The NHWC Transmission

May 2018

CONTENTS

Click on hyperlinks located throughout this newsletter for more information.

NHWC 2017-19 Officers and Directors

Bridging Gaps: How Remotely Sensed Dust-On-Snow Information Can Inform Seasonal Water Supply Forecasts Developed Using Operational Hydrologic Models

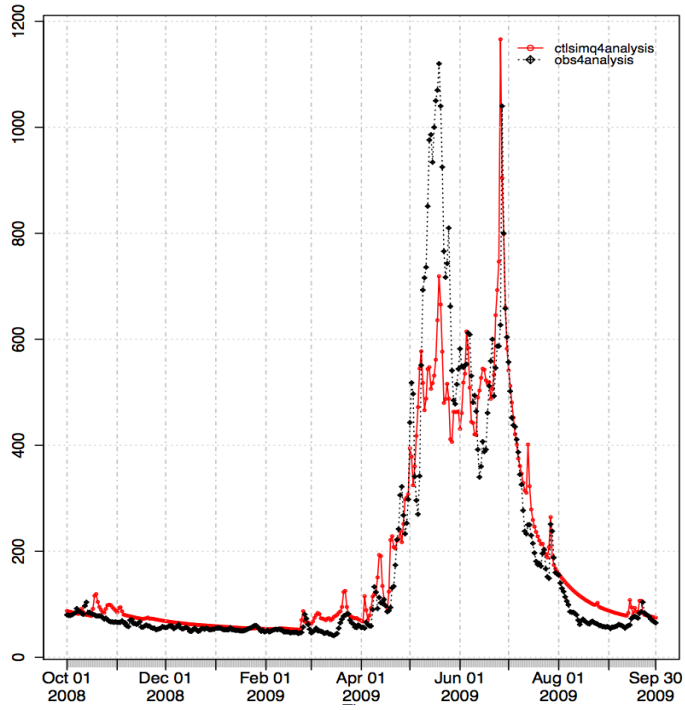
William Paul Miller, NWS

Recent advancements in remote sensing technology, data collection, and dissemination of such data has made it possible for those who work with the forecasting and management of water resources to begin incorporating and utilizing this new information. The Colorado Basin River Forecast Center (CBRFC), an office within the National Weather Service, forecasts seasonal (April through July) volumetric water supply conditions over the entire Colorado River Basin and the eastern portion of the Great Basin. CBRFC forecasts inform the decision-making process at numerous agencies and reservoirs, including Lakes Mead and Powell. Since 2015, the CBRFC has been effectively using remotely sensed data from the National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory's (JPL) Moderate Resolution Imaging Spectroradiometer (MODIS) satellite to quantify the impact to snowmelt-driven streamflow runoff from dust deposition on snowpack. Dust deposition on snowpack reduces the albedo of the snow, resulting in increased melt rates and changes to runoff peaks and timing. These changes in snowmelt characteristics can greatly influence the management and operation of rivers and reservoirs.

The CBRFC worked closely with researchers from NASA JPL to understand how MODIS data could be used in an operational setting. Attention was paid to the Uncompahgre River area in the San Juan River Basin located near the Four Corners area of Colorado, Utah, Arizona, and New Mexico. This area has historically experienced substantial and frequent dust-on-snow events. It was found that the incorporation of dust-on-snow information from the MODIS satellite improved the CBRFC's ability to simulate flows, particularly with respect to the timing and magnitude of the peak (Figure 1).

The CBRFC currently relies on the Sacramento Soil Moisture Accounting (Sac-SMA) hydrologic model, coupled with a snow accumulation and ablation (SNOW-17) model, to develop streamflow forecasts. These traditional models are not able to directly ingest contemporary remotely sensed data, so hydrologists at the CBRFC needed to be innovative and resourceful to develop a methodology to incorporate dust-on-snow information into daily operational forecasts. The SNOW-17 model is a temperature index model, meaning that observed and forecasted air temperatures drive the model to develop appropriate melt characteristics. Since the SNOW-17 model does not include parameters accounting for snow albedo, hydrologists at the CBRFC developed a relationship between MODIS satellite data and temperature to account for changes in snowpack albedo. As albedo decreases,

➡



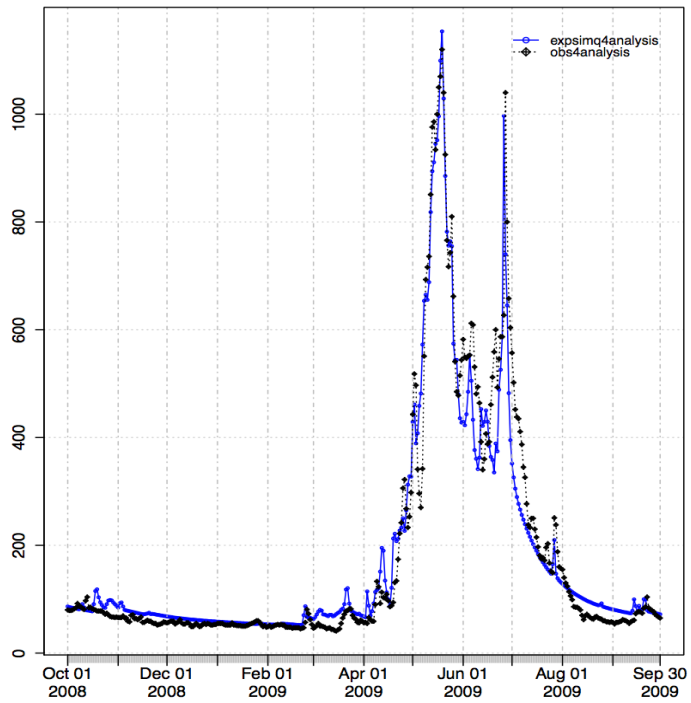


Figure 1: The left graph shows observed streamflow in black and simulated streamflow in red during a May 2009 runoff event on the Uncompahgre River without the utilization of MODIS dust on snow information. The right graph shows the same observed data in black, but the blue line represents simulated streamflow with the incorporation of MODIS data.

temperatures within the CBRFC's hydrologic modeling paradigm can be adjusted upwards to increase snowpack melt rates and accelerate the timing of runoff in response to the presence of dust on snow. This truly innovative method allows the CBRFC to continue to use traditional operational modeling systems with state-of-the-art information collection and data systems.

To maintain transparency and share results with interested stakeholders, the CBRFC produces maps showing the daily temperature adjustment due to changes in snow albedo, as derived from the MODIS satellite. These maps show red colors when temperatures are adjusted upwards in response to decreased albedo, and blue colors when temperatures are adjusted downward in response to higher snowpack albedo which typically occurs after a fresh snow event (Figure 2).

The CBRFC continues to evaluate the effectiveness of utilizing remotely sensed data and is working with researchers to investigate the possible use of remotely sensed snow-covered area and snow depth information. The incorporation of NASA JPL MODIS data into CBRFC operational forecasts illustrates how the research to operations gap can be overcome through close collaboration and cooperation between stakeholders and agencies, as well as

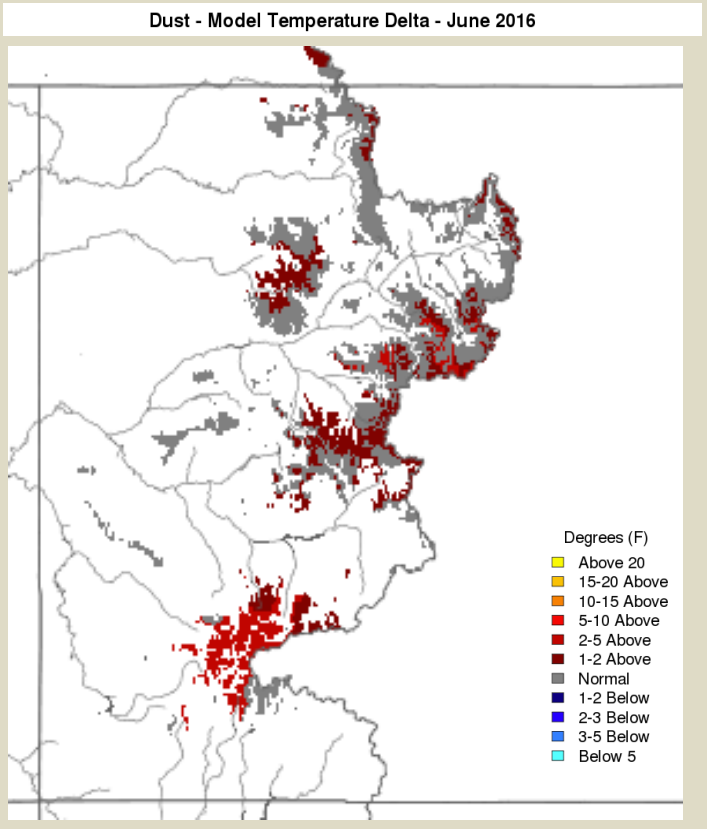


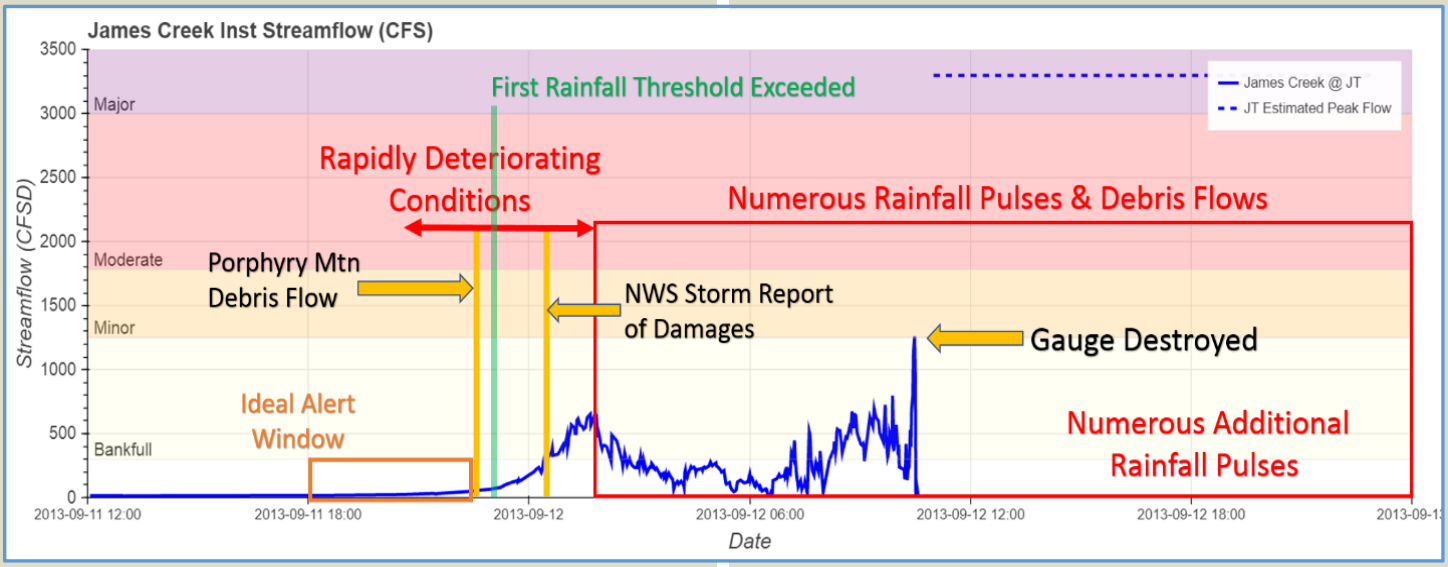
Figure 2: CBRFC temperature adjustments in response to MODIS satellite data over the western Colorado area.

how "outside the box" thinking can overcome seeming disconnects between older models and contemporary data and technology.

Refining Rainfall Alert Thresholds for the James Creek Watershed in Colorado

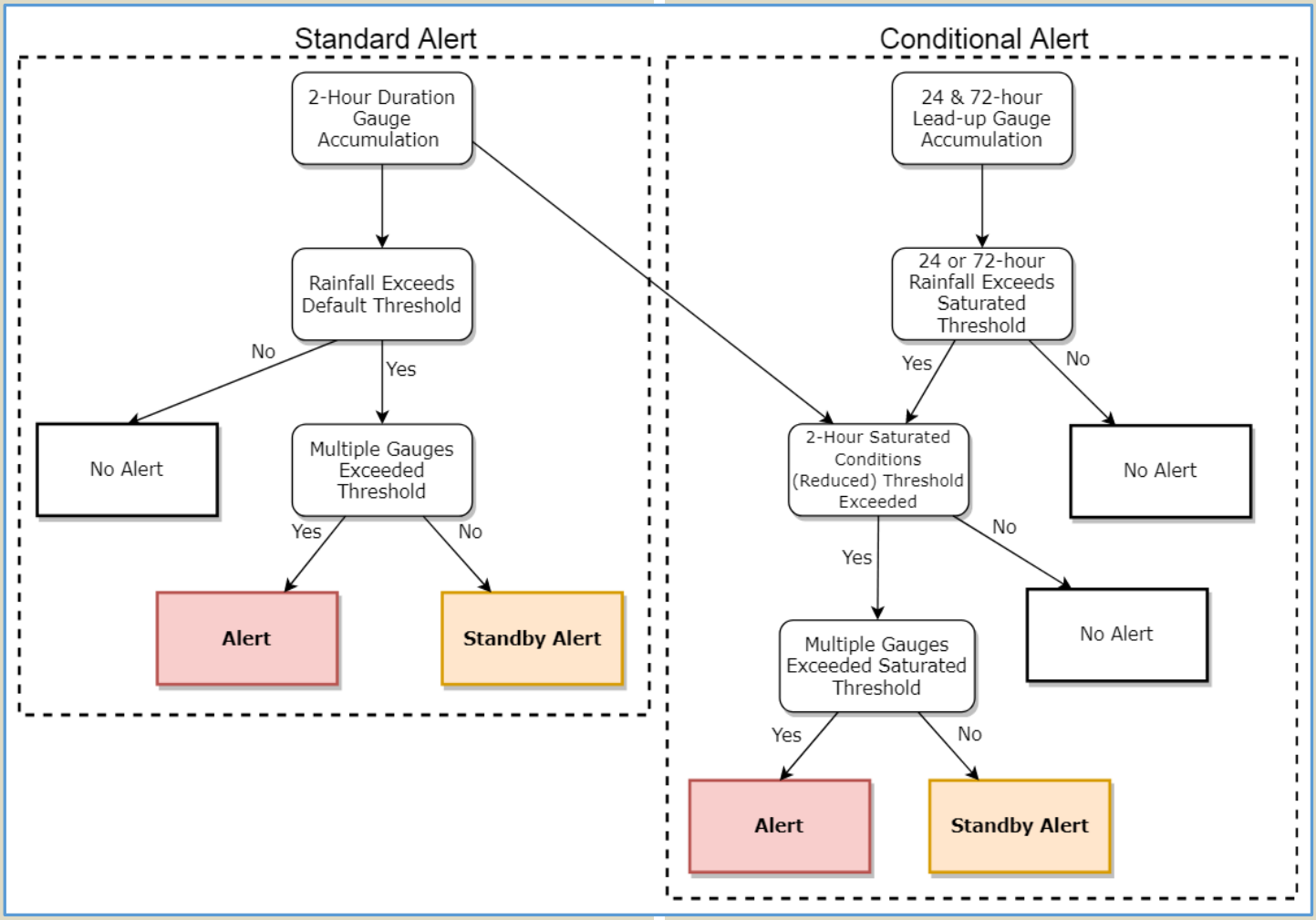
Ryan Spies and Graeme Aggett, Lynker Technologies

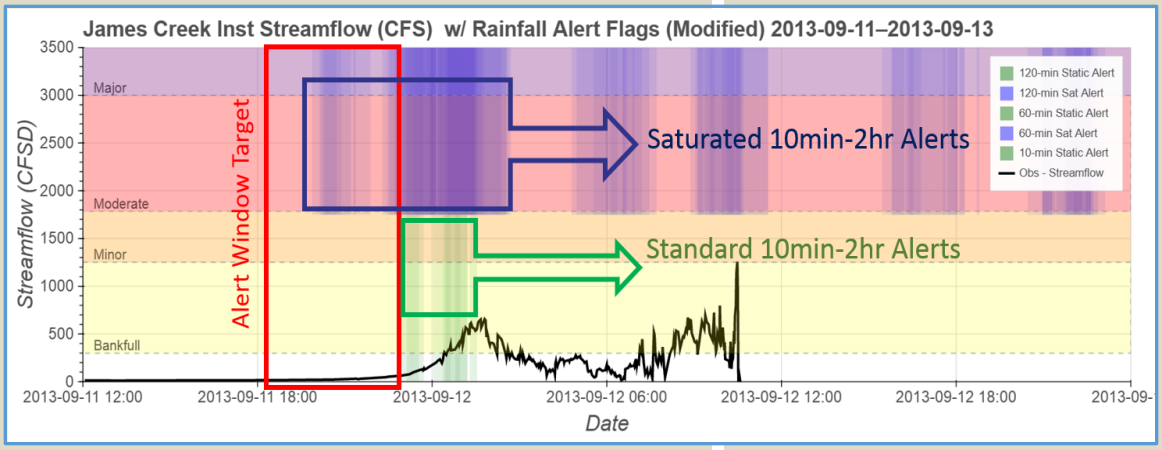
In the wake of September 2013 heavy rainfall and ensuing flooding and debris flow damage, the mountain town of Jamestown Colorado is working to improve the Flood Early Warning System for the small community. A reanalysis of the 2013 rain gauge data found the existing rainfall thresholds configured for the automated rain gauge alert network did not provide an adequate level of alert lead time. This finding was largely due to the abnormally prolonged nature of the rainfall event with relatively moderate rainfall intensities. The existing rainfall threshold values were not well-suited for the extended rainfall duration over the mountains of the James Creek watershed.



To improve the rainfall alert lead time in advance of flooding and/or debris flows, Lynker Technologies developed a more comprehensive system of "conditional" rainfall alerts to be included with standard thresholds currently used within the Boulder County OEM monitoring system. The newly developed conditional alerts rely on a "if this then that" approach to determine if antecedent rainfall conditions warrant a sensitivity adjustment to account for additional rainfall falling on saturated soils. By using the longer duration (e.g. 24-hour and 72-hour) continuous rainfall accumulation calculations as a proxy for saturated soil conditions, the shorter-duration rainfall accumulation thresholds are treated as dynamic values that will be reduced when conditions are primed for rapid runoff and/or debris flow potential. This system of conditional thresholds is intended to be applied alongside the standard (static) threshold values (e.g. 1-inch rainfall in 1-hour). The combined rainfall alert configuration might then provide a more robust monitoring system capable of covering a wider range of rainfall scenarios that could potentially lead to flooding and debris flow hazards.

The historical rainfall analysis (1999-2016) tested and evaluated numerous rainfall alarm thresholds in preparation for providing emergency managers and the Jamestown community with insight and recommendations for future rainfall alert monitoring. The graphical approach applied to this development/evaluation aimed to focus alert thresholds on potential threats related to flooding on James Creek as well as hillslope saturation and subsequent debris flow initiation (based on the chronology of observed impacts during the Sep. 2013 event). The rainfall analysis largely focused on the following criteria when testing and evaluating threshold values:

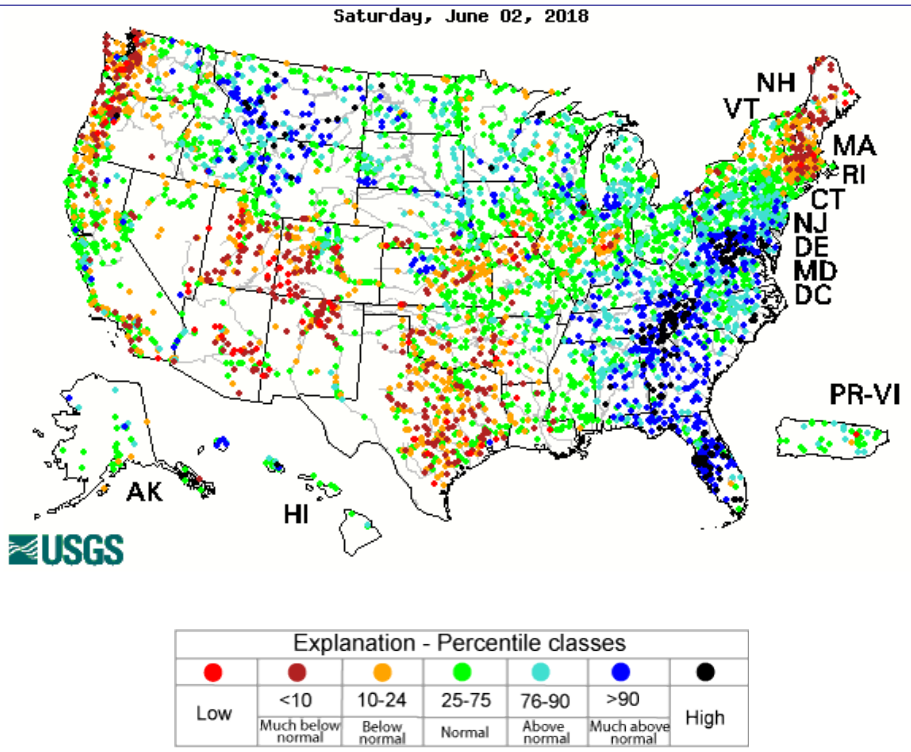




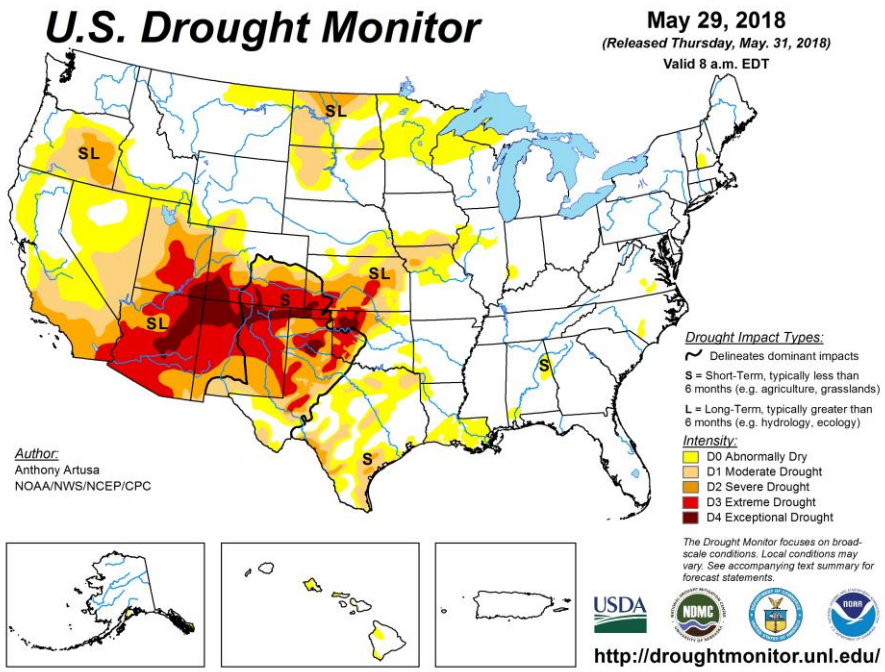
- Timing of threshold exceedances for the September 2013 event
- Quantity and validity of alert instances in the historical evaluation (compare to NWS warnings issued and storm reports)
- Simultaneous alert instances for multiple gauges
- Simultaneous alert instances for multiple threshold duration periods

Results from the retrospective alert analysis for the September 2013 event show new conditional alert instances occurring nearly 3-hours in advance of the first damage reports and the first standard rainfall alert. While the September 2013 rainfall event was the only significant event within the observed data period of record, there were several shorter-duration rainfall events included in the historical record evaluation. The newly defined conditional alerts were not triggered outside of the September 2013 event which highlights the intended use of the conditional alerts in providing advanced lead time without adding “false alarm” instances. When combined with a comprehensive communication and community response plan, these conditional thresholds can better prepare the Jamestown community for an uncertain future of heavy rainfall events.

Hydrologic Conditions in the United States
Through May 29, 2018



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



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

June Newsletter Articles Focus:

Data Collection

The NHWC is requesting articles that focus on practices, technologies and tools used to gather and disseminate real-time hydro-meteorological data.

Please consider writing an article that highlights how your organization collects and disseminates real-time data.

Submit your article to:

editor@hydrologicwarning.org

June 15th is the deadline for inclusion in the June issue.

Future Newsletter Articles Focus

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

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

NHWC Calendar

June 17-20, 2019 – The NHWC 13th Biennial Training Conference and Exposition, Louisville, Kentucky

General Interest Calendar

June 17-21, 2018 – ASFPM 2018 Annual Conference, Phoenix, Arizona

July 10-12, 2018 – National Association of Flood & Stormwater Management Agencies (NAFSMA) 40th Anniversary Annual Meeting, Santa Fe, NM

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

Parting Shot

In Memory
Timothy Royer
April 1, 2018

Timothy Royer, Senior Technician for the City of Fort Worth's TPW Stormwater Field Engineering, died unexpectedly on Sunday, April 1st. He was 56 years old.

Timothy was born and raised on the island of Dominica in the West Indies.

He was truly a one-of-a-kind co-worker, friend, and colleague. Always professional, kind-hearted, and industrious. He initially started with the City as a temporary employee and was later hired as a full time, permanent employee in December 2012. As their Senior Engineering Technician, he was responsible for managing the High-Water Detection Warning System program.

Timothy participated in several National Hydrologic Warning Council and ALERT Users Group conferences since 2012.

Contributed by **Sue Swenor**, High Sierra Electronics, Inc.