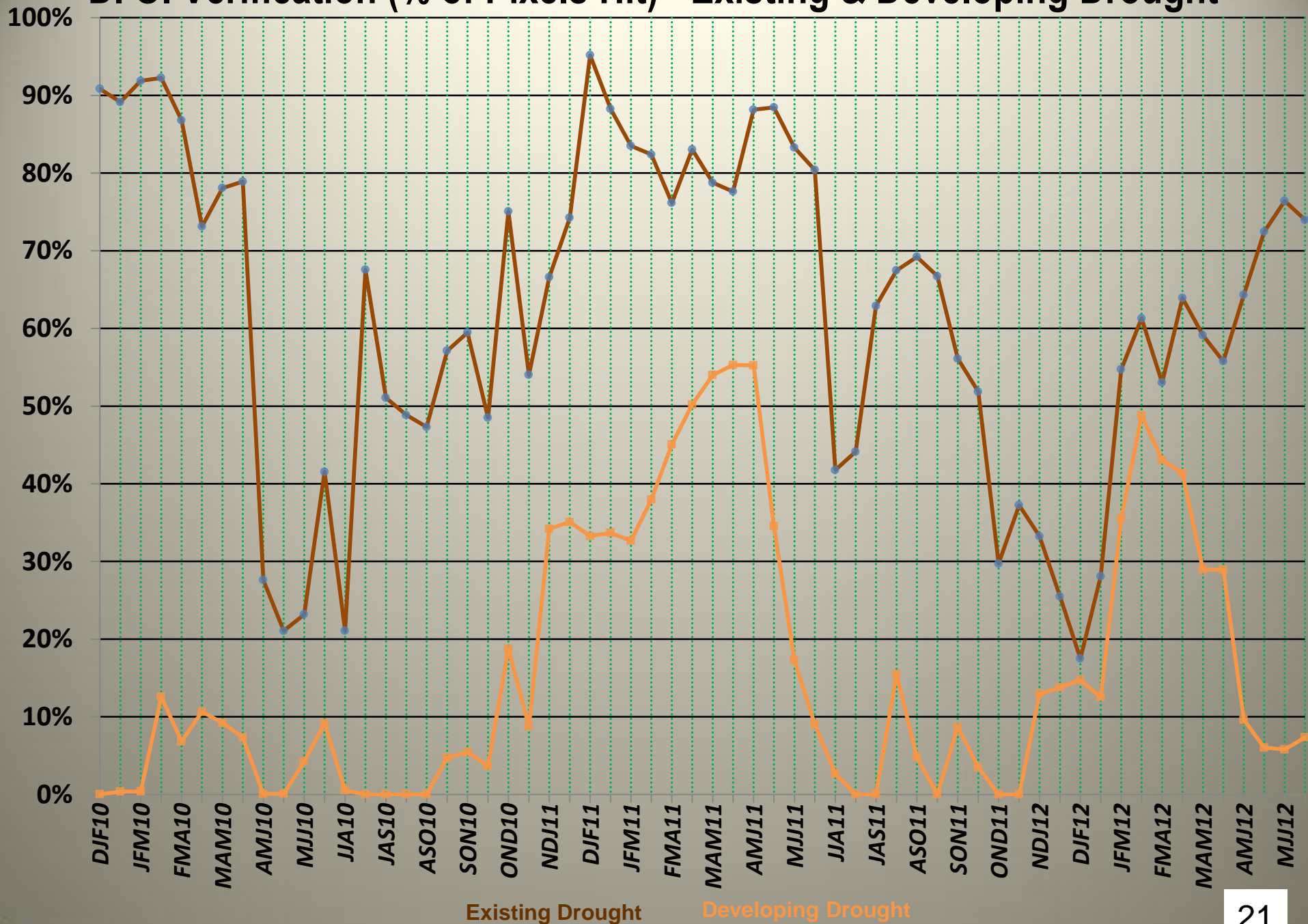
D.O. Verification Scores (% of Pixels Hit)



Drought Outlook Skill (Forecast Score minus Persistence Score)

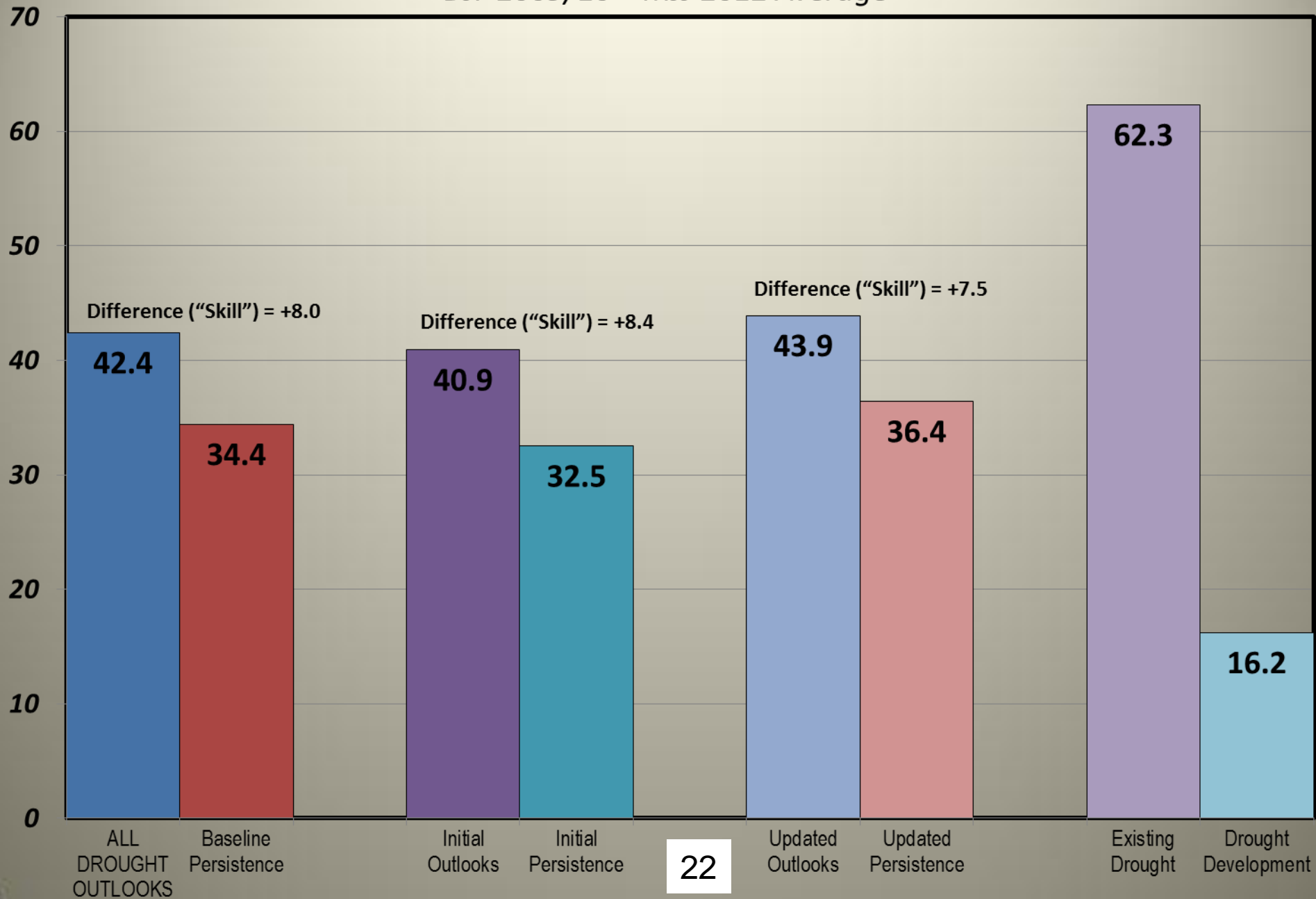


D. O. Verification (% of Pixels Hit) - Existing & Developing Drought



D.O. VERIFICATION: Percent of Area Accurately Forecast

DJF 2009/10 – MJJ 2012 Average



Challenges

- Blending short-term forecasts with seasonal forecasts;
- Improving skill of forecasts (especially **Precipitation**) at all time ranges;
- Providing useful information for both the agricultural and hydrologic community, including down-scaling (regionalization);
- Automation of USDO production and verification;
- Improve skills/tools for developing drought when no ENSO signal (e.g. 2012 Midwest Flash Drought);
- *Ideally: Develop an objective & probabilistic (or categorical) drought outlook;*



Next Steps in Drought Forecasting

Short-Term:

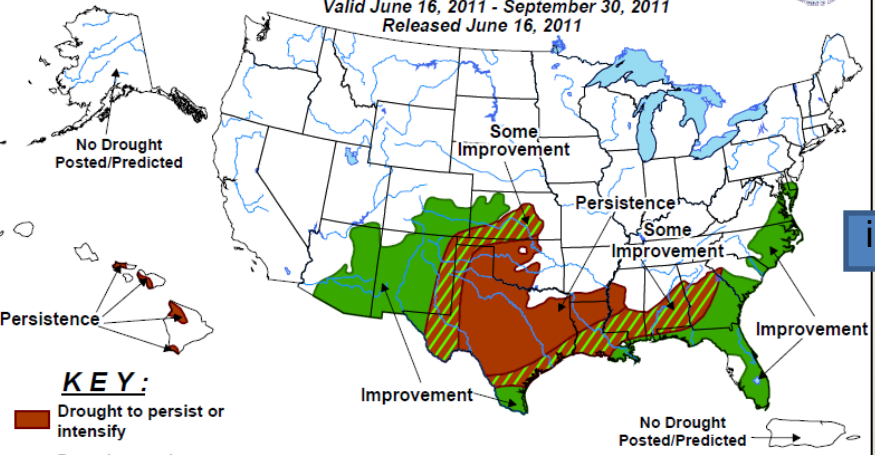
- Modify 3-Month Outlook Categories (Some Improvement → Removal, Improvement, or Persistence);
- Produce a 1-Month Outlook (ag-interests) that replaces Updated 3-Month USDO;
- Additional GIS procedures to better automate & objectify USDO (like USDM);
- Real-Time USDO Verification: Make more objective & automated;
- Create and post Public Documentation (Internet) for the USDO;

Long-Term (see *Challenges*):

- Develop a R2O plan for long-term improvement of USDO:
 - Improvement of Precipitation forecasts in the models is highest priority;
 - Integration of Temperatures, Precipitation, and Soil Moisture Forecasts ;
- Engage the drought community for ideas on improving the USDO:
 - * Comparison of the (subjective) USDO with objective ones, such as objective SPI or one based upon the PDI;
 - * Regionalization of the USDO (collaborate with RCCs, RISAs, etc.);
- Continuation of the current manual forecast, with the objective forecasts used as input and run in parallel;
- Customer preferences between objective versus subjective USDOs;
- Develop a probabilistic and/or categorical objective USDO;

U.S. Seasonal Drought Outlook Drought Tendency During the Valid Period

Valid June 16, 2011 - September 30, 2011
Released June 16, 2011



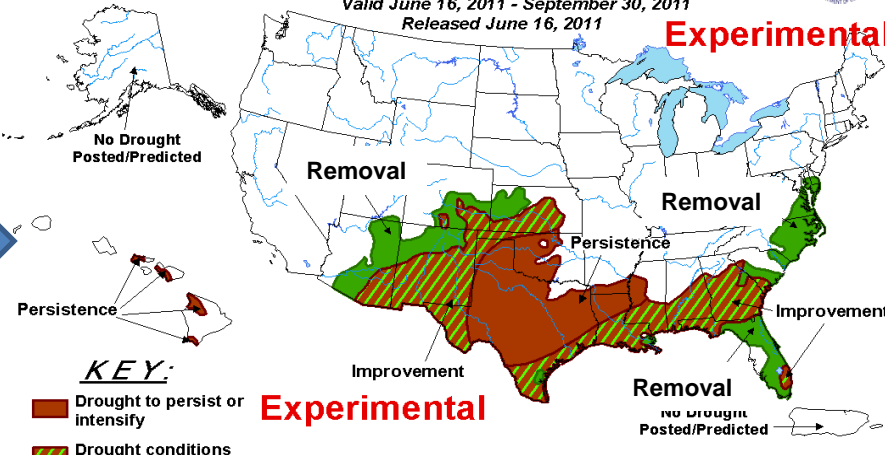
- KEY:**
- Drought to persist or intensify
 - Drought ongoing, some improvement
 - Drought likely to improve, impacts ease
 - Drought development likely

Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Short-term events – such as individual storms – cannot be accurately forecast more than a few days in advance. Use caution for applications – such as crops – that can be affected by such events. "Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4 intensity). For weekly drought updates, see the latest U.S. Drought Monitor. NOTE: the green improvement areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply drought elimination.



U.S. Seasonal Drought Outlook Drought Tendency During the Valid Period

Valid June 16, 2011 - September 30, 2011
Released June 16, 2011



- KEY:**
- Drought to persist or intensify
 - Drought conditions improve, drought ongoing
 - likely to be removed
 - Drought development likely

Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Short-term events – such as individual storms – cannot be accurately forecast more than a few days in advance. Use caution for applications – such as crops – that can be affected by such events. "Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4 intensity). For weekly drought updates, see the latest U.S. Drought Monitor. NOTE: the green improvement areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply drought elimination.

Experimental

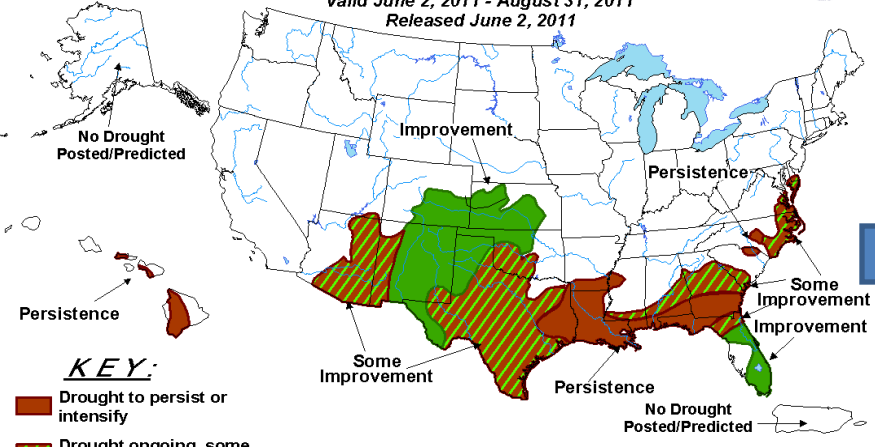
Experimental

Removal
No Drought
Posted/Predicted

Current USDO: Initial 3-Month (Top) & Updated 3-Month (Below)

U.S. Seasonal Drought Outlook Drought Tendency During the Valid Period

Valid June 2, 2011 - August 31, 2011
Released June 2, 2011



- KEY:**
- Drought to persist or intensify
 - Drought ongoing, some improvement
 - Drought likely to improve, impacts ease
 - Drought development likely

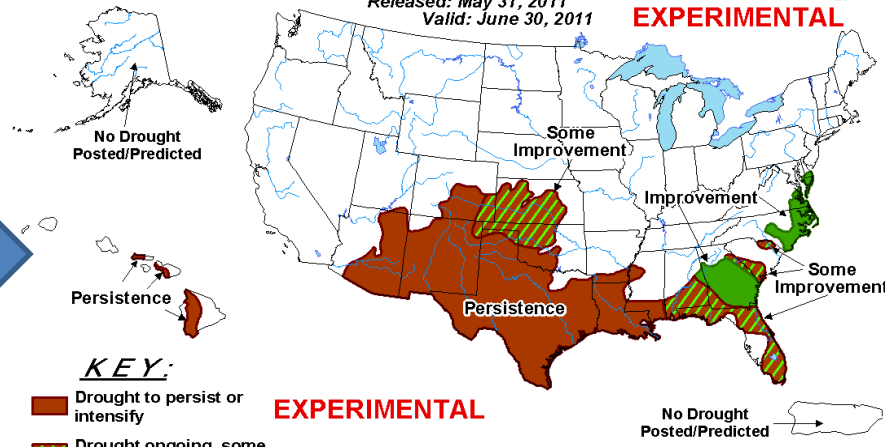
Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Short-term events – such as individual storms – cannot be accurately forecast more than a few days in advance. Use caution for applications – such as crops – that can be affected by such events. "Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4 intensity). For weekly drought updates, see the latest U.S. Drought Monitor. NOTE: the green improvement areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply drought elimination.



Proposed USDO: 3-Month (Top) & 1-Month (Below)

U.S. Monthly Drought Outlook Drought Tendency During the Valid Period

Released: May 31, 2011
Valid: June 30, 2011



- KEY:**
- Drought to persist or intensify
 - Drought ongoing, some improvement
 - Drought likely to improve, impacts ease
 - Drought development likely

Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Short-term events – such as individual storms – cannot be accurately forecast more than a few days in advance. Use caution for applications – such as crops – that can be affected by such events. "Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4 intensity). For weekly drought updates, see the latest U.S. Drought Monitor. NOTE: the green improvement areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply drought elimination.

EXPERIMENTAL

EXPERIMENTAL

Removal
No Drought
Posted/Predicted



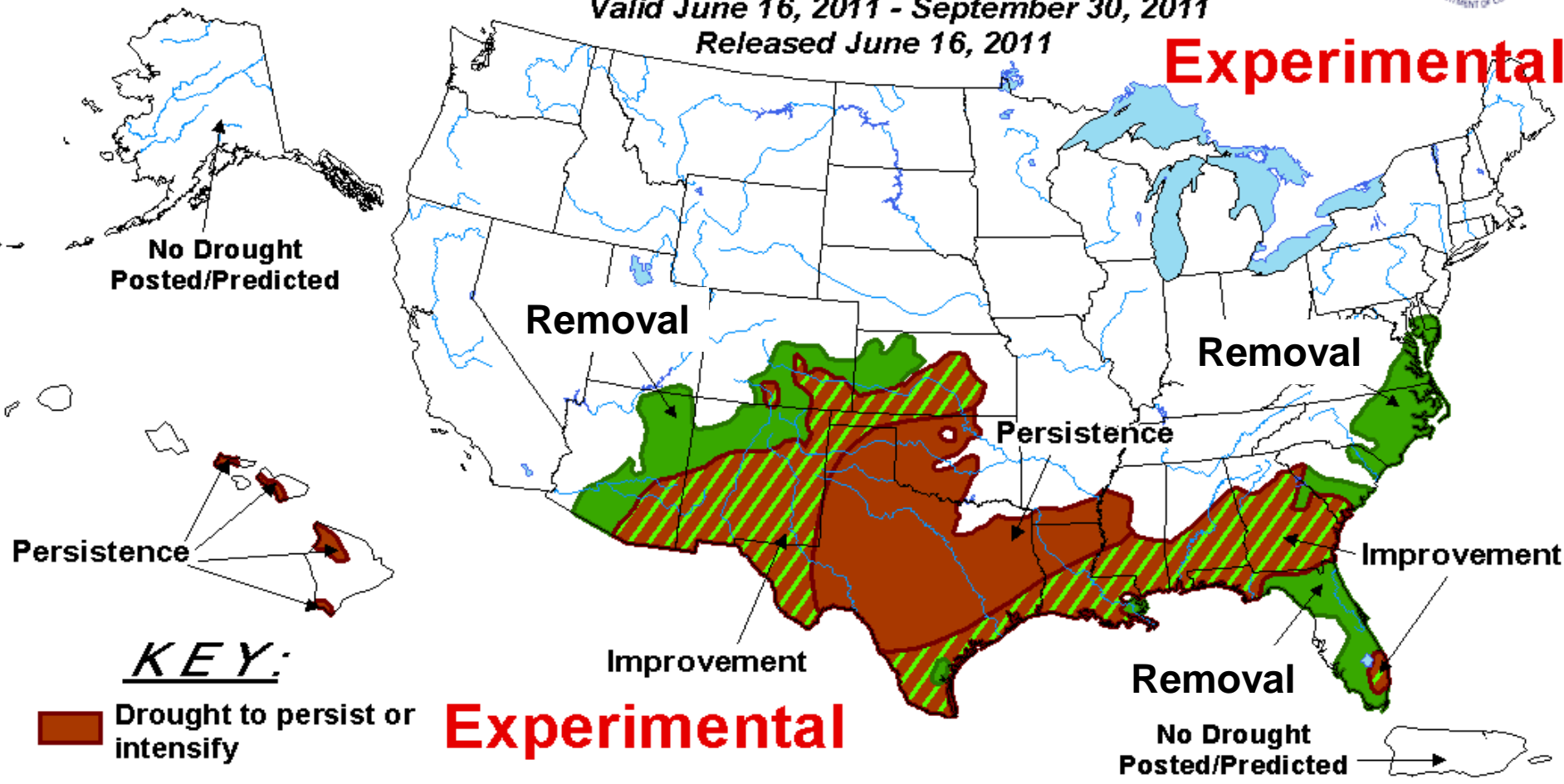
U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period





Valid June 16, 2011 - September 30, 2011

Released June 16, 2011

Experimental



KEY:

-  Drought to persist or intensify
-  Drought conditions improve, drought ongoing
-  Drought likely to be removed
-  Drought development likely

Experimental

Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Short-term events -- such as individual storms -- cannot be accurately forecast more than a few days in advance. Use caution for applications -- such as crops -- that can be affected by such events.

"Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4 intensity). For weekly drought updates, see the latest U.S. Drought Monitor. NOTE: the green improvement areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply drought elimination.

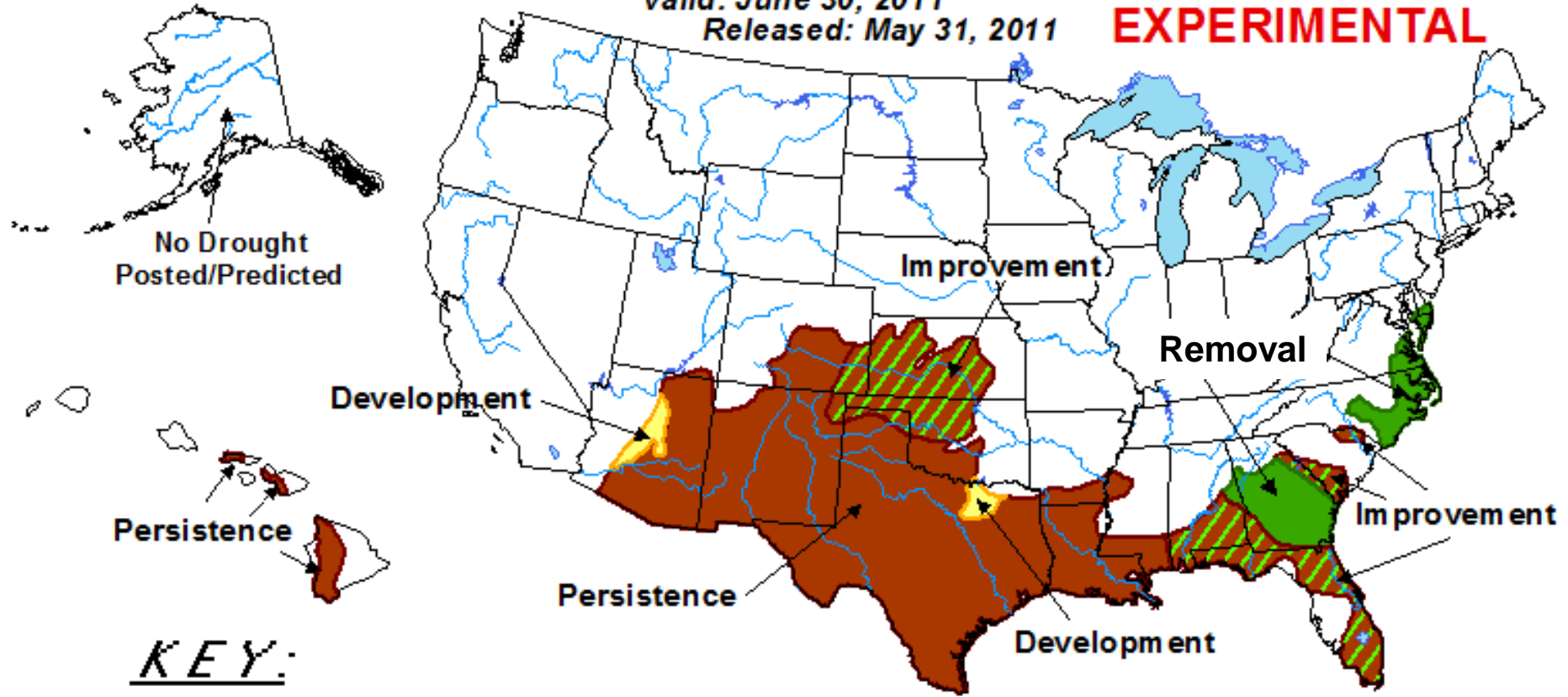
hatched green & brown

U.S. Monthly Drought Outlook





Drought Tendency During the Valid Period

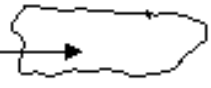
Valid: June 30, 2011
Released: May 31, 2011

EXPERIMENTAL



EXPERIMENTAL

- KEY:**
-  Drought to persist or intensify
 -  Drought ongoing but improvement expected
 -  Drought likely to be alleviated
 -  Drought development likely

No Drought Posted/Predicted 

Depicts large-scale trends based on subjectively derived probabilities guided by short- and medium-range statistical and dynamical forecasts. Short-term events -- such as individual storms -- cannot be accurately forecast more than a few days in advance. Use caution for applications -- such as crops -- that can be affected by such events.

"Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4 intensity). For weekly drought updates, see the latest U.S. Drought Monitor.

NOTE: The green improvement areas imply drought alleviation. The hatched green and brown areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply drought elimination.



CPC Drought Outlooks

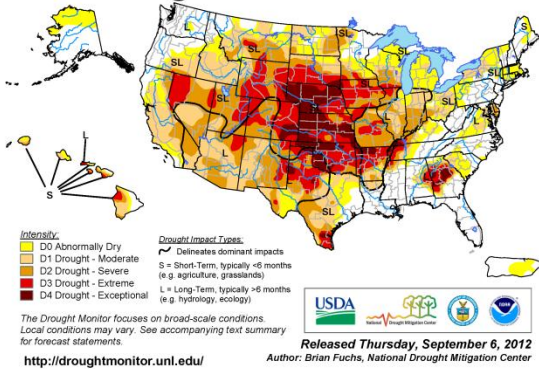
E. O'Lenic, K. Mo, D. Miskus, R. Tinker, A. Artusa, W. Higgins



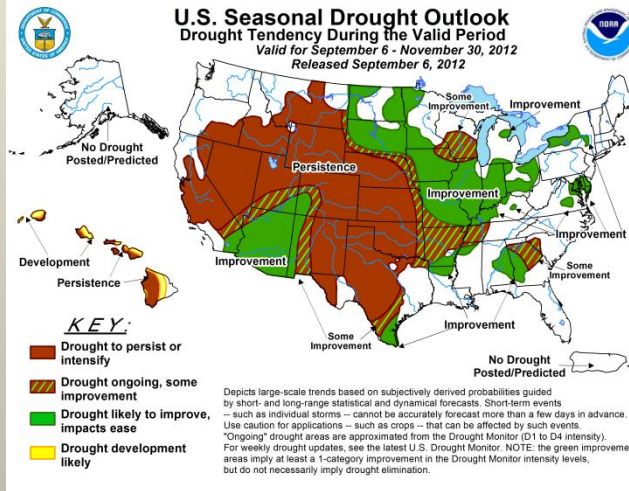
Current Status

CPC, NDMC, USDA, NCDC jointly produces a weekly Drought Monitor (DM), assessing current conditions.

U.S. Drought Monitor September 4, 2012

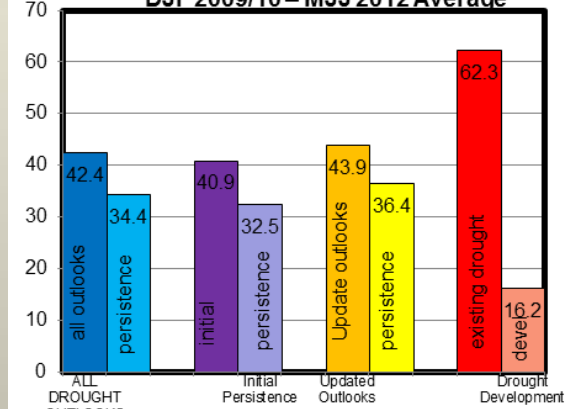


CPC produces a Drought Outlook (DO) twice each month, for the upcoming season. DM serves as a starting point for the DO.



Verification consists of comparing the accuracy of the official DO with a forecast of persistence of current observations forward.

D.O. VERIFICATION: Percent of Area Accurately Forecast DJF 2009/10 – MJJ 2012 Average



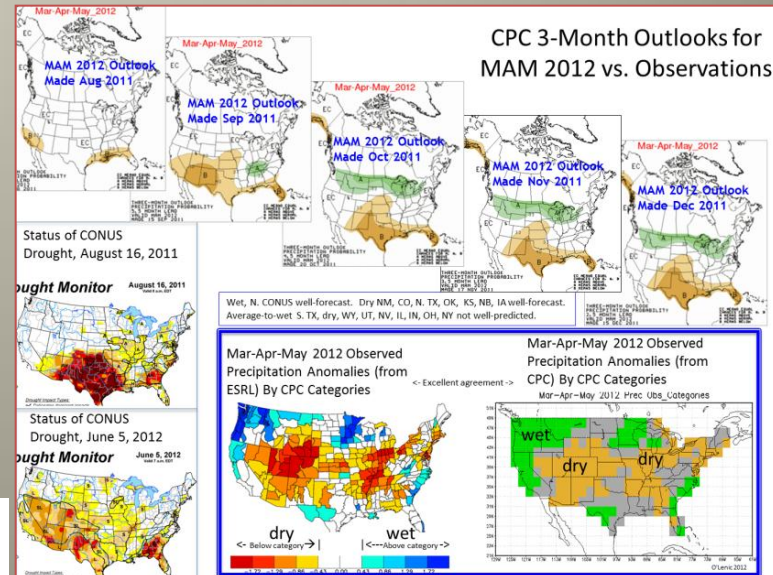
THE WEEKLY DM IS THE STARTING POINT FOR THE DO. OTHER INPUTS INCLUDE:

- THE 3-MONTH P OUTLOOK,
- REGIONAL EXPERT ASSESSMENTS, TELCONS
- SHORT-MEDIUM RANGE FORECASTS.

Proposed DO Improvements

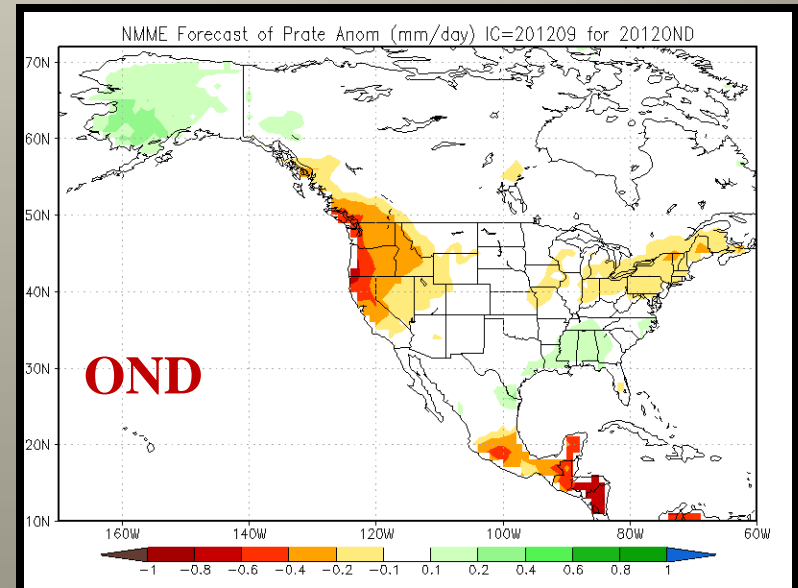
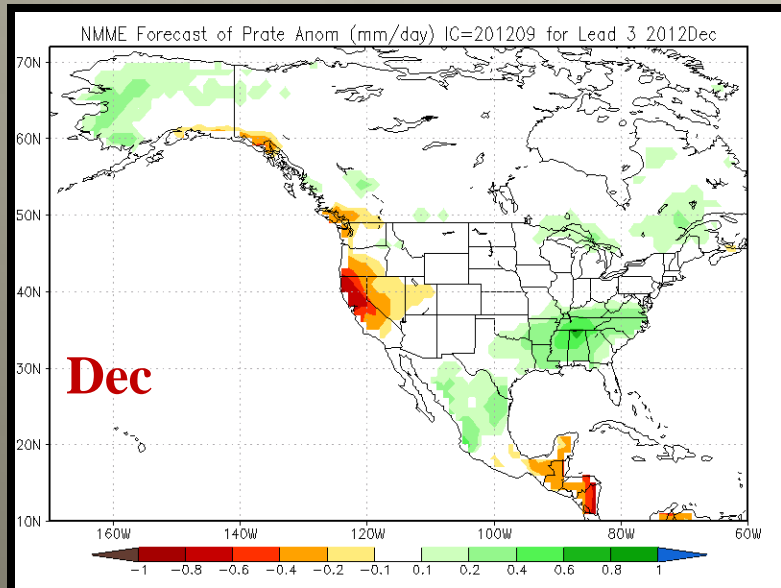
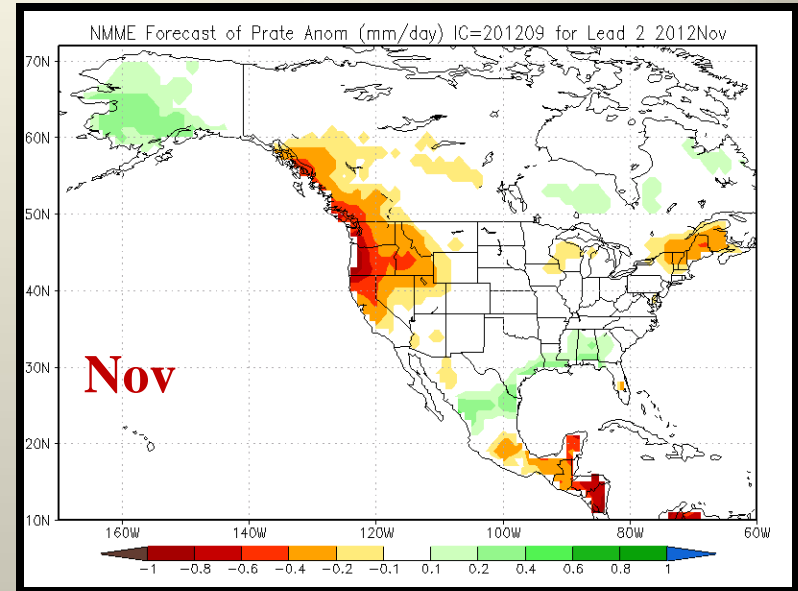
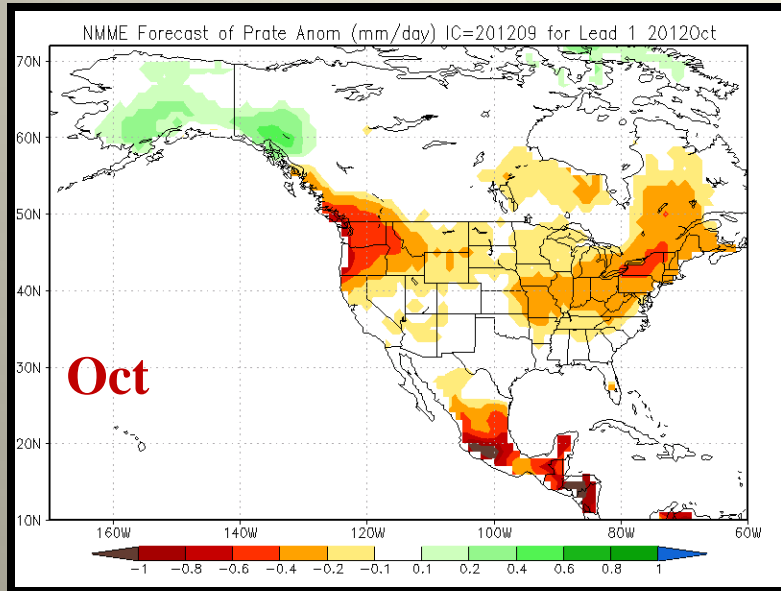
- *New Categories: Remove “some improvement”, add “removal”*
- *Zero-lead 1-mo DO replaces update DO now made early in month*
- *Long-term R2O plan to ensure infuse science into DO Including:*
 - Improved precipitation and soil forecasts through the Climate Testbed,
 - probabilistic version of the DO,
 - greater objectivity and reproducibility,
 - skill masking.
- *User-Feedback: A continually updated set of user requirements*
- *User – Tested documentation: Do users understand the product?*
- *Verification – automation, documentation*

POST-MORTEM OF MAM 2012 3-MO PRECIPITATION OUTLOOK



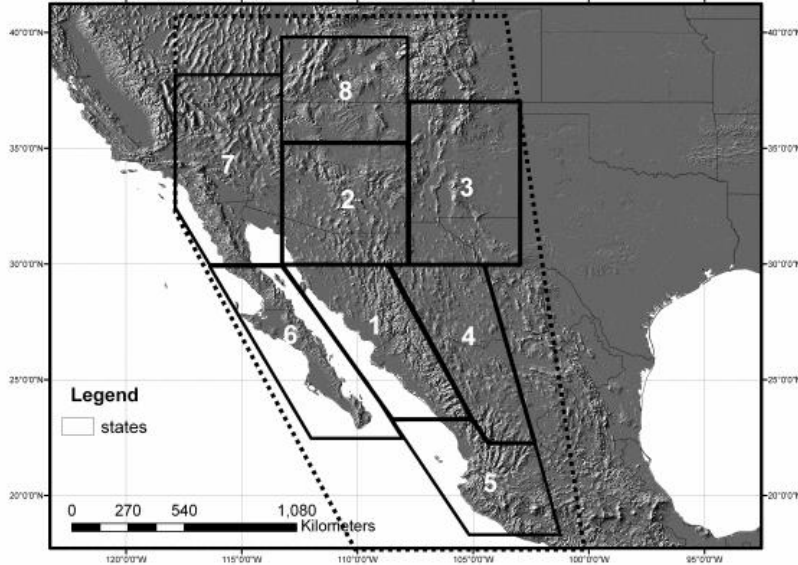
CPC 3-Month Outlooks for MAM 2012 vs. Observations

NMME Prec Forecasts

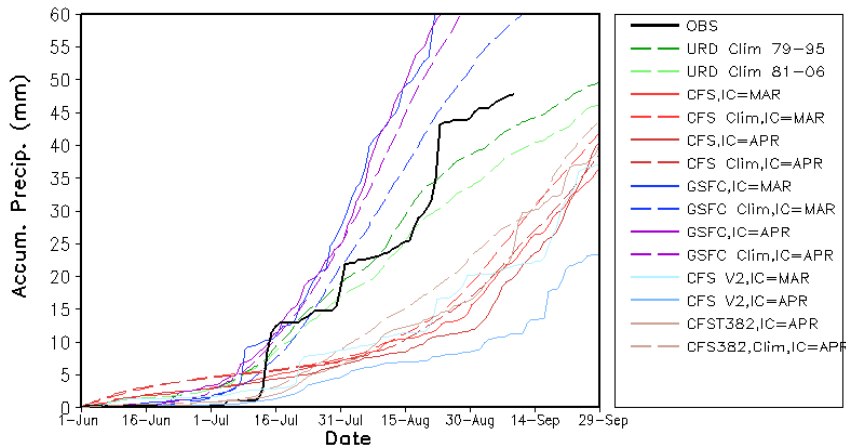


NAME Forecasts

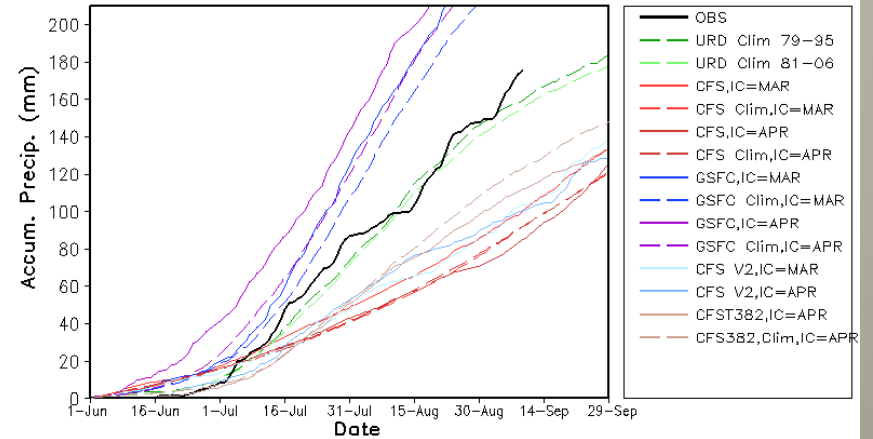
North American Monsoon sub-regional domains



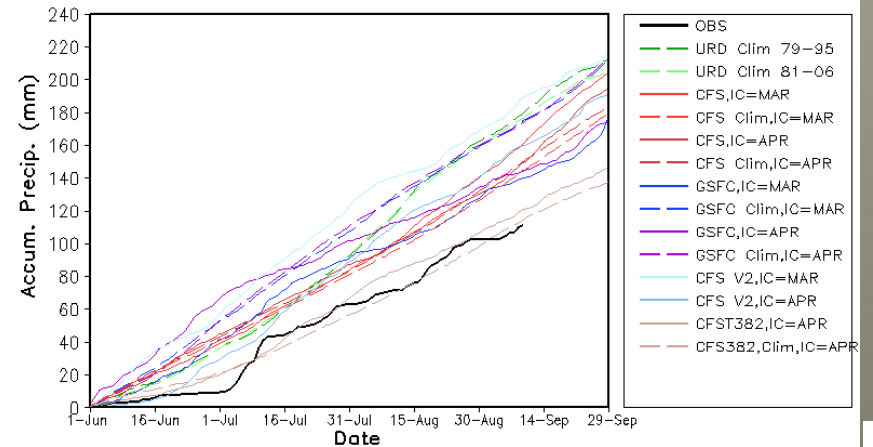
2012 NAME Forecast Forum Zone 7
Accumulated Precipitation



2012 NAME Forecast Forum Zone 2
Accumulated Precipitation



2012 NAME Forecast Forum Zone 3
Accumulated Precipitation

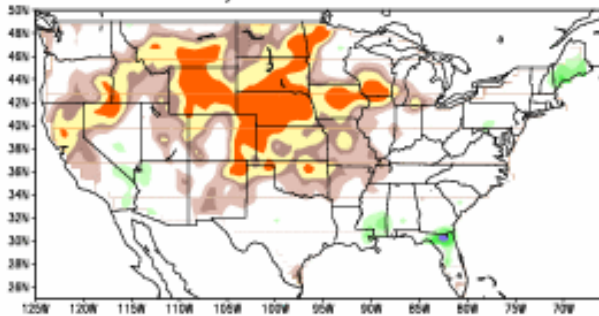


SPI Forecasts Based on CFSv2

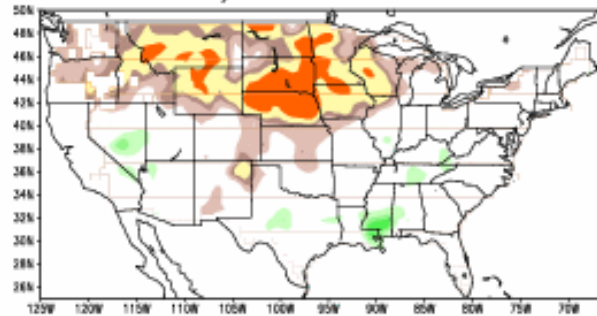
IC: 2-3 Oct 2012

SPI Fcst based on CFSRv2 (ICs=Oct 02 and 03 2012)

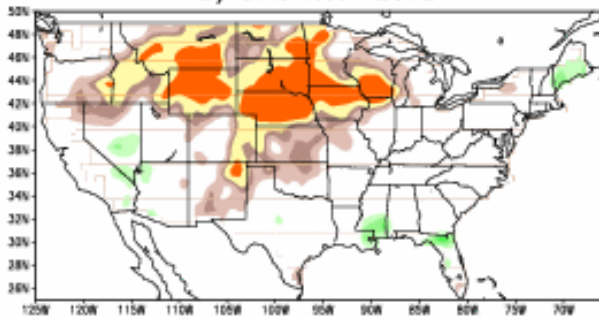
a) SPI6 Oct 2012



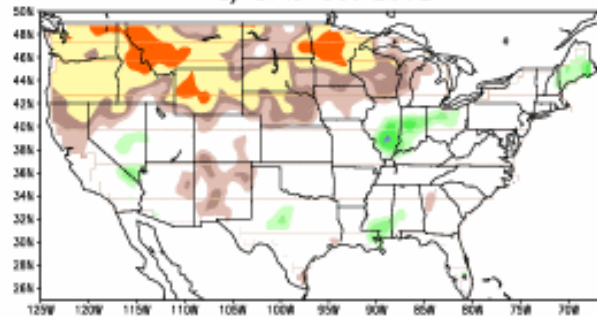
c) SPI6 Dec 2012



b) SPI6 Nov 2012



d) SPI3 Oct 2012



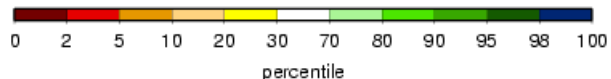
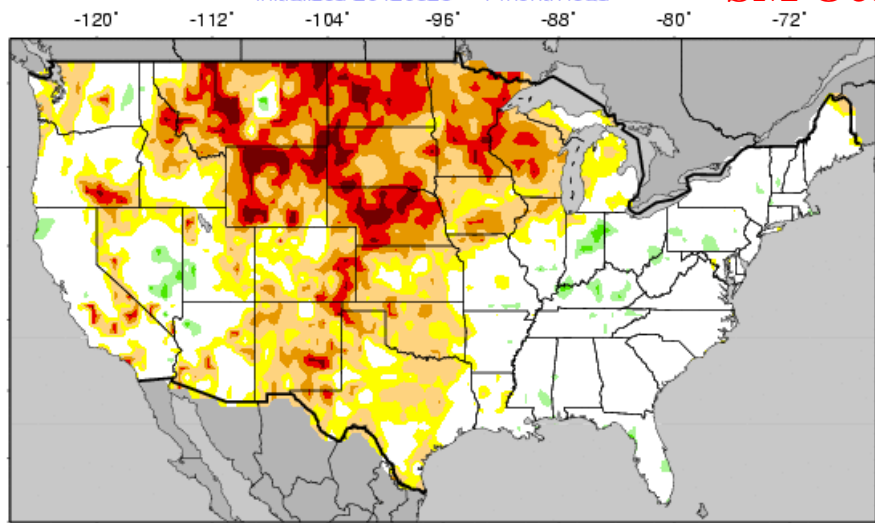
- Dry conditions over the central U.S. will slowly improve, but spread north during next few months.
- Wet conditions along the Gulf Coast & SW will persist through the next season.

VIC Predicted Soil Moisture Percentiles

based on ranking of ESP ENSO-Subset median

Initialized 20120928 -- 1 month lead

SM Oct

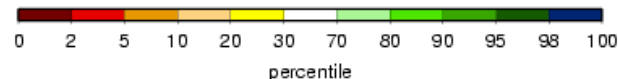
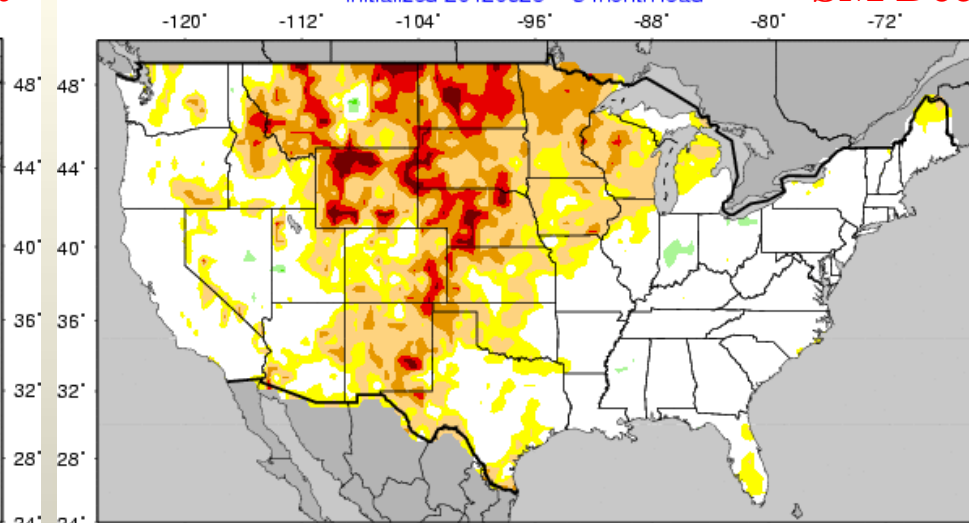


VIC Predicted Soil Moisture Percentiles

based on ranking of ESP ENSO-Subset median

Initialized 20120928 -- 3 month lead

SM Dec

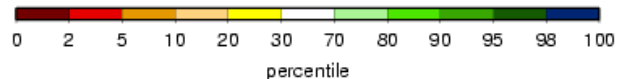
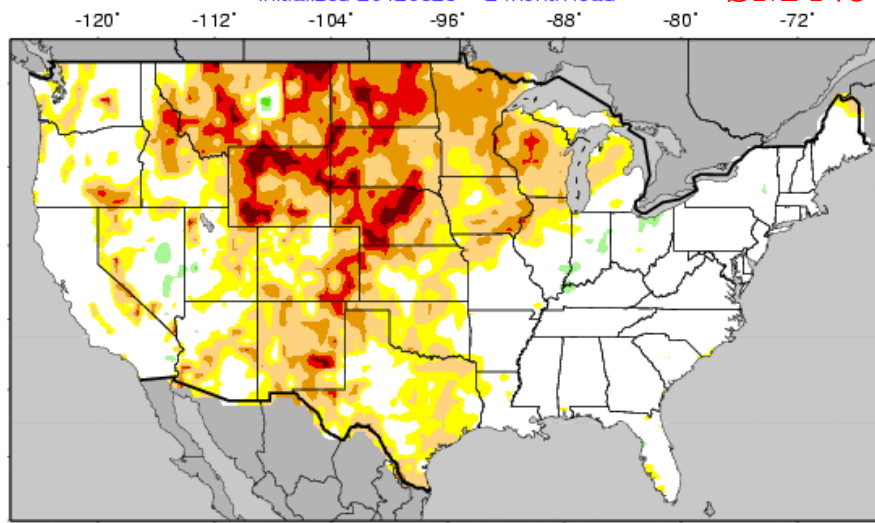


VIC Predicted Soil Moisture Percentiles

based on ranking of ESP ENSO-Subset median

Initialized 20120928 -- 2 month lead

SM Nov

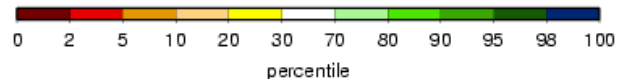
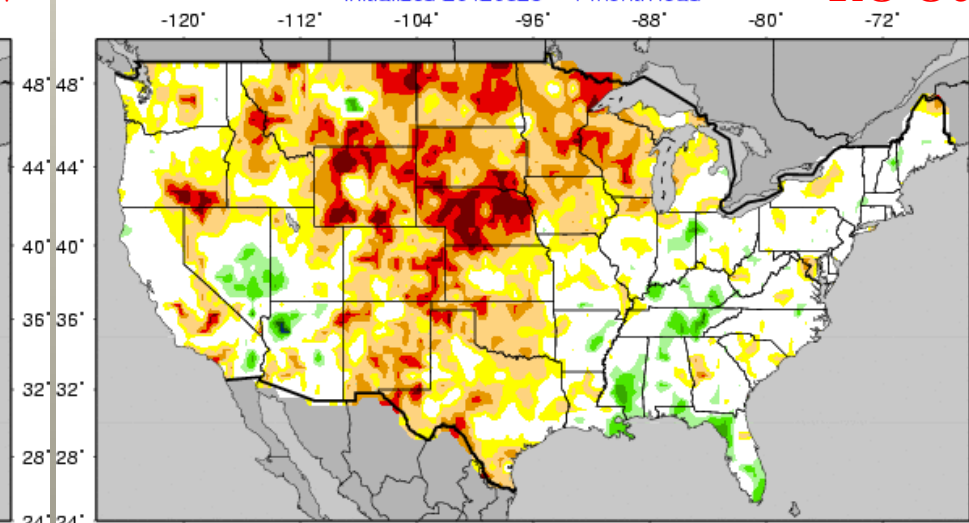


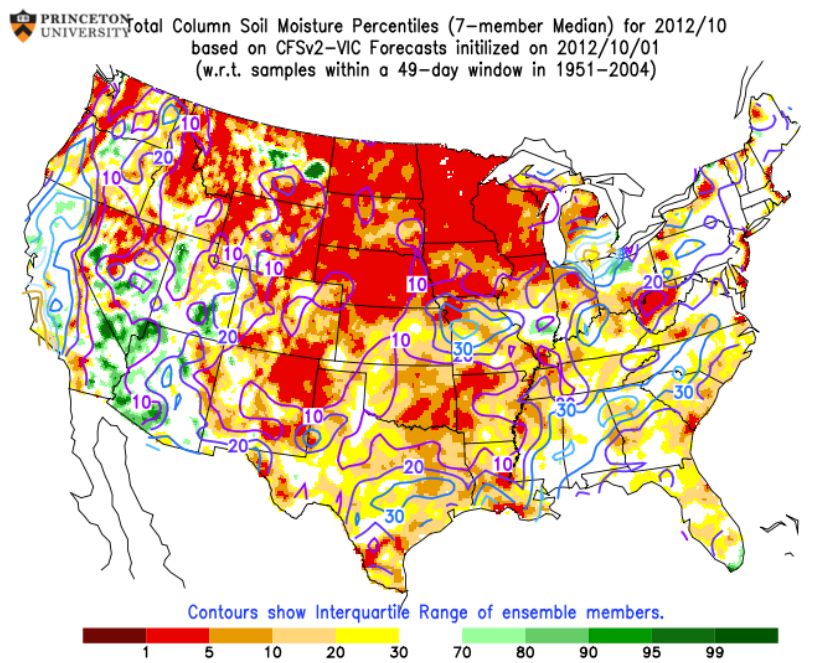
VIC Predicted Cumulative 3-month Runoff Percentiles

based on ranking of ESP ENSO-Subset median

Initialized 20120928 -- 1 month lead

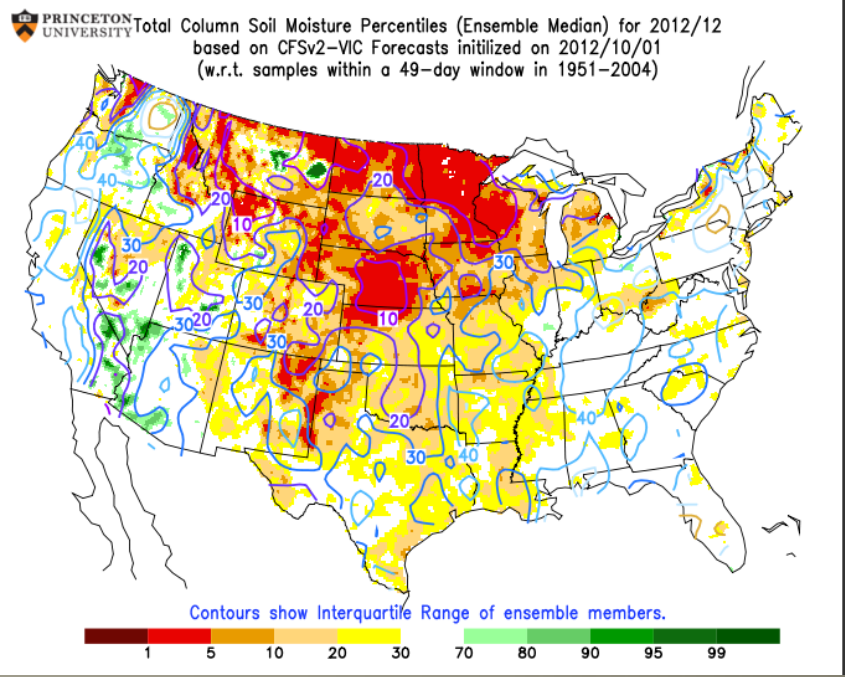
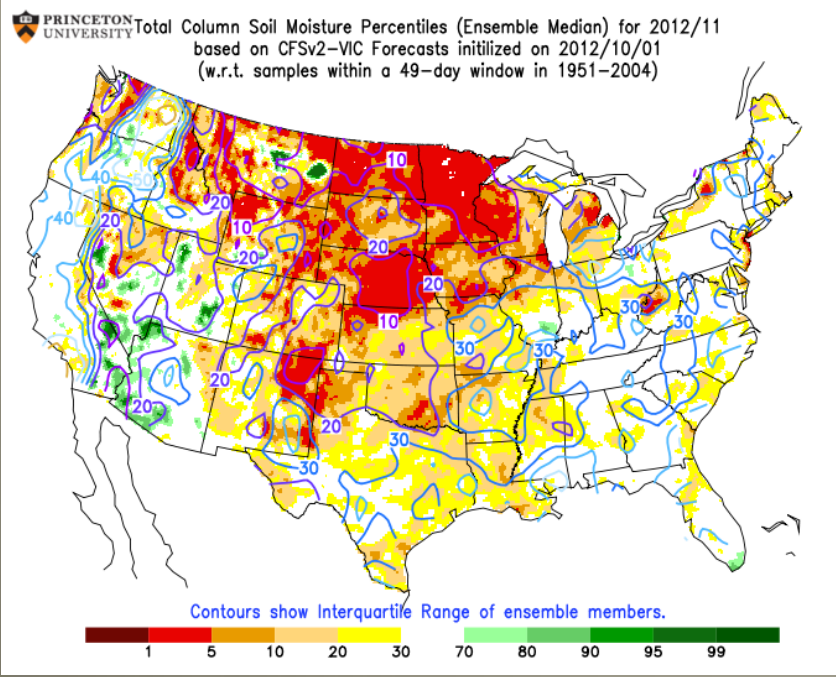
RO Oct





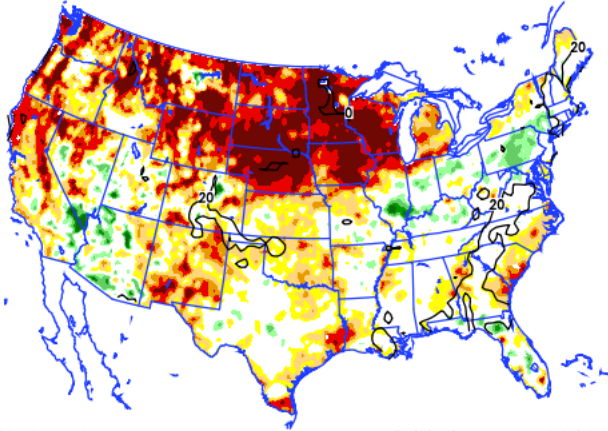
Princeton SMP Forecasts IC=20121001

- Drought continues to cover a large portion of the country, especially over the north-central part of the U.S.



10/4/12 (1-week lead)

Predicted Daily Soil Moisture Percentile on 20121004
(wrt samples within a 49-day window in 1979-2011)



CFSv2-VIC-based ensemble forecast initialized on 20120928
Shaded: median of 20-member ensemble; Contours: interquartile range



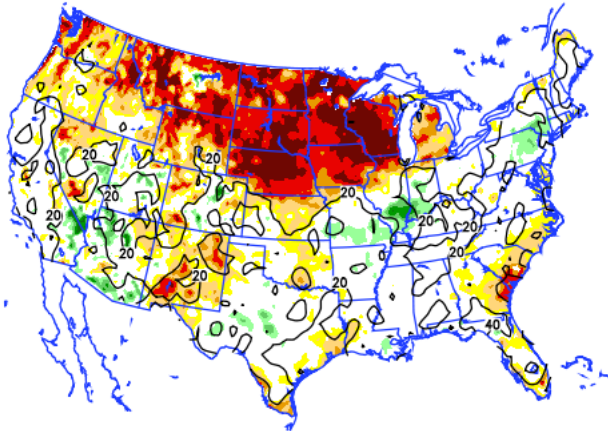
2012-10-08-03:17

MI State U SMP Forecasts IC=20120928

- Similar spatial patterns to the forecasts from the Princeton System, but less severe in S&C Plains.
- MSU forecasts show more wetness along the Gulf Coast and over the SW Monsoon region.

11/1/12 (5-week lead)

Predicted Daily Soil Moisture Percentile on 20121101
(wrt samples within a 49-day window in 1979-2011)



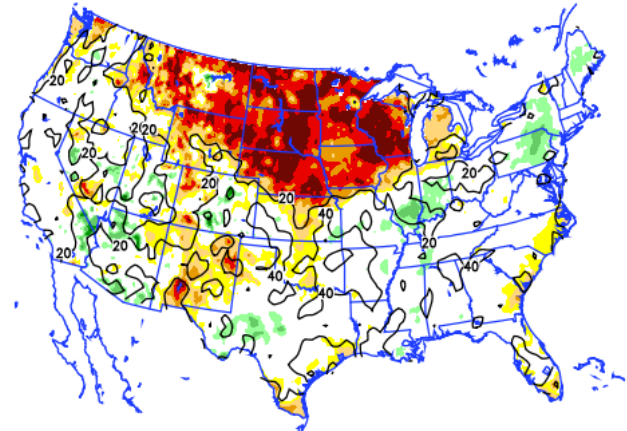
CFSv2-VIC-based ensemble forecast initialized on 20120928
Shaded: median of 20-member ensemble; Contours: interquartile range



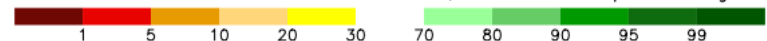
2012-10-08-03:21

12/6/12 (10-week lead)

Predicted Daily Soil Moisture Percentile on 20121206
(wrt samples within a 49-day window in 1979-2011)



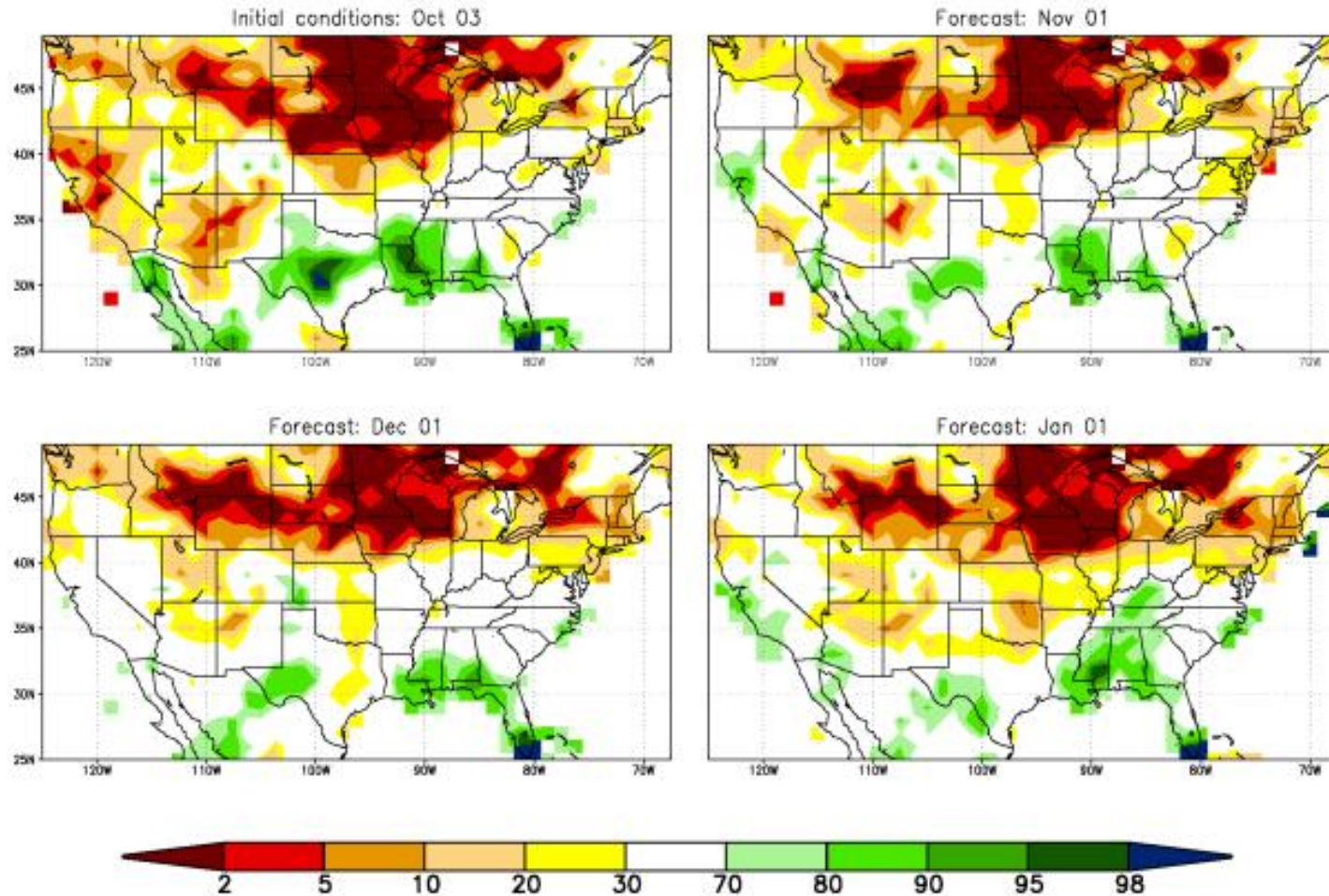
CFSv2-VIC-based ensemble forecast initialized on 20120928
Shaded: median of 20-member ensemble; Contours: interquartile range



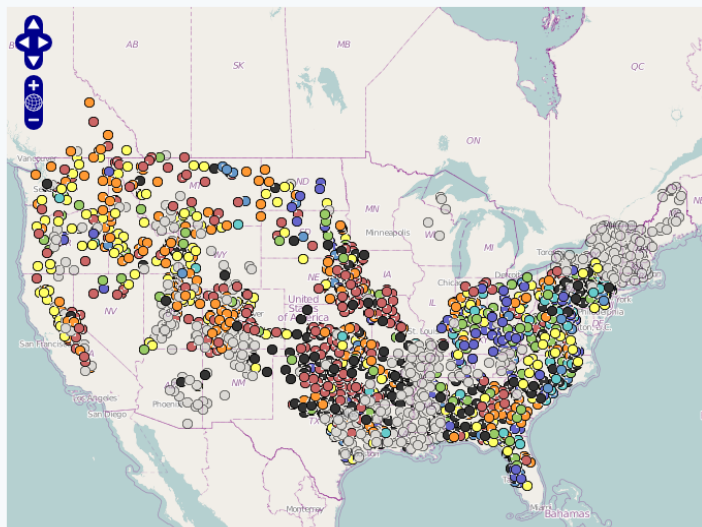
2012-10-08-03:26

NASA GEOS-5 Forecast System

Soil moisture percentile from NASA GEOS-5 forecast system



National Water Resources Map for October 2012



[Need Help?](#)
Map Options

Point Data

Time Period:
 Normalization:

Legend

- > 150% of median
- 130% - 150% of median
- 110% - 130% of median
- 90% - 110% of median
- 70% - 90% of median
- 50% - 70% of median
- < 50% of median
- No median
- No Forecast

Download

[Download data in KML Format](#)

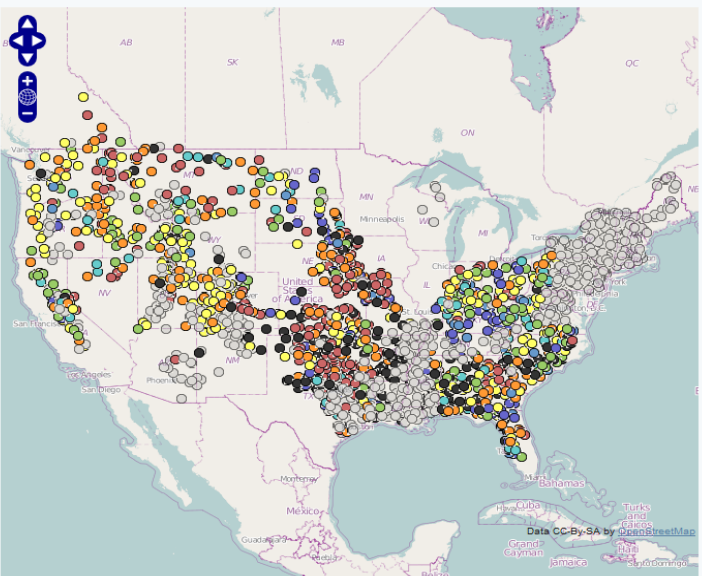
About

NOAA River Forecast Center model output is plotted on the map. Forecasts are valid for the month selected above. The most recent forecast for that month is plotted.

NWS/RFC Water Resources Outlook O,N,D 2012

Dry: S&C Plains, N Rockies
Wet: N Plains, OH Valley, CA

National Water Resources Map for November 2012



[Need Help?](#)
Map Options

Point Data

Time Period:
 Normalization:

Legend

- > 150% of median
- 130% - 150% of median
- 110% - 130% of median
- 90% - 110% of median
- 70% - 90% of median
- 50% - 70% of median
- < 50% of median
- No median
- No Forecast

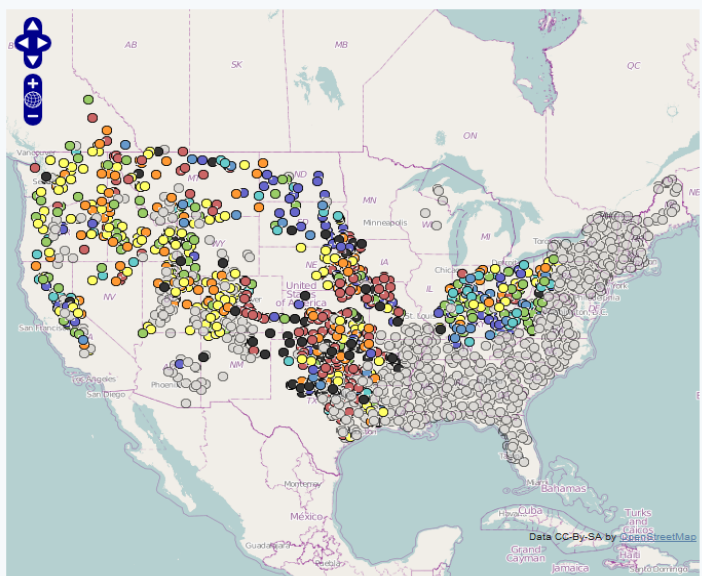
Download

[Download data in KML Format](#)

About

NOAA River Forecast Center model output is plotted on the map. Forecasts are valid for the month selected above. The most recent forecast for that month is plotted.

National Water Resources Map for December 2012



[Need Help?](#)
Map Options

Point Data

Time Period:
 Normalization:

Legend

- > 150% of median
- 130% - 150% of median
- 110% - 130% of median
- 90% - 110% of median
- 70% - 90% of median
- 50% - 70% of median
- < 50% of median
- No median
- No Forecast

Download

[Download data in KML Format](#)

About

NOAA River Forecast Center model output is plotted on the map. Forecasts are valid for the month selected above. The most recent forecast for that month is plotted.

What would Drought Outlook authors like to see in terms of prediction tools?

Improved model forecasts of Precipitation (all time periods);

Improved model forecasts of Extreme Temperature Events (e.g. duration & intensity);

Attribution Study of Summer 2012 Flash Drought (*more tomorrow at DTF*);

A skill assessment of recently developed drought forecast products;

Are Outlooks made for certain seasons usually more skillful than others?

Modifying existing Palmer suite of drought products
(e.g., develop products similar to the NCDC probability of Palmer drought amelioration or elimination/removal over 1,2, or 3 months in near-real time using *daily* data)

Soil moisture change probabilities in an ABSOLUTE sense by end of forecast period
(probability based upon the climatological envelope);

Incorporate (if possible) forecasts of other indices (e.g. NAO & PDO) into Monthly DO;



THANK YOU!

Any Questions, contact:

Anthony.Artusa@noaa.gov

(301) 683-3408

Or

David.Miskus@noaa.gov

(301) 683-3453

