The NHWC Transmission

July 2018

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US IOOS® QARTOD Project Stream Flow QC Manual

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The U.S. Integrated Ocean Observing System is a partnership of 17 federal organizations. Within IOOS, the Quality Assurance / Quality Control of Real-Time Oceanographic Data (QARTOD) Project is tasked with developing quality control manuals for 34 IOOS core variables where possible (QARTOD Project Plan Update, U.S. IOOS, 2015). Our team has an IOOS project manager, a board of advisors, a national coordinator, a technical writer, and hundreds of volunteers who contribute to the manuals. Eleven manuals have been developed along with several additional supporting documents, and they can be found at https://ioos.noaa.gov/project/qartod.

One of the primary purposes of our QARTOD manuals is to provide guidance to those creating software to implement these real-time QC tests. Here, real time means that: data are delivered without delay for immediate use; the time series extends only backwards in time, where the next data point is not available; and sample intervals may range from a few seconds to a few hours or even days, depending upon the sensor configuration. Another important distinction is our focus on QC – testing the resultant data – in contrast to QA, where efforts center on the techniques used initially to generate quality data.

The manuals are drafted and reviewed by a committee of subject matter experts, reviewed again by operators and data users, and reviewed a third time by the broadest community possible. All comments received throughout the manual development process are recorded in an adjudication matrix, where a response is recorded. Manuals are updated every few years to ensure content remains accurate and relevant.

Figure 1- A typical U.S. Geological Survey stage (water level) station with accompanying meteorological sensors.

QARTOD is developing a Manual for Real-Time Quality Control of Stream Flow Observations: A Guide to Quality Control and Quality Assurance for Stream Flow Observations in Rivers and Streams. Tests apply to discharge values calculated using the most commonly employed observations, such as stage (water levels from pressure sensors, microwave [Fig. 1], and acoustic altimeters), acoustic Doppler velocity meters and current profilers, and radar surface velocity sensors.

Our initial list of stream discharge tests (a work in progress) addresses data gaps, syntax, location, gross range, climatological range, spikes, rate of change, flat line, multi-variate comparisons, attenuated signal, and neighbor inspection. Tests are identified as required (easily implemented), highly recommended (more challenging), or suggested (perhaps in development). Experienced local operators are in the best position to select test thresholds.

Tests results are characterized by the flags shown in Table 1. QARTOD flags follow the standard adopted by the Intergovernmental Oceanographic Commission and are described in the QARTOD data QC flag manual (US IOOS, 2017 and UNESCO, 2013).

Table 1. QARTOD data flags.

Flag	Description
Pass=1	Data have passed critical real-time quality control tests and are deemed adequate for use as preliminary data.
Not Evaluated=2	Data have not been QC-tested, or the information on quality is not available.
Suspect or Of High Interest=3	Data are considered to be either suspect or of high interest to data providers and users. They are flagged suspect to draw further attention to them by operators.
Fail=4	Data are considered to have failed one or more critical real-time QC checks. If they are disseminated at all, it should be readily apparent that they are not of acceptable quality.
Missing Data=9	Data are missing; used as a placeholder.

QARTOD test guidance has helped to establish QC standards internationally. The tests identify system failures sooner, improve service response, increase data return, and prevent the dissemination of flawed data. Most importantly, they provide assurance to data generators and users that each data point has been evaluated and can be used with confidence for decisions, models, forecasts, and other applications.

We are grateful for the assistance already provided by U.S. IOOS, the U.S. Geological Survey, the Water Survey of Canada, the National Institute for Research in Science and Technology for the Environment and Agriculture of France, and the Tasman District Council of New Zealand. We would appreciate your thoughts and suggestions; please contact mark.bushnell@noaa.gov to obtain a draft for your consideration.

References

U.S. Integrated Ocean Observing System, 2015. U.S IOOS QARTOD Project Plan - Accomplishments for 2012–2016 and Update for 2017–2021. 47 pp. https://doi.org/10.7289/V5JQ0Z71

U.S. Integrated Ocean Observing System, 2017. Manual for the Use of Real-Time Oceanographic Data Quality Control Flags Version 1.1. 41 pp. https://doi.org/10.7289/V5B56GZJ

Paris. Intergovernmental Oceanographic Commission of UNESCO, 2013. Ocean Data Standards, Vol.3: Recommendation for a Quality Flag Scheme for the Exchange of Oceanographic and Marine Meteorological Data. (IOC Manuals and Guides, 54, Vol. 3.) 12 pp. (English) (IOC/2013/MG/54-3) http://www.nodc.noaa.gov/oceanacidification/support/MG54_3.pdf

Using Gridded NOAA Atlas 14 Point Precipitation Depths and a Site-Specific Depth-Area Reduction to Determine Varying Frequency Hydrographs within the Elkhorn River Watershed

Katherine Werner, U.S. Army Corps of Engineers

Introduction

The Elkhorn Basin Flood Plain Management Services (FPMS) Study is a collaborative effort between the Nebraska Department of Natural Resources (NeDNR), the United States Army Corps of Engineers (USACE), and the Federal Emergency Management Agency (FEMA) Region VII. The Elkhorn River is located in northeastern Nebraska and covers approximately 7,000 square miles, 11 Federally Constructed Levees, 5 high hazard dams, and dozens of NFIP participating communities. Previous flood risk information in the basin was developed specific to different communities or decisions, such as NFIP Mapping and levee management (O&M, risk screening, NFIP certification, and 408 modifications).

Unfortunately, these different studies used various methods and lead to inconsistent data. One of the reasons for there being no previous basin wide evaluation is the basin itself, with a large area and point precipitation gradient, basin modeling is a challenge. With efforts to remap the area in the NFIP, expected levee certification efforts, transportation improvement efforts, and recent flooding in 2010, it was recognized that there was a need for updated, consistent information.

The purpose of the hydrologic analysis was to develop peak flow frequencies (2-, 5-, 10-, 25-, 50-, 100-, 200-, 500-year, and 100-plus) and corresponding hydrographs throughout the Elkhorn River Basin. Peak flow frequencies were estimated at over a dozen gages throughout the watershed using Bulletin 17C guidelines. Additionally, a gridded hydrologic model of the Elkhorn watershed using HEC-HMS was developed, calibrated, and simulated with frequency-based design storms to estimate peak flow frequencies and associated hydrographs at 372 computation points throughout the watershed.

Gridded point precipitation estimates from NOAA Atlas 14 were used to develop frequency-based hypothetical storms. Using point precipitation requires the application of areal reduction factors to transform the point rainfall depths to an equivalent rainfall depth over a given area. In HEC-HMS, these areal reduction factors are built in for drainage areas up to 400 square miles. Due to the larger size of the Elkhorn Basin, it was necessary to develop a site-specific depth-area reduction curve.

Site-Specific Depth-Area Reduction Curve

To develop a site-specific depth-area reduction curve, dozens of storms across a region with similar hydrometeorological characteristics were analyzed based on hourly radar data. Figure 1 illustrates the approximate regional boundary, along with the approximate centers of the storms.

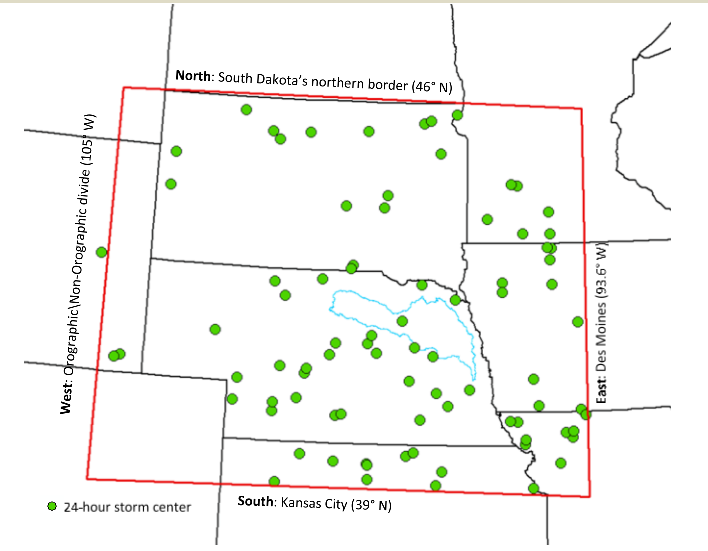


Figure 1. The 24-hour historical storm centers in green; with the Elkhorn Basin boundary in blue and the approximate regional storm boundary used to develop depth area reduction curves in red.

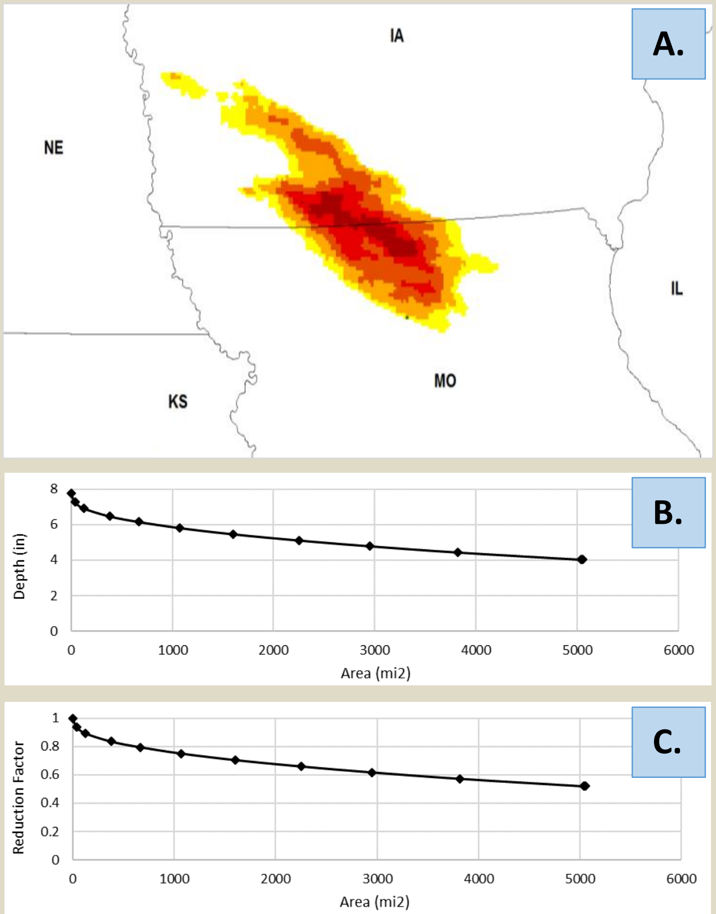


Figure 2. The analysis for each storm included: (A) evaluation of the storm to create isohyets, (B) development of depth-area curve, and (C) normalization to find a depth area reduction curve.

Figure 2 shows the three major steps in the analysis of each storm which included the spatial examination of the storm to create isohyets, the development of the depth-area curve, and the normalization to generate the depth-area reduction factors. The spatial analysis and depth-area curve development for each event was done prior to this study as part of an ongoing USACE effort to develop an extreme storm database. Depth-area curves were normalized by dividing by the corresponding storm's maximum rainfall depth to obtain depth-area reduction factors.

To develop a site-specific curve with study emphasis on infrequent flood events, a number of the storms with lower depth-area reduction curves were omitted. Based on the remaining storms and with more weight on those storms closer to the Elkhorn Basin, a new areal reduction curve was developed. For modeling purposes, a step function was developed to break the smoothed depth-area reduction curve into nearly a dozen increments (see Table 1). The stepped

Table 1. The stepped area increments and depth area reduction factors.

Area Range (mi²)		DARF
0	20	1.0
20	30	0.98
30	60	0.96
60	125	0.93
125	250	0.88
250	400	0.84
400	600	0.80
600	1100	0.75
1100	1500	0.695
1500	3000	0.65
3000	7000	0.59

area increments reasonably represent the depth-area reduction values for all the computation points (within 3%) and significantly reduce the number of model runs necessary to produce results at each point.

Figure 3 displays the depth-area reduction curves for the 24-hour storms, the adopted curve, the corresponding stepped curve, and the computation points.

NOAA Atlas 14 Point Precipitation

To develop the frequency-based hypothetical storms, the gridded NOAA Atlas 14 point precipitation product was downloaded for each frequency of interest. Using a gridded precipitation product allows for the precipitation gradient across the basin to be captured. The point precipitation depth varies up to 2 inches across the Elkhorn Basin for the 24-hour duration, 100-year return period storm.

The point precipitation rasters were downloaded and processed using an ArcGIS model to obtain a gridded HEC-DSSVue output, a format HEC-HMS can recognize. Time series grids for the duration of the precipitation event were developed for all frequencies using the HEC-MetVue tool and an assumed alternating block temporal pattern.

Application

Before running the calibrated HEC-HMS model, the depth-area reduction factors were applied to the gridded precipitation frequency events. Within HEC-MetVue, the precipitation events were multiplied by the depth-area reduction factors (i.e. 0.84 for computation points with drainage areas ranging from 250-400 square miles) which resulted in eleven precipitation products for each frequency. To efficiently filter all the HEC-HMS outputs to obtain only pertinent flows at all the computation points, several python scripts were created and run within HEC-DSSVue. The final product was a tabular peak flow frequency and a single HEC-DSSVue file containing the pertinent suite of frequency hydrographs at each of the 372 computation points.

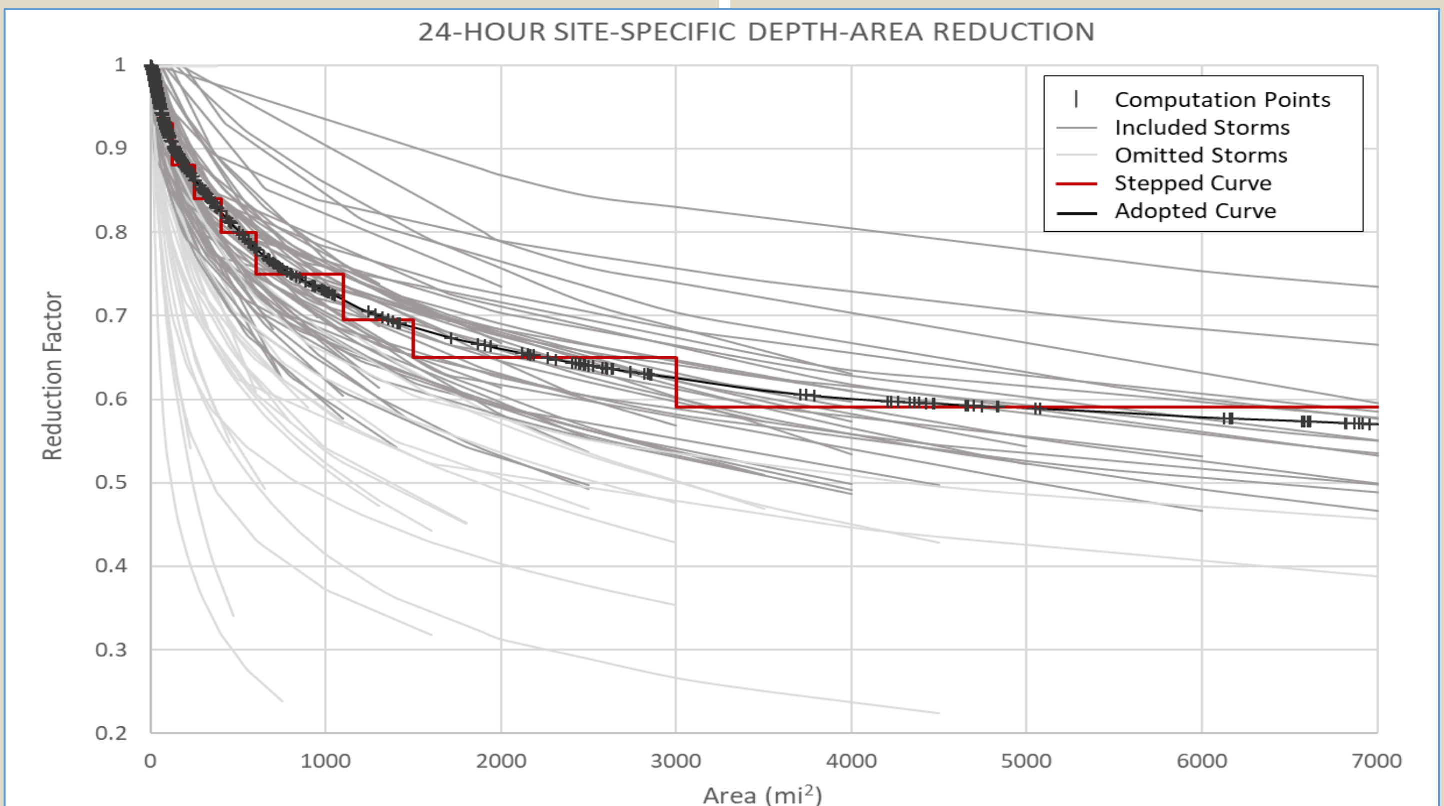


Figure 3. The depth-area reduction curves for regional 24-hour storms, the final site-specific depth-area reduction curve, the stepped curve used for HEC-HMS modeling, and the 372 computation points within the Elkhorn Watershed.

Save the Date - 1

2018 Fall Workshop

The 2018 ALERT Users Group Fall Workshop is scheduled for Thursday, October 25, 2018 at the Courtyard Sacramento Airport Natomas, 2101 River Plaza Drive, Sacramento, CA, 95833

The meeting cost is $100.00, which includes breakfast and lunch.

Please RSVP to Robert Laag, relaag@rivco.org or 951-955-1232. The deadline to register is noon on October 19, 2018

For more information, visit https://alertsystems.org/

Save the Date - 2

NHWC 10th Annual Texas Fall Workshop

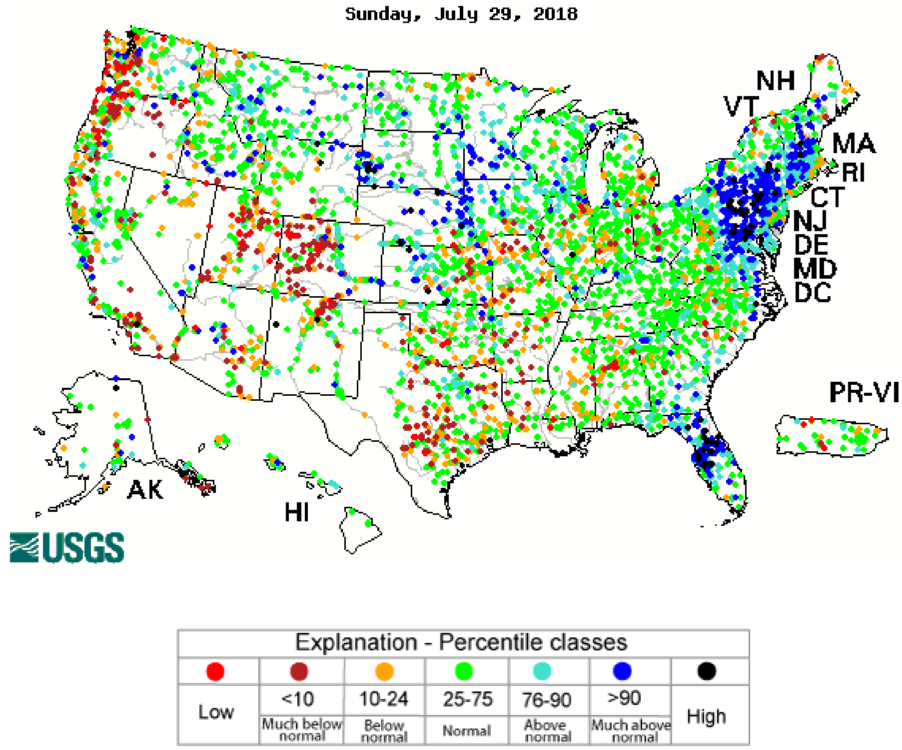
November 14-15, 2018

Like last year, the venue for this years' workshop will be the historic Menger Hotel located at 204 Alamo Plaza in San Antonio, Texas.

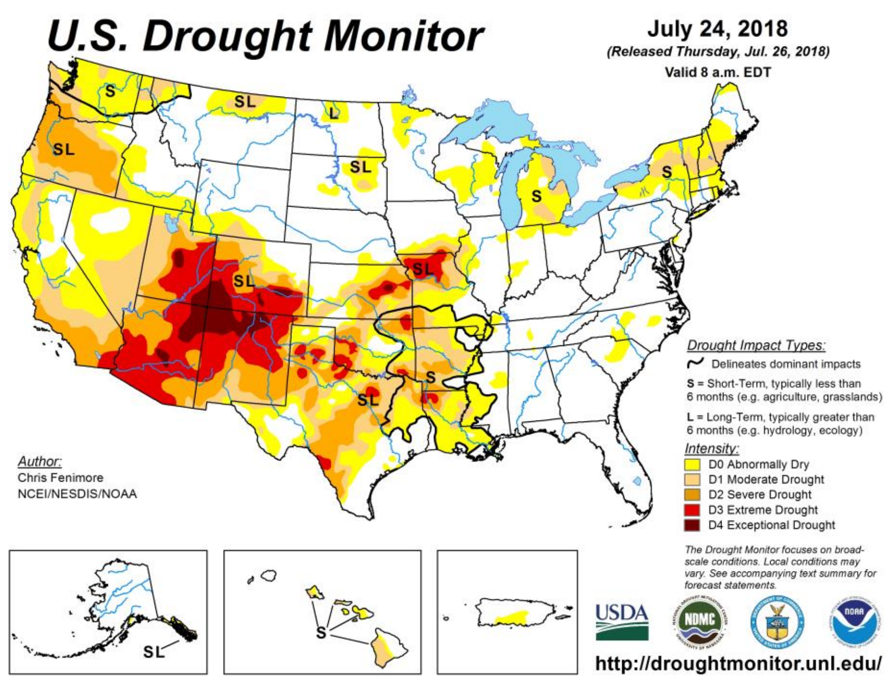
Watch this newsletter and the NHWC website for new information coming soon.

Hydrologic Conditions in the United States

Through July 24, 2018



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



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

August Newsletter Articles Focus:

Hazard Communication and Public Awareness

NHWC is requesting articles that focus on getting the word out.

Please prepare an article that explains how your organization gets the right real-time data and information to the right people for the right response.

Submit your article to:

editor@hydrologicwarning.org

August 10th is the deadline for inclusion in the August issue.

Future Newsletter Articles Focus

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

Aug- Hazard Communication & Public Awareness
Sep- Modeling/Analysis
Oct - Data Collection
Nov- Hydrology

NHWC Calendar

November 14-15, 2018 – 10th Annual Texas Fall Workshop, San Antonio, Texas

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

General Interest Calendar

September 9-13, 2018 – ASDSO Dam Safety 2018, Seattle, Washington

October 25, 2018 – 2018 ALERT Users Group Fall Workshop, Sacramento, California

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

Parting Shot

Keeping an eye on dam safety.

Adobe Dam, Arizona – July 26, 2018

This remote camera system is one of 3 installed last week by the Flood Control District of Maricopa County (FCDMC), Arizona to help keep close watch on their flood control dams. This one, installed at Adobe Dam, augments an existing ALERT2 station at this location. Recent images from this and other cameras operated by the FCDMC can be accessed at http://alert.fcd.maricopa.gov/alert/Google/v3/gmap.html.

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