Just How is the U.S. Drought Monitor Made?

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USDM Forum, SFWMD-West Palm Beach, FL, April 16-18, 2013
USDM (NADM) Annual Forums

- Lincoln, NE, November 2000
- Asheville, NC, April 2002
- NADM, Asheville, June 2003
- Cedar City, UT, October 2003
- NADM, Regina, SK, October 2004
- Washington, D.C., October 2005
- NADM, Mexico City, October 2006
- Portland, OR, October 2007
- NADM, Ottawa, October 2008
- Austin, TX, October 2009
- NADM, Asheville, April 2010
- Washington, D.C., April 2011
- NADM, Cancun, Mexico, April 2012
- West Palm Beach, FL, Spring 2013
The U.S. Drought Monitor

Since 1999, NOAA (CPC, NCDC, WRCC), USDA, and the NDMC have produced a weekly composite drought map -- the U.S. Drought Monitor -- with input from numerous federal and non-federal agencies

- Western Region Climate Center on board 2008
- 11 authors in all
- Incorporate relevant information and products from all entities (and levels of government) dealing with drought (RCC’s, SC’s, federal/state agencies, etc.) (350+ experts)
Requirement: Authors must work at a regional or national “center”, government or academia/research
There are currently 11 authors, and all are volunteers
Approaches to Drought Assessment

- Single index or indicator (parameter)
- Multiple indices or indicators
- **Composite (or “hybrid”) Indicator**

![Drought Severity Index by Division](image)

**U.S. Drought Monitor**

- Weekly Value for Period Ending OCT 18, 2008
- Long Term Palmer

- **Drought Impact Terms**
  - **D0 Abnormally Dry**
  - **D1 Drought - Moderate**
  - **D2 Drought - Severe**
  - **D3 Drought - Extreme**
  - **D4 Drought - Exceptional**

- **Drought Impact Terms**
  - **S = Short Term, typically <4 months**
  - **L = Long Term, typically >4 months**

- **The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.**

http://droughtmonitor.unl.edu/
U.S. Drought Monitor

April 9, 2013
Valid 7 a.m. EDT

Intensity:
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:
- S = Short-Term, typically <6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically >6 months (e.g. hydrology, ecology)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://droughtmonitor.unl.edu/

Released Thursday, April 11, 2013
Author: David Miskus, NOAA/NWS/NCEP/CPC
Objectives

- “Fujita-like” scale
- *NOT* a forecast!
- *NOT* a drought declaration!
- Identify **impacts** (S, L)
- Assessment of **current** conditions
- Incorporate **local expert** input
- Be as **objective** as possible
U.S. Drought Monitor Map

Drought Intensity Categories

D0 Abnormally Dry (30%tile)

D1 Drought – Moderate (20%tile)

D2 Drought – Severe (10%tile)

D3 Drought – Extreme (5%tile)

D4 Drought – Exceptional (2%tile)
Advantages of percentiles:
- Can be applied to any parameter
- Can be used for any length of data record
- Puts drought in historical perspective

The drought categories are associated with historical occurrence/likelihood (percentile ranking)

- It is not anecdotal or subjective, like “It’s really, really dry!!” ….or, “I don’t remember it ever being this dry, we have to be D4!!”

D2, Severe Drought: once per 10 to 20 years
D1, Moderate Drought: once per 5 to 10 years
D0, Abnormally Dry: once per 3 to 5 years
<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Possible Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>D0</td>
<td>Abnormally Dry</td>
<td>Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered</td>
</tr>
<tr>
<td>D1</td>
<td>Moderate Drought</td>
<td>Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested</td>
</tr>
<tr>
<td>D2</td>
<td>Severe Drought</td>
<td>Crop or pasture losses likely; water shortages common; water restrictions imposed</td>
</tr>
<tr>
<td>D3</td>
<td>Extreme Drought</td>
<td>Major crop/pasture losses; widespread water shortages or restrictions</td>
</tr>
<tr>
<td>D4</td>
<td>Exceptional Drought</td>
<td>Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies</td>
</tr>
</tbody>
</table>
USDM Listserve Subscribers
(as of August 10, 2012)

Total: 335 (does not include 1 participant from Canada)
The Importance of Local Expert Input

The U.S. Drought Monitor Team Relies on Field Observation Feedback from the Local Experts for Impacts Information & “Ground Truth”

- Listserver (350+ Participants: 2/3 Federal, 1/3 State/Univ.)

  - Local NWS & USDA/NRCS Offices
  - State Climate Offices
  - State Drought Task Forces
  - Regional Climate Centers

The primary means of communication with our “eyes in the field” is thru email; The email “Expert Group” is called the **USDM Listserver**
Regional and Local Feedback/Input Process

- Various webinars/telecons/reports/products
- Regional Climate Centers and NOAA Regional Climate Coordinators
- State Climatologists
- National Integrated Drought Information System (NIDIS) Pilot DEWS basin webinars:
  - UCRB (Upper Colorado River Basin)
  - ACF (Apalachicola-Chattahoochee-Flint)
  - Southern Plains
  - California? Missouri River Basin?
- North Carolina, Hawaii, Oklahoma, Texas, New Mexico, Alabama, Florida, South Dakota, Kentucky, Arizona and Montana
UCRB Weekly Drought Assessment

http://www.drought.gov/portal/server.pt/community/ucrb

Consensus recommendation to USDAM author
The Colorado group sends out a full ppt to back up their suggestions after their conference call.

Fig. 9: March 13th release of U.S. Drought Monitor for the UCRB.

On the current depiction of the U.S. Drought Monitor (USDM) map (Fig. 9), the USDM author has decreased the area of D2 in the Wasatch range in the UCRB based on recent precipitation. In the northern CO mountains (Grand County), it is recommended that the D1 be adjusted slightly and expanded eastward along the Continental Divide (Fig. 9, solid black line). This will set up a very sharp gradient at and west of the Divide, which is representative of conditions in that area and will match better with SNOTEL precipitation percentiles.

In northeast CO, a further expansion of D0 is recommended (Fig. 9, dashed black line). In the past 30 days, this area has experienced little to no precipitation, much warmer than average temperatures, low relative humidities, high winds, and wildfire dangers. 30-day SPIs are very low, VIC soil moisture shows drying, and D0 will better represent that short-term dryness being experienced there.

Status quo is recommended for the rest of CO and the rest of the UCRB.
Schedule & Process
The authors usually takes 2-week turns, although cases arise where they do a 1-week or 3-week shift. The reason: After two weeks, you are spent.

Each author typically has two 2-week shifts per year.
The first and most important thing for the USDM community to know is the data “period”; *The data cutoff* – i.e. precipitation has to have fallen by this time to be included in the analysis – is *7 am EST, 8 am EDT, Tuesday morning*. This is done to (a) provide a consistent, week-to-week product and (b) provide the author a 24-hour window to assess the data and come up with a final map by Wed. evening.
DRAFT 1 is emailed to the USDM contributors, aka “DROUGHT” listserv, usually by COB Monday. This map is an iterative work in progress, and provides the impetus for starting that week’s discussion.
Tuesday is very busy, with dozens (hundreds?) of emails, several conference calls, and sometimes individual phone calls. **Draft 2** (and sometimes more) goes out after getting all of the info, although it remains a work in progress.
By Noon, EST Weds, we send out a near-final draft (DRAFT 3), and we close the door on changes to the map ~ 2 pm, EST. Sometimes late, key input will make the cut...and before we finalize, we send out any updates in subsequent drafts, but 2 pm is our “it’ll have to wait until next week” deadline.
A **FINAL** map is sent out ~3-4 pm to make sure there are no errors or other egregious mistakes. The author then composes a national narrative, broken down by regions, highlighting the past week’s weather, impacts and USDm changes.
By 6 pm EST on Wed., all the files are compressed and sent to several different groups, most importantly the Drought Mitigation Center, who then confirms receipt before the author is free to go.
On Thursday, at 8:30 am, ET, the USDMA Map and Narrative are released on the NDMC website.
The cycle repeats the following week (although week 2 is usually easier). Keep in mind the author’s primary job responsibilities do not get put on hold.
So just how does the USDM get edited/created every week?
Inputs
What follows is a very small sample of some of the products we use...
Integrates Key Drought Indicators:
- Palmer Drought Index
- SPI
- KBDI
- Modeled Soil Moisture
  - NLDAS
- 7-Day Avg. Streamflow
- Precipitation Anomalies

Growing Season:
- Crop Moisture Index
- Sat. Veg. Health Index
- VegDRI/ESI/etc.
- Soil Moisture
- Mesonets
- State/Regional

In The West:
- SWSI
- Reservoir levels
- Snowpack (SNOTEL)
- SWE
- Streamflow

Created in ArcGIS
Objective Blends

- **Short-Term Blend**

  - 35% Palmer Z Index
  - 25% 3-Month Precip.
  - 20% 1-Month Precip.
  - 13% CPC Soil Model
  - 7% Palmer Drought Index

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**Objective Short-Term Drought Indicator Blend Percentiles**

*September 15, 2012*

The map illustrates the percentile distribution of the Short-Term Drought Indicator Blend for various regions across the United States. The inputs and methodology are described in detail, with the map showing how different precipitation and soil moisture conditions correlate with drought severity.

**Inputs (as percentiles):**
- 35% Palmer Z-Index
- 25% 3-Month Precipitation
- 20% 1-Month Precipitation
- 13% CPC Soil Moisture Model
- 7% Palmer Drought Index

This map approximates impacts that respond to precipitation over several days to a few months, such as agriculture, topsoil moisture, unregulated streamflows, and most aspects of wildfire danger. The relationship between indicators and impacts can vary significantly with location and season. Do not interpret this map too literally.

This map is based on preliminary climate division data. Local conditions and final data may differ. See the detailed product suite description for more details.
One big advantage of editing the drought areas in GIS is there is a wealth of weather and hydrological data also available in GIS format; we can bring the data directly into the “Drought Monitor” and line up the drought depiction with the observations. 

More on this later.
The first order of business is to bring in the past week’s precipitation to see if drought reduction/improvement is warranted. The left vertical banner bar shows the scale, in inches; the area of interest rec’d 1 to almost 3” of rain.
Some Examples of Decision Making Using the DM

(Science before Policy)

- **Policy**: 2008 Farm Bill/Internal Revenue Service/US Department of Agriculture (Secretarial “Fast Track” Disaster Designations, FSA + NRCS programs)/NOAA National Weather Service/Environmental Protection Agency/State drought plan triggers

- ~3.5M+ page views and ~2M+ visitors/year

- **Media**: The Weather Channel/USA Today and all major newspapers/Internet Media/Network News/ CNN/NPR/etc.

- Presidential/Congressional *briefings*
2012 Drought Impacts: “Fast Track” Secretarial Disaster Designation Process

2012 Secretarial Drought Designations - All Drought

All Drought Disaster Incidents as of 9/12/2012
- State Boundary
- County Boundary
- Tribal Lands
- Primary Counties: 2,038
- Contiguous Counties: 303

USDA Farm Service Agency
Production, Emergencies and Compliance Division
Washington, D.C.
September 12, 2012
U.S. Corn Areas Experiencing Drought

Reflects September 25, 2012
U.S. Drought Monitor data

Approximately 84% of the corn grown in the U.S. is within an area experiencing drought, based on historical NASS crop production data.

- Major areas combined account for 75% of the total national production annually.
- Major and minor areas combined account for 99% of the total national production annually.

Major and minor agricultural areas are derived from NASS county-level crop production data from 2006 to 2010. Additional information on these agricultural data can be found at: http://www.nass.usda.gov/.

Mapped drought areas are derived from the U.S. Drought Monitor product and do not depict the intensity of drought in any particular location. More information on the Drought Monitor can be found at: http://www.drought.unl.edu/dm/monitor.html.
Next Steps

- Continue interactions with local drought task forces, State Climate Offices, WFOs/RFCs, Regional Climate Centers
  - Foster new basin/state interactions
  - NIDIS RDEWS basin briefings…more coming
    - S.Plains/California/MO Basin/Carolinas/Chesapeake/others??
- Continue to encourage and incorporate new/enhanced/innovative products via GIS tools:
  - ACIS gridded SPI-SPEI/sc-PDSI,
  - Augment with remote sensing products
  - NLDAS, etc…
- Taking the Objective Blends from a climate division base to a station-based/gridded layer
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