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March 4, 2009

OFFICE OF SURFACE WATER TECHNICAL MEMORANDUM 2009.02

SUBJECT: Release of WinRiver II Software (version 2.04) for Computing Streamflow from Acoustic Doppler Current Profiler Data

The purpose of this memorandum is to announce the availability of WinRiver II version 2.04 for collecting and processing data from Teledyne RD Instruments¹ (TRDI) acoustic Doppler current profilers (ADCP's). All USGS users who collect streamflow data using TRDI ADCP's must upgrade to WinRiver II version 2.04 immediately. The software is available to USGS personnel at http://hydroacoustics.usgs.gov/movingboat/mbd_software.shtml.

Several significant changes have been implemented in WinRiver II version 2.04. Some of these changes may result in differing measured discharge compared to prior releases. Some measurements collected during the 2009 water year should be reprocessed as indicated in the list of key changes below (sections in italics).

- 1. Improved Stability.** The USGS and TRDI received many reports of software crashes when using WinRiver version 2.02. TRDI identified several causes for this instability and has addressed these in the current release. Version 2.04 should provide much improved stability.
- 2. Change in Side-Lobe Cutoff Calculation.** For each ensemble, WinRiver calculates a depth below which velocities measured by the ADCP are not used due to possible errors caused by side-lobe interference. This depth is referred to as the side-lobe cutoff. In previous versions of WinRiver (2.02 or earlier) the side-lobe cutoff was calculated as 6% of the depth, computed as the mean of all valid beam depths for an ensemble (figure 1a). The new side-lobe cutoff is calculated as 6% of the shallowest beam depth in an ensemble (figure 1b). For example, the side lobe cutoff computed for ensemble 78 in figure 1 for prior versions of WinRiver II is 2.4 ft. The beam depths measured for this ensemble were 1.9, 3.5, 3.3, and 1.7 ft. The new side lobe cutoff, computed using WinRiver II version 2.03 and 2.04 is 1.6 ft. The change in the side-lobe cutoff may result in fewer valid depth cells in ensembles near sloping banks and in cross sections with irregular or rough streambeds. As a consequence, the middle (measured portion of the cross-section) discharge will decrease and the bottom (unmeasured or extrapolated portion of the cross-section) discharge will increase.

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

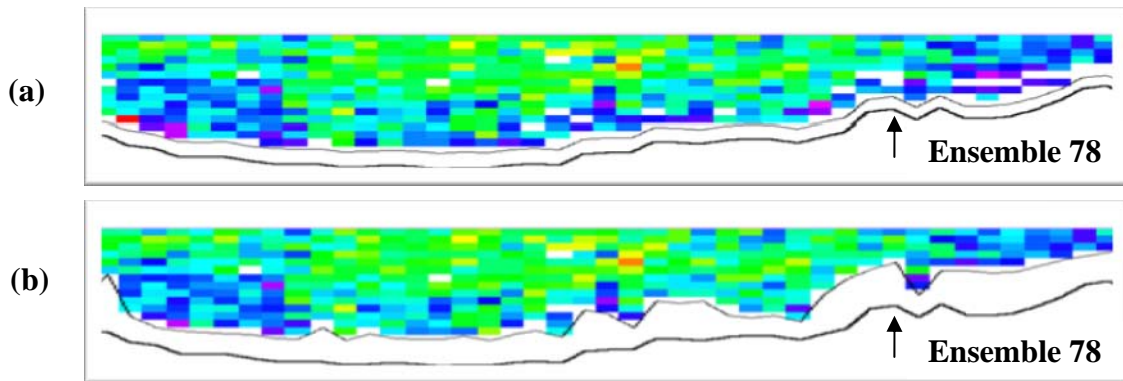


Figure 1. Velocity contour plot of a transect processed with side-lobe cutoff calculated as (a) 6 percent of mean beam depths, as in WinRiver versions prior to 2.03 and (b) with the new side-lobe cutoff calculated as 6 percent of the minimum beam depths.

OSW has used the new version of WinRiver II to reprocess discharge measurements from Oberg and Mueller (2007) as well as other available measurements. Based on the discharge measurements reviewed to date, the new side-lobe cutoff has resulted in a median difference in discharge of +0.5 percent. The typical change in discharge was less than 1 percent. However, for about 4 percent of the discharge measurements reviewed the discharge changed by more than 5 percent. The largest changes were found for measurements made in shallow uneven cross sections that would typically be considered poor measurement sections. These cross sections are characterized by mean differences of beam depths for individual ensembles ranging from 17 to 32 percent.

Measurements collected in the 2009 Water Year with a mean difference of beam depths in individual ensembles exceeding 15% or a mean number of valid depth cells per ensemble less than 4 must be reprocessed using version 2.04.

3. **Improved Section-by-Section Mode.** The WinRiver II Section-by-Section (SxS) software contains a number of enhancements requested by OSW, however, this software has not yet been fully tested by OSW. If use of the SxS software is necessary, the results need to be quality assured with comparison measurements or other approaches suggested by OSW. Assistance from OSW is available to users willing to test the SxS software.
4. **Bottom Depth Screening.** Prior to the release of WinRiver II version 2.04, version 2.03 was briefly available from both the TRDI and USGS Hydroacoustics websites. The only difference between WinRiver II versions 2.03 and 2.04 is the addition of optional methods for screening bottom track data. In version 2.03, an additional screening was applied that required valid bottom track velocities in order to consider measured beam depths to be valid. This change resulted in ensembles being marked bad when bottom track was invalid, even though Global Position System (GPS) data (GGA or VTG) were being used for the navigation

reference. The OSW was unaware of this change in version 2.03. OSW consulted with TRDI when this became known and TRDI release version 2.04 which still includes this capability but makes the screening optional, and disabled by default, for moving-boat discharge measurements. This screening may affect discharge measurements collected or reprocessed with WinRiver II 2.03 while using GPS as the reference. However, this screening had no effect on discharge measurements using bottom-track as the reference.

Measurements in the 2009 water year which used GGA or VTG data as the navigation reference and were processed in WinRiver II version 2.03 must be reprocessed using version 2.04.

The bottom depth screening based on valid bottom track velocities has been applied to all section-by-section measurements since the introduction of the section-by-section software. Version 2.04 now provides the option to turn off this depth screening, which is by default turned on. With the depth screening turned on, section-by-section measurements require valid bottom track to collect velocity profiles. If the bottom tracking is questionable at a site, the user should evaluate the data with and without depth screening enabled, and use the appropriate setting for the site conditions.

- 5. Additional Changes.** A complete list of changes and fixes can be found in the release notes available at <http://rdinstruments.com/webdl/Software/WINRIV2.TXT>

Recorded webinars discussing the changes in version 2.03 and the change in depth screening in version 2.04 are available on the Hydroacoustics Webinars page <http://hydroacoustics.usgs.gov/training/webinars.shtml>. A list of known issues for the latest WinRiver II release is maintained on the OSW Hydroacoustics forum at <http://hydroacoustics.usgs.gov/forum>.

If you have any questions or comments about the policies and guidance in this memo, please contact Mike Rehmel (msrehmel@usgs.gov) or the OSW Hydroacoustics Work Group (hawg@simon.er.usgs.gov).

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References

Oberg, K.A., and Mueller, D.S., 2007, Validation of Streamflow Measurements Made with Acoustic Doppler Current Profilers: Journal of Hydraulic Engineering, v. 133, No. 12, p. 1421-1432