The NHWC Transmission

April 2016

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## A MetStorm® Analysis on the Lower Mississippi River Valley Storm of March 2016

Katie Laro, Tye Parzybok, and Alyssa Hendricks, MetStat, Inc.

Early March proved to be a very rainy period in the Southern US. An upper level low over southern Texas initiated an atmospheric river that channeled warm, moist, unstable air from the Gulf of Mexico and into the Lower Mississippi River Valley region. This pattern provided the necessary ingredients to produce thunderstorms and heavy rain over the area for several days. Subsequent major flooding occurred in parts of Louisiana and eastern Texas. As the system started to set up, MetStat began to monitor the approaching storm and provided a brief synopsis including the modeled precipitation and forecasted average recurrence interval (ARI) in a blog post on metstat.com/extreme-precipitation-blog on 7 March 2016.

LA 838 in Ouachita Parish. *Photo courtesy of Louisiana Department of Transportation and Development (DOTD)*

Given the magnitude and aftermath of the rainfall from this storm, and the need for publicly available quality controlled multi-sensor precipitation estimates, a MetStorm analysis was performed. MetStorm is a Geographic Information System (GIS) based analysis system that produces gridded precipitation at 5-minute and/or 1-hour intervals over a specified domain (Laro, 2015; Parzybok, 2015). Algorithms blend precipitation data from Weather Decision Technologies' 250 m Polarimetric Radar Identification System (POLARIS) quantitative precipitation estimates (QPE), Synoptic Data Corp's quality-controlled rain gauge data, and satellite rainfall estimates into a seamless GIS grid, which provides the basis for summary statistics, maps, tables, and plots. Figure 1 (next page) shows the total storm map depicting the rainfall that occurred with the Lower Mississippi River Valley storm from 8 March 2016 12 UTC through 11 March 2016 12 UTC. A maximum amount of 23.91 inches was estimated near Oak Ridge, LA.

While MetStorm uses radar estimates, satellite estimates, and quality controlled gauge data, another popular and publicly available product is the Stage IV precipitation estimates, also known as Multi-Sensor Precipitation (MPE). Stage IV data, created and generically quality controlled by the NWS River Forecast Centers and mosaicked into a single CONUS grid by the National Centers for Environmental Prediction, blends together 4 km radar data with approximately 3,000 hourly reporting gauges and 8,000 daily reporting gauges (Lin and Mitchell, 2005), compared to 20,000 hourly and 17,000 daily stations available to MetStorm. For this analysis domain,

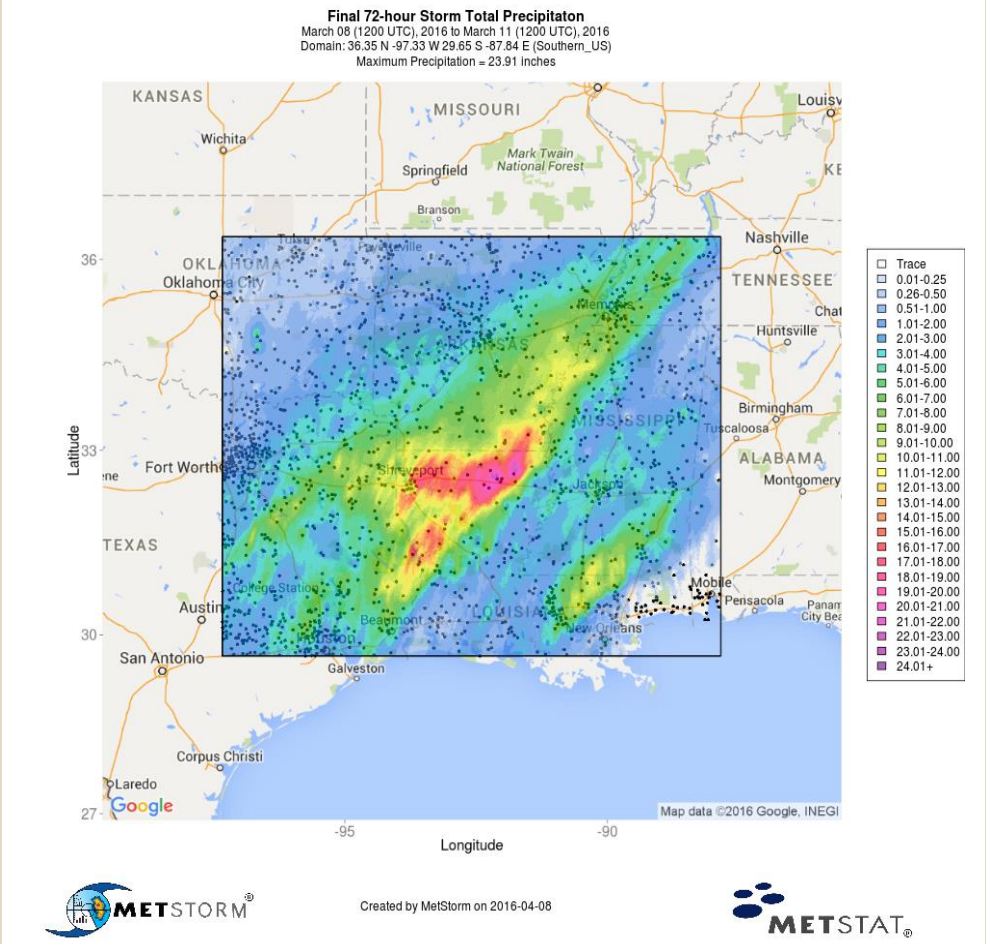



Figure 1: MetStorm 72-hour Total Storm Map

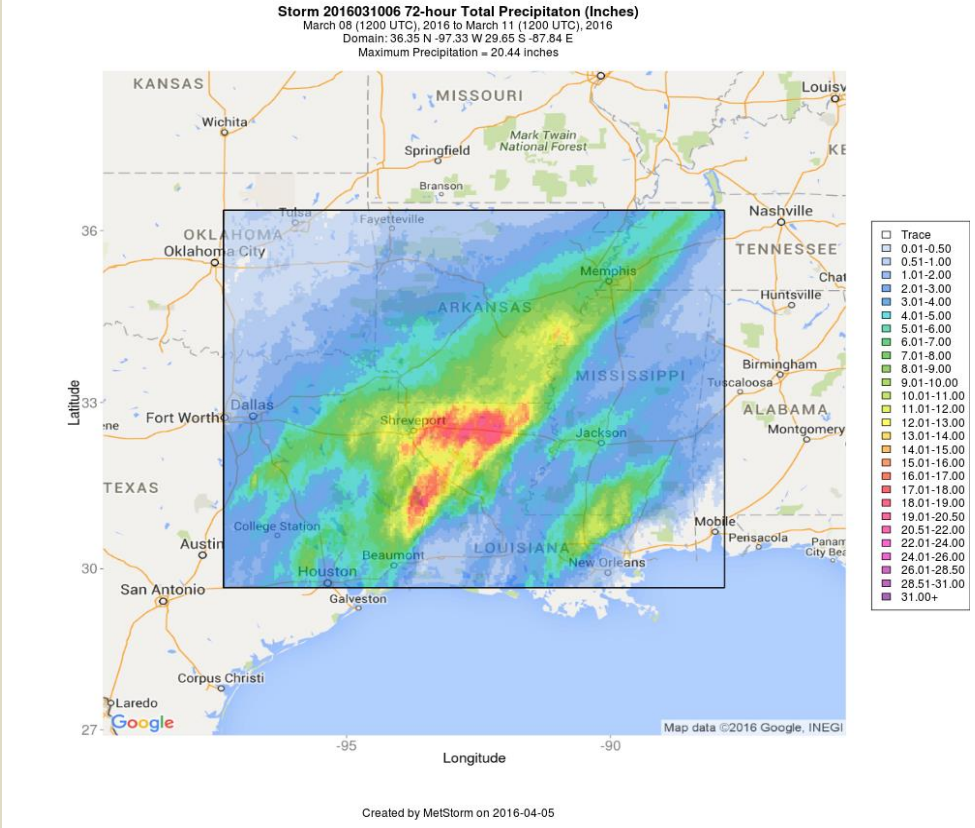



Figure 2: Stage IV 72-hour Total Storm Map

MetStorm utilized 1,913 gauge reports. Figure 2 (below left) provides a comparison 72-hour total storm map through aggregating one-day total precipitation grids for the same period of 8 March 2016 12 UTC through 11 March 2016 12 UTC. The maximum estimated rainfall from the Stage IV product was 20.44 inches.

To put the rainfall depths into perspective, a 72-hour ARI map was calculated using NOAA Atlas 14 volume 9 Version 2.0: Southeastern States (Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi) (see Figure 3, next page). The ARI, or Average Recurrence Interval, is an objective means of conveying the rarity of a rain event. An ARI for rainfall does not equate to the same ARI for the subsequent flooding, i.e., the rarity of an amount of rain over a period of time may not result in the same rarity of the flooding it produces. The 72-hour highest rainfall was 23.91 inches which equates to over a 1000-year precipitation ARI, meaning the chance of a storm of this magnitude occurring in this location has less than a 0.1% chance of occurring any given year.

Another analytic historically used to objectively describe storm precipitation in a three-dimensional perspective is the Depth-Area-Duration (DAD) plot. The DAD analytic is an intuitive way to describe the storms magnitude, areal size, and duration all in one plot. A subset of the applications of the DAD include monitoring precipitation thresholds for flooding or other consequences and aiding in the computation of probable maximum ➡

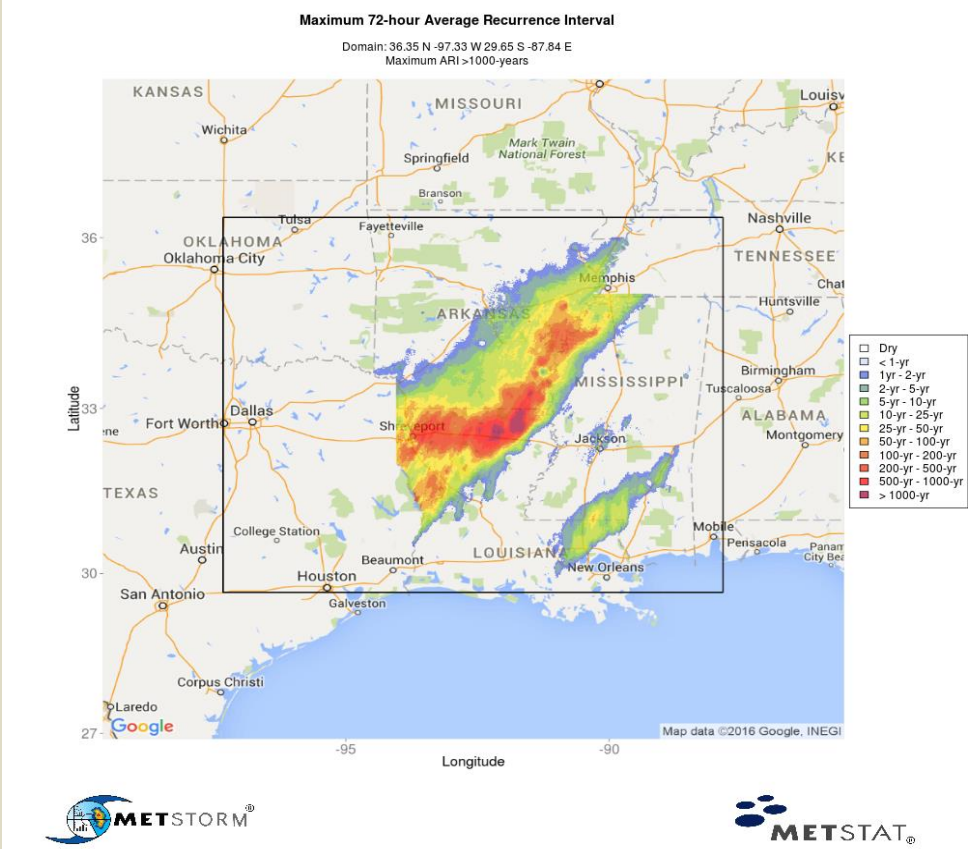



Figure 3: MetStorm 72-Hour Average Recurrence Interval Map

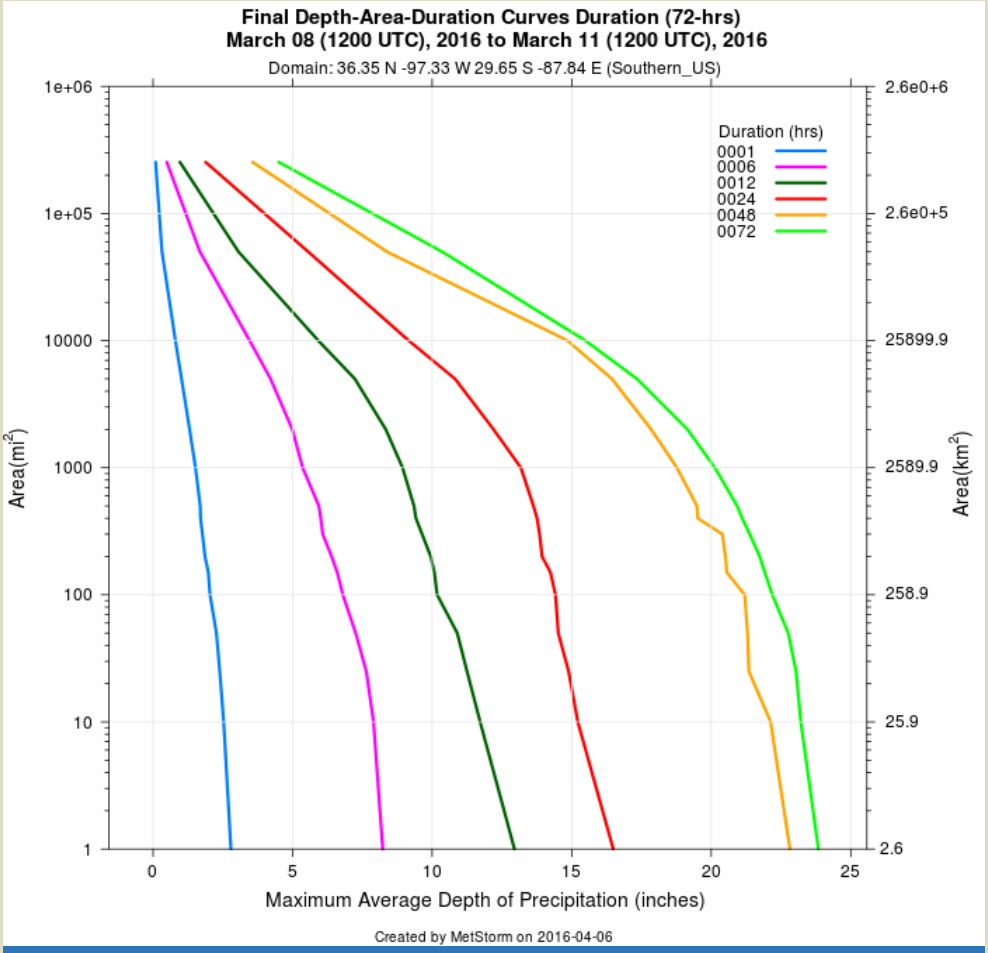



Figure 4: MetStorm Depth-Area-Duration Curves

precipitation (PMP) estimates that influence the design and operation of structures such as dams, nuclear power plants, and levees. The DAD for the Lower Mississippi River Valley storm shows that an average of 14.42 inches fell over a 100 square mile area size in 24-hours, as shown in Figure 4 (below left).

A systematic means of providing an accurate, detailed analysis of precipitation associated with a recently occurring storm has historically been difficult to attain given the lack of reliable data. However, with the advent of readily available real-time precipitation gauge data and radar-estimated precipitation data, near real-time, systematic storm analyses is possible. Through social media and the metstat.com blog, MetStat was able to successfully communicate to the public the evolution, magnitude, and rarity of the Lower Mississippi River Valley storm by sharing some of the analytics outlined in this article.

References:

Laro, K. and T. Parzybok, 2015: MetStorm® Near Real-time Storm Precipitation Analytics. 11th National Hydrologic Warning Council Training Conference and Exposition. Indianapolis, Indiana. June 15-18, 2015.

Lin, Y. and K. E. Mitchell, 2005: The NCEP Stage II/IV hourly precipitation analyses: development and applications. Preprints, 19th Conf. on Hydrology, American Meteorological Society, San Diego, CA, 9-13 January 2005, Paper 1.2.

Parzybok, T., N. A. Lock, C. W. Porter, K. Laro, A. D. Hendricks, and W. Mokry Jr. 2015: MetStorm® Near Real-time Storm Precipitation Analytics Using Dual-pol Radar Data. 37th Conference on Radar Meteorology. Norman, OK.

# USGS Tracks Louisiana Floods to Help Guide Emergency Relief

**Athena Clark**, U.S. Geological Survey

US Geological Survey water science specialists moved quickly to assist flood relief work in Louisiana by documenting the extent of historic, long-lasting flooding in March across a broad swath of the state, from Shreveport in the northwest to the Pearl River in the southeast.

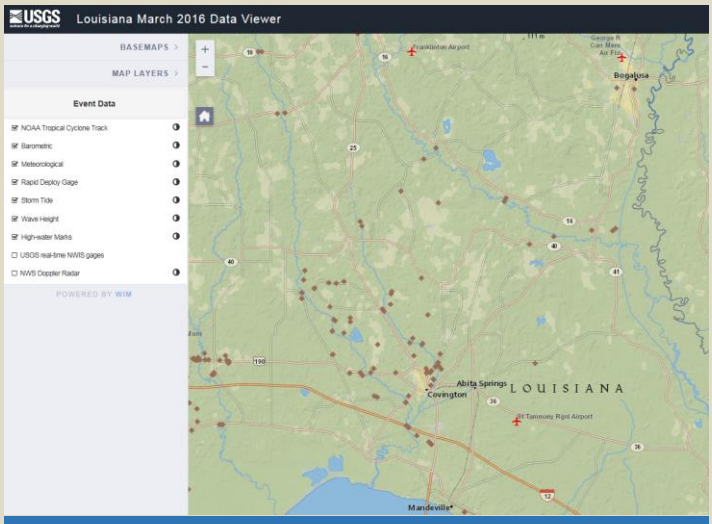
Triggered by a slow-moving low pressure system that dumped between 10 and 26 inches of rain across the state the week of March 7, the floods prompted a statewide federal disaster declaration. News media reported that the flooding caused four deaths, and Louisiana emergency managers said floodwaters damaged more than 11,000 homes and temporarily closed interstate highway I-10 at the Texas-Louisiana border, I-20 at three locations in North Louisiana, and I-49 south of Shreveport.

“A lot of people experienced flooding who had never experienced flooding before,” said Benton McGee, a USGS supervisory hydrologist based in Ruston, Louisiana and one of the coordinators of the ongoing fieldwork. “In some places this flooding is of a magnitude that we would not normally expect to see again in our lifetimes.”

Some rivers and bayous remained above their official flood stage more than two weeks after the rains began.

Working in two- and three-person teams, at least 34 USGS hydrographers from seven states – Alabama, Arkansas, Georgia, Louisiana, Mississippi, North Carolina and Tennessee – collected more than 390 high water marks at sites ranging from USGS stream gages to fences, barns, houses, bridges and trees. “I’m proud of how USGS responded so quickly in this situation,” said Athena Clark, Deputy Director, USGS Lower Mississippi Gulf Water Science Center. “One of the strengths of the USGS is its ability to mobilize rapidly to provide timely and useful hydrologic data when decision makers need it the most.”

USGS hydrographer Aaron Pugh of Little Rock, Arkansas documents a high water mark left by flooding in Shreveport, Louisiana near Cross Lake




USGS Louisiana March 2016 Data Viewer (http://stn.wim.usgs.gov/LouisianaMarch2016/) Red diamond markers show locations of USGS identified high water marks.

The high water marks, collected at the request of the Federal Emergency Management Agency, will document flood depths and extent. “FEMA will use this information to target flood relief aid to the areas where the need is greatest,” said Marie Peppler, USGS federal agency liaison and coordinator for the national USGS Flood Inundation Mapping Program.

A map of Louisiana’s March 2016 high water marks, with information about each mark, is available on the USGS Flood Information site.

At least 12 USGS stream gages recorded the highest volume of stream flow measured in those gages’ existence. On the Little River near Rochelle, Louisiana, a stream gage installed in 1958 broke a record for that site, documenting floodwater flows of 134,000 cubic feet per second. At that rate, the river would fill an Olympic-sized swimming pool, containing 88,000 cubic feet of water, in less than one second.

On Saline Bayou near Lucky, Louisiana, the recorded flow of 24,300 cubic feet per second was nearly twice the previous record of 13,500 cubic feet per second, which took place in 1945. And on Bayou Toro near Toro, Louisiana, flows of 83,900 cubic feet per second broke a record of 52,700 cubic feet per second set in 1968.

## Save the Date

## 2017 National Hydrologic Warning Council Training Conference & Exposition

June 5-8, 2017
Squaw Valley, California

The 2017 NHWC Training Conference & Exposition will be held on June 5-8, 2017 at the Resort at Squaw Creek near Olympic Valley, California

Watch this **link** for more information and updates.

## 2016 International Atmospheric Rivers Conference

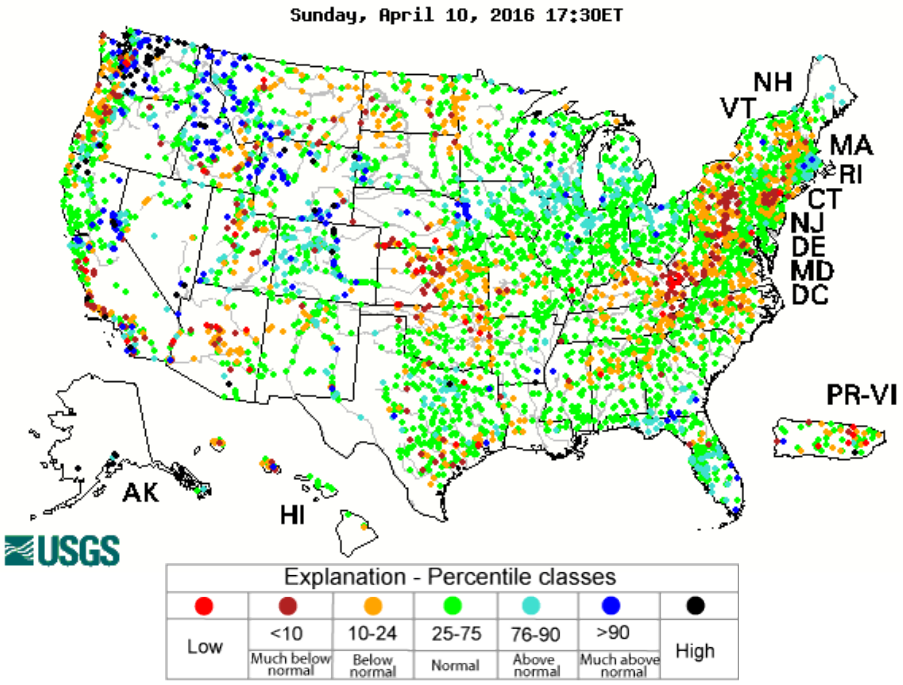
### August 8-11, 2016

The 2016 International Atmospheric Rivers Conference will convene at 8am on Monday 8 August 2016 in the beautiful Robert Paine Scripps Forum at the Scripps Institution of Oceanography in La Jolla, California.

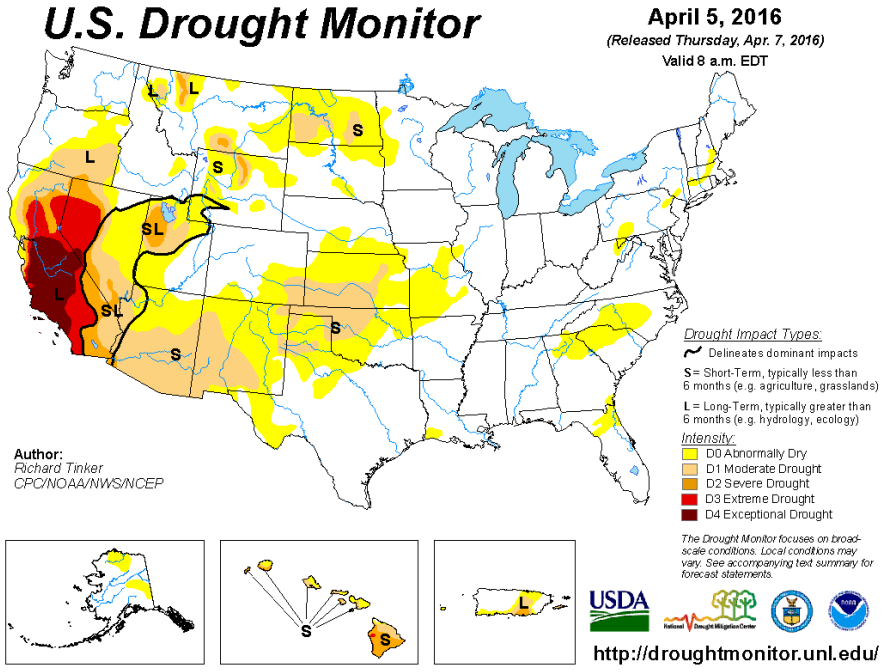
Four full days of presentations will cover global regional perspectives on atmospheric river science including associated and parallel processes. A poster session will be held late Tuesday afternoon and will be followed by a buffet dinner on Tuesday evening (lasting until approximately 8pm). Other conference days are expected to end at approximately 5pm.

Click **here** for more conference information

# Hydrologic Conditions in the United States
## Through April 10, 2016




**Latest stream flow conditions in the United States. (courtesy USGS)**




**Latest drought conditions in the United States.**
**(courtesy National Drought Mitigation Center)**

## May Newsletter Articles Focus:

## Modeling & Analysis

The NHWC is requesting articles that focus on practices, technologies and tools used to model, predict and analyze hydro-meteorological events and to support decision making for emergency response and floodplain management.

Submit your article to:

editor@hydrologicwarning.org

May 6th is the deadline for inclusion in the May issue.

## Future Newsletter Articles Focus

To give you more time to prepare articles, below is the article focus schedule for the next four months:

**May - Modeling/Analysis**
**Jun - Data Collection**
**Jul - Hydrology**
**Aug - Hazard Communication & Public Awareness**

## NHWC Calendar

September 20-21, 2016 - NHWC Northeast Regional Workshop, Albany, New York

June 5-8, 2017 – NHWC 2017 Training Conference & Exposition, Squaw Valley, California

## General Interest Calendar

April 18-22, 2016 - ALERT Users Group Training Symposium and Preparedness Workshop, Tenaya Lodge at Yosemite National Park, California

June 19-24, 2016 - ASFPM 2016 40th Annual National Conference, Grand Rapids, Michigan.

August 22-25, 2016 – National Association of Flood & Stormwater Management Agencies Annual Meeting, Portland, Oregon

*(see the event calendar on the NHWC website for more information)*

## Parting Shot

**Folsom Dam: March 7th, 1:30pm**


The last time flood waters were released from Folsom Dam was 2012. See an interview with NHWC's past president Dr. David Curtis on Folsom.tv.

Photo by David Curtis, WEST Consultants