United States Department of the Interior
U.S. GEOLOGICAL SURVEY
Reston, Virginia 20192

In Reply Refer To: March 21, 2016
Mail Stop 415

Memorandum

OFFICE OF SURFACE WATER TECHNICAL MEMORANDUM 2016.03

SUBJECT: Release and use of QRev for processing moving-boat streamflow measurements
            made with acoustic Doppler current profilers

The purpose of this memorandum is to announce the release of U.S. Geological Survey (USGS) QRev software for processing streamflow measurements made using an acoustic Doppler current profiler (ADCP) from a moving-boat. Office of Surface Water (OSW) developed QRev to improve the consistency and efficiency of processing ADCP streamflow measurements. Users are encouraged to use QRev to process moving-boat ADCP streamflow measurements because QRev provides:

1. automated data quality checks with feedback to the user;
2. automated data filtering;
3. automated application of extrap, LC, and SMBA algorithms;
4. consistent processing algorithms independent of the ADCP used to collect the data;
5. improved handing of invalid data; and
6. an estimated uncertainty to help guide the user in rating the measurement.

After a transitional period (3-6 months) to ensure that implementation is smooth and any issues and bugs are addressed, OSW plans to make use of QRev mandatory for processing moving-boat ADCP streamflow measurements. OSW will issue a future memorandum indicating when use of QRev becomes mandatory. Although QRev has been tested extensively through multiple rounds of beta testing, early adoption and use of QRev will help resolve implementation issues and any remaining bugs. If users experience problems with using QRev please post to the QRev board on the WMA Technical Support Forum (https://simon.er.usgs.gov/smf/index.php?board=53.0) or contact David Mueller (dmueller@usgs.gov) so that the problem can be addressed. If a problem or bug prevents use of QRev, the use of WinRiver II and RiverSurveyor Live for post-processing is still acceptable.

Background

The review and post-processing of ADCP moving-boat streamflow measurements have been accomplished using manufacturer-supplied software and the user's knowledge and experience to interpret the quality of the measurement, correctly configure discharge processing settings, and set appropriate thresholds to screen out erroneous data. These dependencies have created two problems for the USGS.

1. The manufacturer-supplied software has limited automated quality assessment features and the graphics and tables for user review are inconsistent among the manufacturers. Consequently, data quality assessment is not independent of the instrument used to make the measurement, but rather is dependent on the capabilities of the manufacturer-supplied software for review and assessment of the data quality. The lack of automated quality assessment places increased responsibility on the user, hinders efficient review, and may result in inconsistent assessments of data quality.

2. Manufacturer-supplied software use different algorithms for some aspects of the data processing and discharge computation. Consequently, if the same data set could be processed by each of the manufacturers' software the resulting discharges could be different.

Development of common and consistent computational algorithms combined with automated filtering and quality assessment of the data will provide substantial improvements in the quality of streamflow measurements and ensure that USGS streamflow measurements made using ADCPs are efficient, consistent, accurate, and independent of the manufacturer of the instrument used to make the measurement.

OSW has developed QRev to compute the discharge from a moving-boat ADCP measurement using data collected with any of the Teledyne RD Instrument (TRDI)[1] or SonTek bottom-tracking ADCPs. QRev applies consistent algorithms for the computation of discharge, independent of the ADCP manufacturer. In addition, QRev automates filtering and quality checking of the collected data and provides feedback to the user regarding potential quality issues with the measurement. Various statistics and characteristics of the measurement, in addition to a simple uncertainty assessment, are provided to the user to assist them in properly rating the measurement. QRev saves an XML file that can be imported into databases or electronic field notes software, such as, SVMobile.

Design, Installation, and Use

QRev was designed to be used in both the field and office. The graphical user interface was designed to work on tablets, so most controls are buttons, radio buttons, and check boxes that can be easily operated by tapping on the screen. QRev is written and compiled with Matlab and requires the installation of the Matlab runtime libraries. Additional details about QRev, download, installation instructions, and recommended workflow can be found at

---

[1] Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

https://hydroacoustics.usgs.gov/movingboat/QRev.shtml. QRev can be used on desktops, laptops, and tablets running either 32- or 64-bit versions of the Windows operating system[2]. QRev should be used in the field to process measurement immediately after data collection and in the office to review measurements. The *_QRev.mat file created by saving processed data in QRev, contains all the original data and final processing settings. The *_QRev.mat file is independent of the original manufacturer files. Thus data processed with QRev should only be reviewed by loading the *_QRev.mat file. WinRiver II and RiverSurveyor Live files should be considered the original field data and not used for review or reprocessing of data previously processed in QRev. In the rare situation where a display of data in WinRiver II or RiverSurveyor Live is not available in QRev, that portion of the data could be reviewed using WinRiver II or RiverSurveyor Live.

Compatibility with SV Mobile and NWIS

The discharge computed by QRev can be loaded into NWIS by importing an XML file created by QRev into SV Mobile version 1.0.10 or later and then importing the resulting XML file from SV Mobile into NWIS. A new stylesheet has been developed to incorporate some of the features of QRev and updates to other fields to better serve information from newer ADCPs. This new stylesheet is automatically available when using the Field Sheet Viewer.

/signed/

Robert R. Mason, Jr.
Chief, Office of Surface Water

Distribution: GS-W All

---

[2] Matlab 2015b is the last version Mathworks will deliver with support for 32-bit operating systems. QRev is expected to support 32-bit operating systems until about mid-2017.