



RD Instruments
Acoustic Doppler Solutions

ChannelMaster H-ADCP Application Note:

Measurements of Extremely Low Flows Using Broadband ChannelMaster Horizontal ADCP in Waiqin River, Nanjing, China

SUMMARY: Horizontal velocity profiles were measured using a RD Instruments 1200 kHz broadband ChannelMaster H-ADCP in Waiqin River, Nanjing, China, on July 30, 2003. The velocity was extremely low, ranging from zero to about 10 cm/s. Results indicated that the broadband 1200 kHz ChannelMaster H-ADCP was able to accurately measure the low flow at a high spatial resolution of 1 meter and high temporal resolution of 60 seconds. In addition, the velocity profile data were found valid up to 50 meters, well exceeding the specified profiling range of 20 meters for 1200 kHz H-ADCPs. Thanks to the patented broadband Doppler technology that makes high accuracy and high resolution velocity profiling at low flows possible.

The Waiqin River at the test site was about 70 meters wide. Its maximum depth was 4 meters. The 1200 kHz H-ADCP ChannelMaster H-ADCP was mounted on a temporary frame. The frame was attached to the left bank wall (Figures 1). The water depth at the ChannelMaster mounting place was about 3 meters. The water surface was 0.45 meters over the instrument during the test.



Figure 1: 1200 kHz ChannelMaster H-ADCP at the test site

The ChannelMaster was configured at a cell size of 1 meter and an averaging interval of 5.9 seconds. The sampling interval was chosen to be the same as the averaging interval so that, if needed, further time averaging in post processing can be made to average out more random noise. Below is the summary of the system settings:

Cell size:	1 meter
Number of cells:	60
Blank distance:	1 meter
Averaging Interval:	5.9 seconds
Sampling Interval:	5.9 seconds

About 20 minutes of data were collected. Figure 2 shows a screenshot of WinHADCP, the ChannelMaster software, when playing back the data. The left top plot shows the time series of x-component of velocities at Cell 1 (blue line) and Cell 40 (red line). The left bottom plot shows time series of velocity magnitude profiles. The right top plot shows a velocity vector profile. The right bottom plot shows a velocity magnitude profile. The data shown are averaged for 60 seconds using WinHADCP in post-processing mode.

It can be seen from the plots that the flow in the river was extremely low during the test period, ranging from zero to about 10 cm/s. Such a low flow condition was a great challenge. However, because it uses BroadBand Doppler technology, the 1200 kHz ChannelMaster H-ADCP was able to accurately measure the flow at the high spatial resolution of 1 meter and high temporal resolution of 60 seconds.

The standard deviation of velocity measurements for one-meter cell and 60-second time averaging was estimated as less than 0.2 cm/s. As shown in the plots, the profile data are “clean”, indicating that the system noise was low enough so that the low flow was accurately measured by the H-ADCP.

It is also noticed from Figure 2 that the velocity profile data are valid up to 50 m from the H-ADCP. This remarkable profiling range was due to favorable conditions at the test site. The water temperature was very high, 33.7 degree C in average. The profiling range of 1200 kHz systems increases with increasing temperature. The water also had adequate acoustic backscatter and was deep enough so that no interference between the acoustic beams and river bottom was observed.

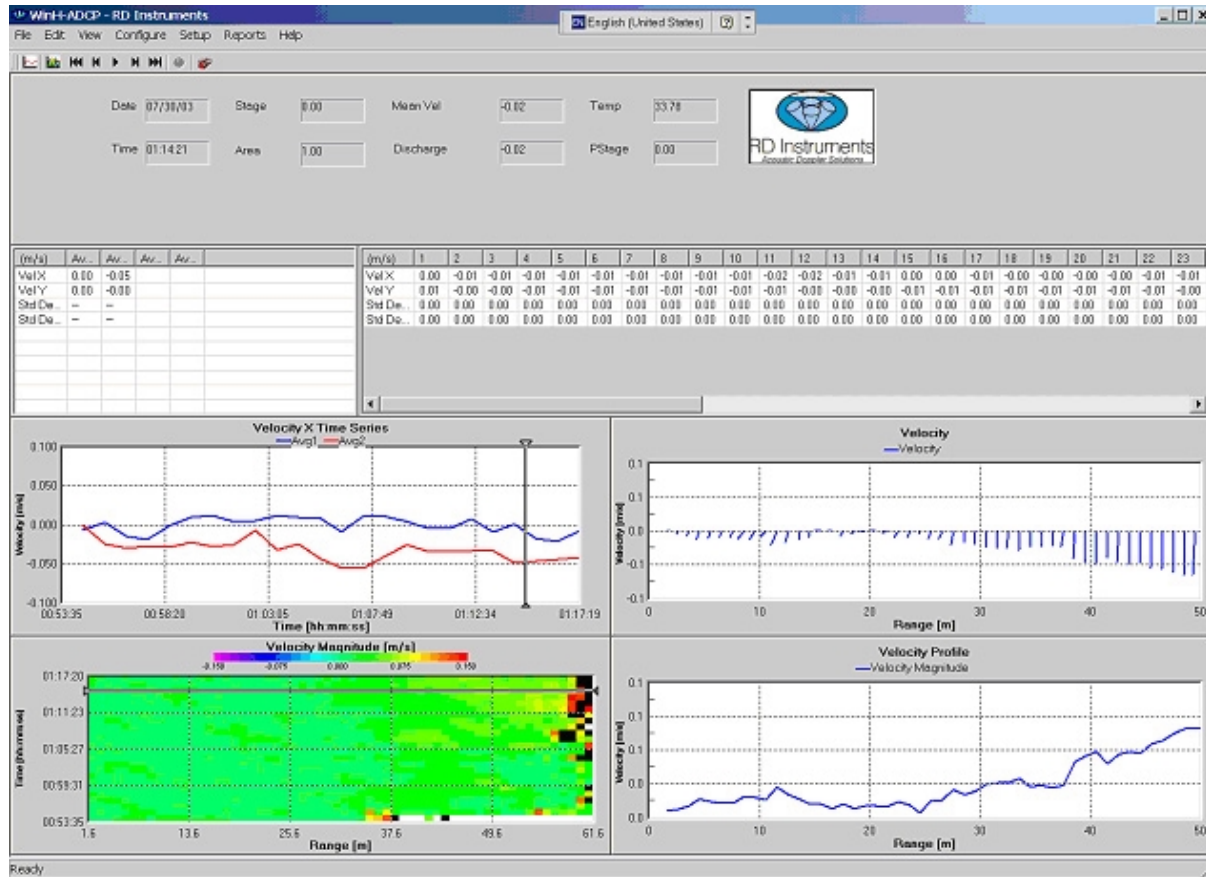


Figure 2: Screenshot of WinH-ADCP when playing back the data collected

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