The NHWC Transmission

February 2017

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NHWC 2015-17 Officers and Directors

USGS TX Water Dashboard: Leveraging Twitter and Web Mapping to Distribute Real-time Water Information

Daniel K. Pearson, USGS
Jim Moffitt, Twitter

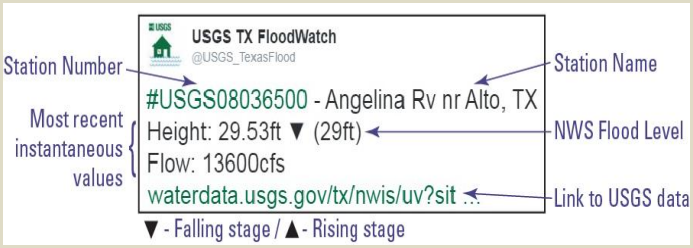
During the recent Texas flooding of 2016, the U.S. Geological Survey (USGS) unveiled a new tool that gives users real-time water, weather and National Weather Service (NWS) flood forecast information all in one place. When water levels are rising, it can be hard to quickly get all the information you need about your area, especially when you're not in front of a computer.

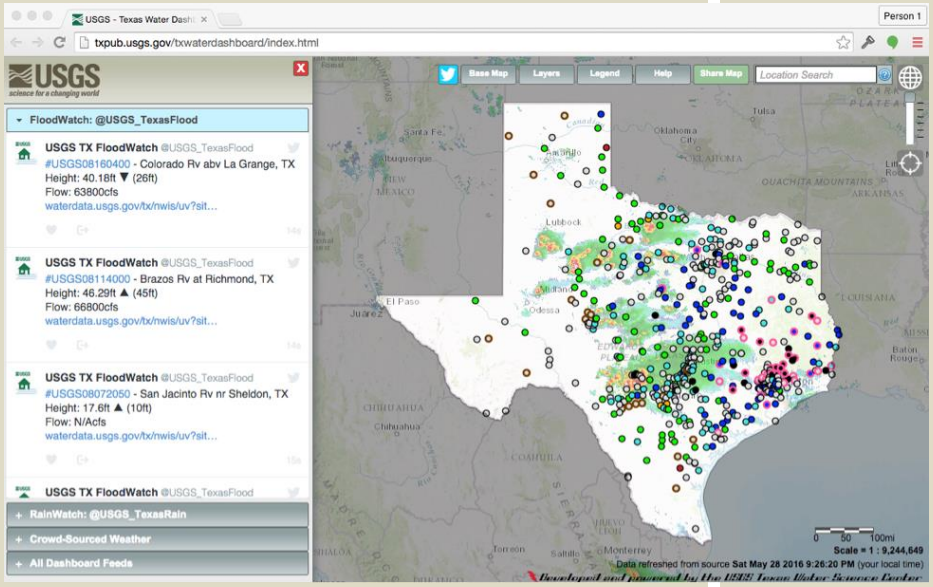
Now, you don't have to search multiple sources when you want the latest information on floods and droughts, or when you're deciding your next recreation destination. The new USGS Texas Water Dashboard presents real-time stream, lake and reservoir, precipitation and groundwater data for more than 750 USGS real-time observation locations in Texas. This USGS information is shown along with weather data such as radar, past precipitation totals, precipitation forecasts and drought conditions from other sources. This cutting-edge map provides critical current water information and NWS forecast data at your fingertips on a desktop, smartphone or other mobile device.

During the recent flooding in Texas, many people throughout the state were without power and relied on social media to get the latest information about current water conditions. It became clear to the USGS Texas Water Science Center that it should explore additional opportunities for distributing water data using social media and mobile platforms.

At its core, Twitter is a real-time public broadcast channel. These characteristics make Twitter a natural platform for public safety communication and early-warning systems. During serious state-wide Texas rains and flooding during 2015 and 2016, Twitter organically emerged as the go-to communication channel for the USGS and other federal, state and local agencies. As widespread power outages occurred, Twitter became an essential source for up-to-date meteorological data and agency announcements.

Since those events, the USGS Texas Water Science Center began exploring new ways to share real-time observation data on the Twitter platform. Two new fully-autonomous feeds were developed to distribute water level and precipitation data: USGS TX FloodWatch (@USGS_TexasFlood) and USGS TX RainWatch (@USGS_TexasRain). The FloodWatch feed automatically sends out Tweets anytime one of about 300 selected USGS stream gages throughout the state rises above the NWS-defined flood level, and delivers information within seconds.





The RainWatch feed Tweets when rainfall exceeds a rate of 0.4 inches per hour. As shown in the example below, the Tweets contain unique, searchable hashtags based on the USGS site ID, current river or rain data, along with a link to that site's page on the USGS National Water Information System (NWIS) system.

The USGS will explore the potential value of this product to the public, and could possibly expand its reach to include the rest of the nation in the future.

Lessons Learned from The Land Down Under

James Stuart, SunWater

February 20th, 2017 marks two years since Tropical Cyclone Marcia (TC Marcia) crossed the Queensland coast. A category 5 system, TC Marcia underwent extremely rapid intensification, overnight to February 20th and moved south passing over the Callide Valley in Central Queensland where riverine flash flooding resulted (see Figures 1 and 2). Community feedback surrounding warnings and dam operation resolved the Queensland State Government to initiate a review leading to a number of recommendations relating to roles and responsibilities with regard to flood warning in Queensland, including a formal role for dam owners such as SunWater.

However, what also became clear, through post-event analysis and through cross referencing other events in Queensland is that there are a number of technical lessons, arguably equally important to those highlighted in the review. These relate to modelling, hydrographic and community resilience components of flood

warning and forecasting systems, particularly in the context of riverine flash floods.

Figure 1: Queensland and the path of TC Marcia, 18th February to 20th February 2015 (Track supplied by Bureau of Meteorology).

Figure 2: Bridge damage, 21st February 2015 (Photo - ABC News).

An uncalibrated, calibrated model?

A well maintained model archive using historical events for calibration and parameter estimation is a mainstay of flood forecasting. What appears to be less well known is how significantly catchment parameters can change once flood events move significantly beyond the bounds of historical experience. In the context of riverine flash floods, there is little time for modification during events. The need to revise parameters 'on the fly' mean models are effectively uncalibrated in such situations.

This was the experience during TC Marcia. Figure 3 shows the post event modelling analysis for the '96k' gauge along Callide Creek, the only inflow gauge to Callide Dam. The gauging trace stopped at 10.23 metres as the logger was inundated. Modelling during the event was difficult and required major revision of catchment parameters relating to changes in catchment storage, channel conveyance, rating curve exceedance and data failure.

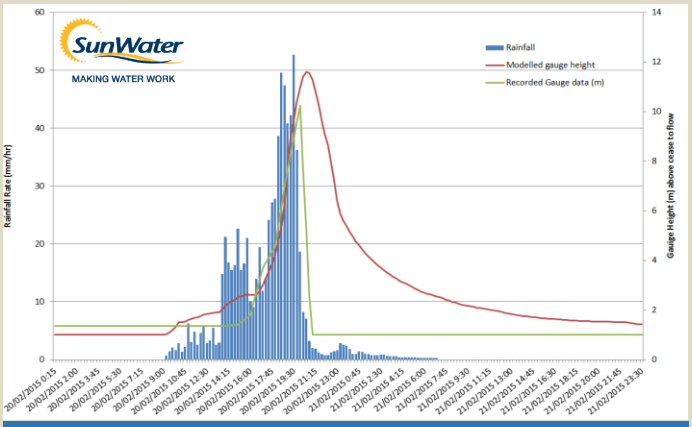


Figure 3: Catchment rainfall with river height and post event analysis from Callide Creek at '96k'.

Channel conveyance altered markedly during the event (Figures 4 and 5, before and after). A more efficient channel brought significantly reduced travel times compared to previous events and rendered the existing stage-discharge rating unreliable. The flood depth at the site was just over two metres above the previous limit of the estimated rating, compounding the uncertainty. Water levels reached just below the roof of the hut seen in Figures 4 and 5.

Figure 4: Callide Dam Inflow Gauge – Before TC Marcia. (Photo – SunWater)

Change in catchment and channel storage parameter estimation was necessary given the above. At the time, rainfall loss rates reduced to zero which indicated unmeasured rainfall, yet post event analysis of additional daily rain totals indicated broad agreement across the catchment with totals matching that measured during the event.

Figure 5: Callide Dam Inflow Gauge – After TC Marcia. (Photo – SunWater)

In addition to the effects of changing parameter estimation, there were also legacy issues relating to reliability of hydrographic data. During the event, there was significant reliance on automated data from stations installed for water resource monitoring without the necessary functionality or redundancy for flood forecasting. Many are located at locations far from ideal for flood forecasting based on historical events, let alone extreme events. One station (see Figure 3) ceased to function as water inundated the logger. No trace of another has ever been found (Figure 6). Both stations were installed as part of a groundwater recharge scheme.

Figure 6: Former gauging station location along Callide Creek (below the dam). No trace of the station was found. (Photo – SunWater)

Community Resilience and preparation

The above factors also have profound effects on the community preparation. The same modelling impacts are occurring when design extreme event modelling takes place that is used by emergency planners. However, in such cases there is no real event data showing just how different catchment behaviour has become. Most extreme design event modelling is based on models calibrated on historical events and it has been the experience of the author that there is little sensitivity testing of model parameters or work to assess rating extensions leading to a potential underestimation of peak flood levels in key areas.

Community resilience activities are focused on two sets of hydrological data; design, and observed events. In Australia, the length of record is short. In countries with longer histories, the probability of design extreme events is much closer to that of the observed. Several recent events in 2011, 2012 and 2015 have demonstrated flood levels well in excess of those *assumed* likely by local communities based on previous experience or from design event modelling. The use of design methods with single temporal and spatial patterns is open to serious question in areas susceptible to tropical rain events. Whilst this is beginning to change with regard to temporal patterns, the variability of spatial patterns can also be vast.

In January 2011, an 'inland tsunami' devastated parts of the Lockyer Valley, just west of Brisbane (Figure 1). Rainfall in the small Paradise Creek catchment of 29km^2 led to velocities able to lower bed levels by 4 metres, 2 metres of which was through bedrock. The ability, for example, of a 5km by 5km storm cell to dump 10mm equating to just over 2000m^3/s for 4 minutes demonstrates the problem; the single spatial pattern has questionable validity in tropical areas and yet is a mainstay of emergency planners.

It is a hazard of flood forecasting that at the time the community wants guidance during a fast moving, record event is possibly the moment there maybe least certainty. Extreme rainfall events are set to increase in Australia with a medium confidence according to the *fifth assessment report from the Intergovernmental Panel on Climate Change*. There are some fundamental, 'back to basic' considerations that mean flood forecasters and communities can and should prepare in some way for such moments in areas likely to be at risk of riverine flash flooding. The ability to recognize such situations is something that can only be learned from experience and passed on through training given the infrequency with which such events occur.

12th National Hydrologic Warning Council Training Conference and Exposition

June 6-8, 2017 at Olympic Valley, California

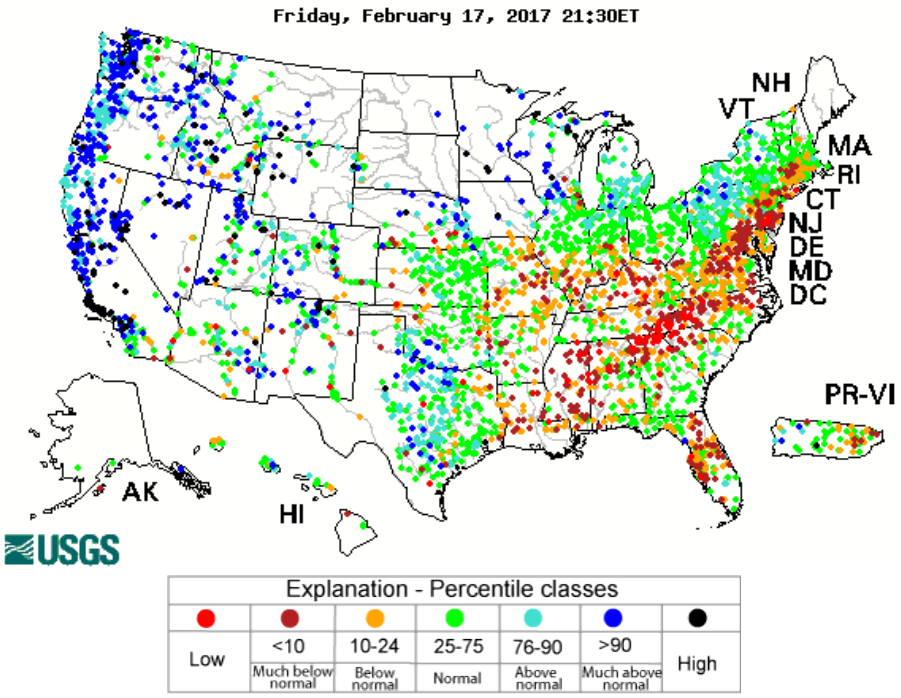
Latest News

- The full conference program is about to be released, go to **www.hydrologicwarning.org**
- Registration fees are available at a reduced rate until April 30 (members and speaker $575, non-members $700). Registration fees include an evening social event at High Camp, 8,200 feet above Squaw Valley and the awards banquet on the last night
- Exhibit booths are available at a reduced rate until February 28
- Special hotel rates of $189 per night are available at Squaw Creek. Hotel reservations can be made online from the NHWC webpage or by calling (530) 583-6300 and referencing "National Hydrologic Warning Council" to secure the group rate. The hotel will honor this special rate until May 15, 2017.
- Reduced government rates of $119 + taxes are available for government employees. To request the special government passkey, please contact april@aprilkrieg.com and provide your government agency information.
- Arrive early and join a golf scramble on Monday June 5 (green fees extra) at 12:30 p.m. at the Squaw Creek Golf Course

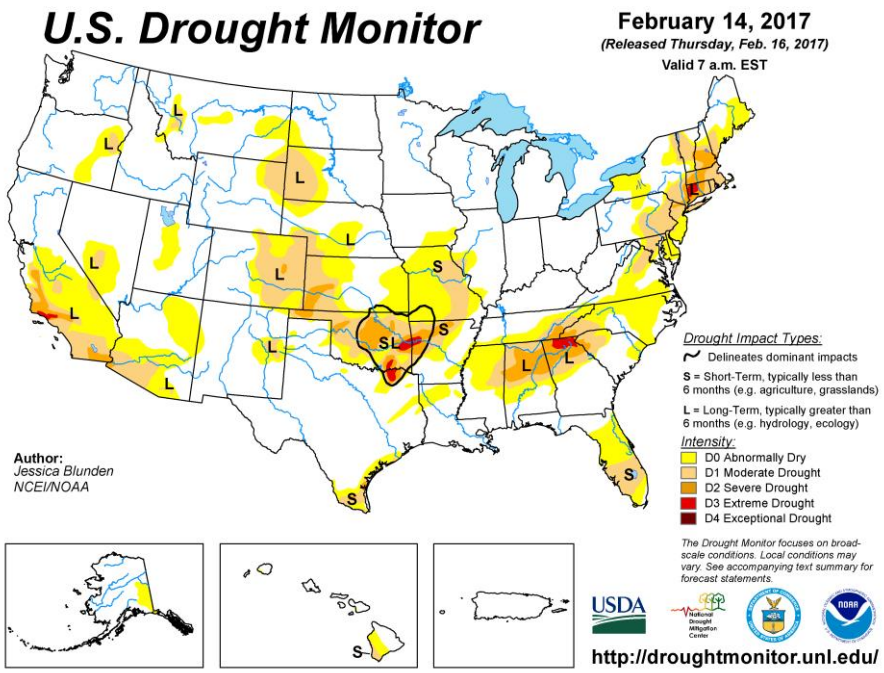
For all the latest information visit

www.hydrologicwarning.org

Hydrologic Conditions in the United States
Through February 14, 2017



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



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

March Newsletter Articles Focus:

Hydrology

The NHWC is requesting articles that focus on hydrology - the science behind the work we do.

Please consider preparing a short article about new methods, research, or discoveries in hydrology or a recent significant hydrologic event.

Submit your article to:

editor@hydrologicwarning.org

March 8th is the deadline for inclusion in the March issue.

Future Newsletter Articles Focus

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

Mar - Hydrology
Apr - Hazard Communication & Public Awareness
May - Modeling/Analysis
Jun - Data Collection

NHWC Calendar

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

General Interest Calendar

April 30 – May 5, 2017 - ASFPM 41st Annual National Conference, Kansas City, Missouri

May 21-25, 2017 - American Society of Civil Engineers, EWRI World Environmental & Water Resource Congress 2017, Sacramento, California

November 5-9, 2017 - AWRA Annual Conference, Portland Oregon

(See the event calendar on the NHWC website for more information.)

Parting Shot

Black Canyon Dam, Arizona – 1/25/2017

The Arizona Game and Fish Department employs a solar powered surveillance camera to keep an eye on this high hazard dam located in the remote high country of Central Arizona. To see the Department's decision support web page for this dam, go to http://water.azgfd.gov/BlackCanyon/

Photo captured off camera by **Brian Iserman**, JE Fuller/Hydrology & Geomorphology, Inc.