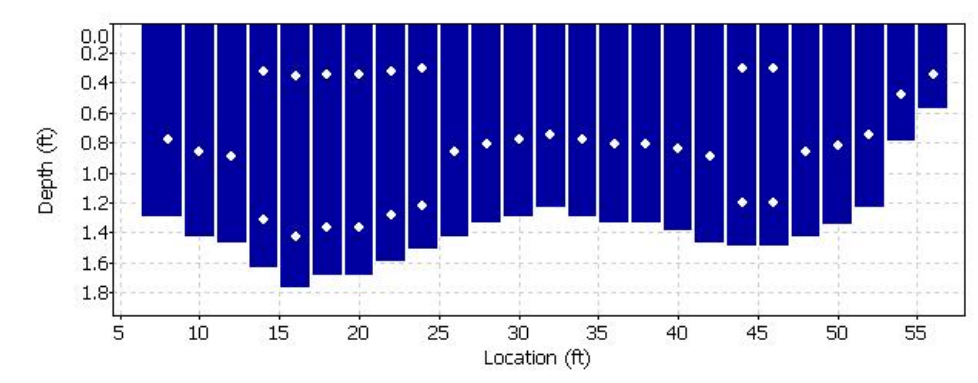
Acoustics IN-KY WSC

(Photograph courtesy of Michael Nolan, U.S. Geological Survey)

The current-meter method uses equipment such as (*A*) the Price AA current meter; (*B*) the Price AA current meter attached to a wading rod; and (*C*) the Price AA meter suspended above a heavy weight.


Depth (ft)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
5
10
15
20
25
30
35
40
45
50
55
Location (ft)

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	15:23	58.00	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	15:23	56.00	0.6	0.580	0.6	0.232	0.5184	1.00	0.5184	1.160	0.6014	1.3
2	15:24	54.00	0.6	0.800	0.6	0.320	0.8009	1.00	0.8009	1.600	1.2812	2.8
3	15:25	52.00	0.6	1.240	0.6	0.496	0.6873	1.00	0.6873	2.480	1.7048	3.8
4	15:26	50.00	0.6	1.360	0.6	0.544	0.7339	1.00	0.7339	2.720	1.9961	4.4
5	15:27	48.00	0.6	1.440	0.6	0.576	0.7884	1.00	0.7884	2.880	2.2705	5.0
6	15:30	46.00	0.8/0.2	1.500	0.2	1.200	0.8278	1.00	0.7672	3.000	2.3017	5.1
6	15:29	46.00	0.8/0.2	1.500	0.8	0.300	0.7067					
7	15:30	44.00	0.2/0.8	1.500	0.2	1.200	0.8839	1.00	0.7726	3.000	2.3179	5.1
7	15:32	44.00	0.2/0.8	1.500	0.8	0.300	0.6614					
8	15:33	42.00	0.6	1.480	0.6	0.592	0.8484	1.00	0.8484	2.960	2.5113	5.5
9	15:34	40.00	0.6	1.400	0.6	0.560	0.8435	1.00	0.8435	2.800	2.3617	5.2
10	15:35	38.00	0.6	1.340	0.6	0.536	0.7533	1.00	0.7533	2.680	2.0186	4.5
11	15:36	36.00	0.6	1.340	0.6	0.536	0.7949	1.00	0.7949	2.680	2.1303	4.7
12	15:37	34.00	0.6	1.300	0.6	0.520	0.8031	1.00	0.8031	2.600	2.0880	4.6
13	15:38	32.00	0.6	1.240	0.6	0.496	0.9058	1.00	0.9058	2.480	2.2468	5.0
14	15:39	30.00	0.6	1.300	0.6	0.520	0.7943	1.00	0.7943	2.600	2.0649	4.6
15	15:40	28.00	0.6	1.340	0.6	0.536	0.6745	1.00	0.6745	2.680	1.8076	4.0
16	15:41	26.00	0.6	1.440	0.6	0.576	0.6762	1.00	0.6762	2.880	1.9473	4.3
17	15:44	24.00	0.8/0.2	1.520	0.2	1.216	0.8720	1.00	0.7292	3.040	2.2167	4.9
17	15:43	24.00	0.8/0.2	1.520	0.8	0.304	0.5863					
18	15:45	22.00	0.2/0.8	1.600	0.2	1.280	0.7690	1.00	0.6366	3.200	2.0374	4.5
18	15:46	22.00	0.2/0.8	1.600	0.8	0.320	0.5043					
19	15:48	20.00	0.8/0.2	1.700	0.2	1.360	0.7825	1.00	0.6596	3.400	2.2429	4.9
19	15:47	20.00	0.8/0.2	1.700	0.8	0.340	0.5367					
20	15:49	18.00	0.2/0.8	1.700	0.2	1.360	0.6535	1.00	0.6035	3.400	2.0521	4.5
20	15:50	18.00	0.2/0.8	1.700	0.8	0.340	0.5535					
21	15:52	16.00	0.8/0.2	1.780	0.2	1.424	0.5558	1.00	0.5303	3.560	1.8879	4.2
21	15:51	16.00	0.8/0.2	1.780	0.8	0.356	0.5049					
22	15:53	14.00	0.2/0.8	1.640	0.2	1.312	0.4636	1.00	0.4537	3.280	1.4884	3.3
22	15:54	14.00	0.2/0.8	1.640	0.8	0.328	0.4439					
23	15:55	12.00	0.6	1.480	0.6	0.592	0.1962	1.00	0.1962	2.960	0.5807	1.3
24	15:56	10.00	0.6	1.440	0.6	0.576	0.2316	1.00	0.2316	2.880	0.6671	1.5
25	*15:57*	*8.00*	*0.6*	*1.300*	*0.6*	*0.520*	*0.1417*	*1.00*	*0.1417*	*3.575*	*0.5066*	*1.1*
26	15:57	4.50	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

The science of underwater acoustics began in 1490, when Leonardo Da Vinci wrote,

"If you cause your ship to stop and place the head of a long tube in the water and place the outer extremity to your ear, you will hear ships at a great distance from you."

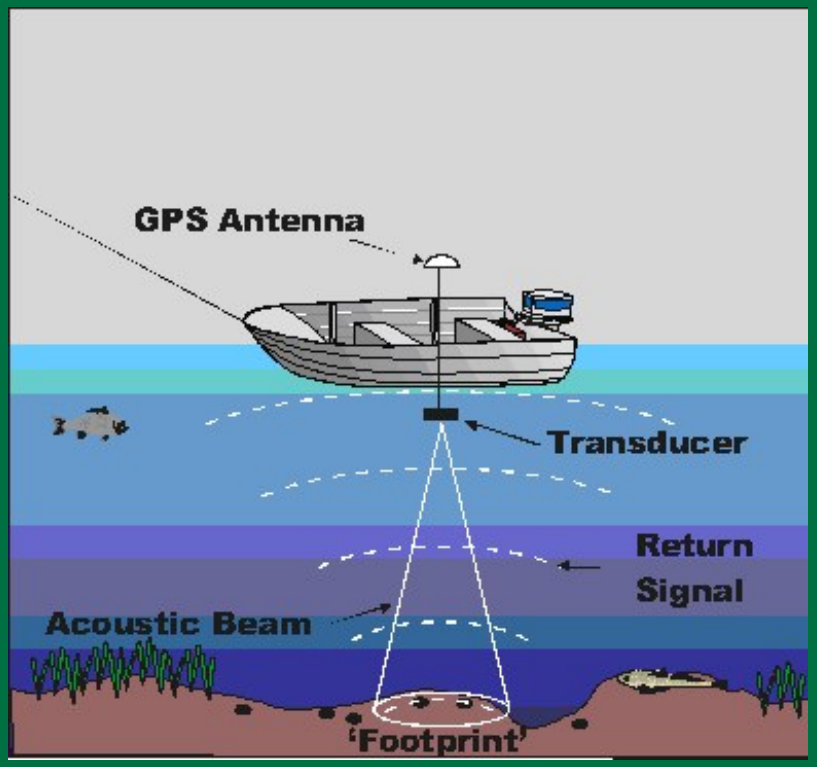
The next major step in the development of underwater acoustics was made by Daniel Colladon, a Swiss physicist, and Charles Sturm, a French mathematician. In 1826, on Lake Geneva, they measured the elapsed time between a flash of light and the sound of a submerged ship's bell heard using an underwater listening horn. They measured a sound speed of 1435 meters per second over a 17 kilometer distance, providing the first quantitative measurement of sound speed in water. The result they obtained was within about 2 % of currently accepted values. In 1877 Lord Rayleigh wrote the **Theory of Sound** and established modern acoustic theory.

The sinking of *Titanic* in 1912 and the start of World War I provided the impetus for the next wave of progress in underwater acoustics. Anti-submarine listening systems were developed. Between 1912 and 1914, a number of echolocation patents were granted in Europe and the U.S.,

The fathometer, or depth sounder, was developed commercially during the 1920s. Originally natural materials were used for the transducers, but by the 1930s sonar systems incorporating piezoelectric transducers made from synthetic materials were being used for passive listening systems and for active echo-ranging systems.

After World War II, the development of sonar systems was driven largely by the Cold War, resulting in advances in the theoretical and practical understanding of underwater acoustics, aided by computer-based techniques.

Single Beam Bathymetry



USGS

Location of Bathymetry Transects

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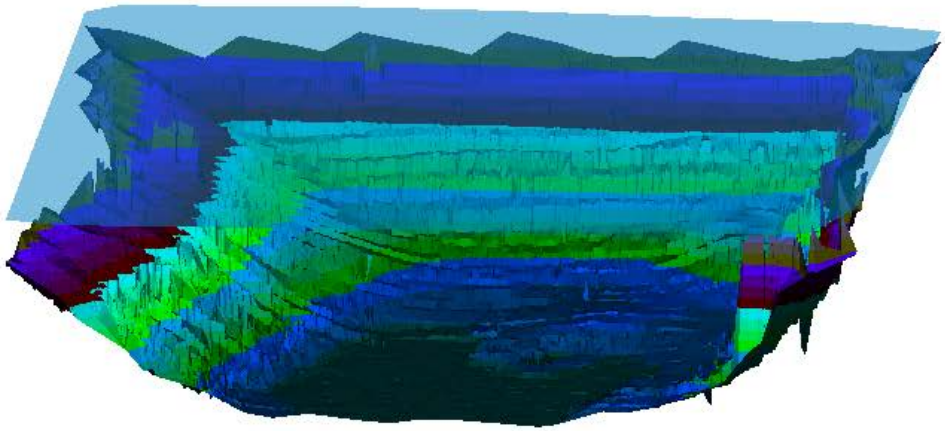
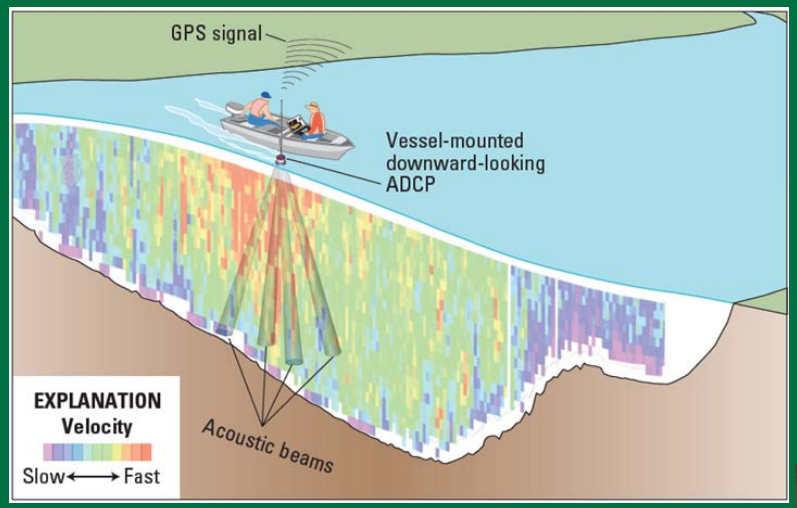


Acoustic Doppler Current Profiler



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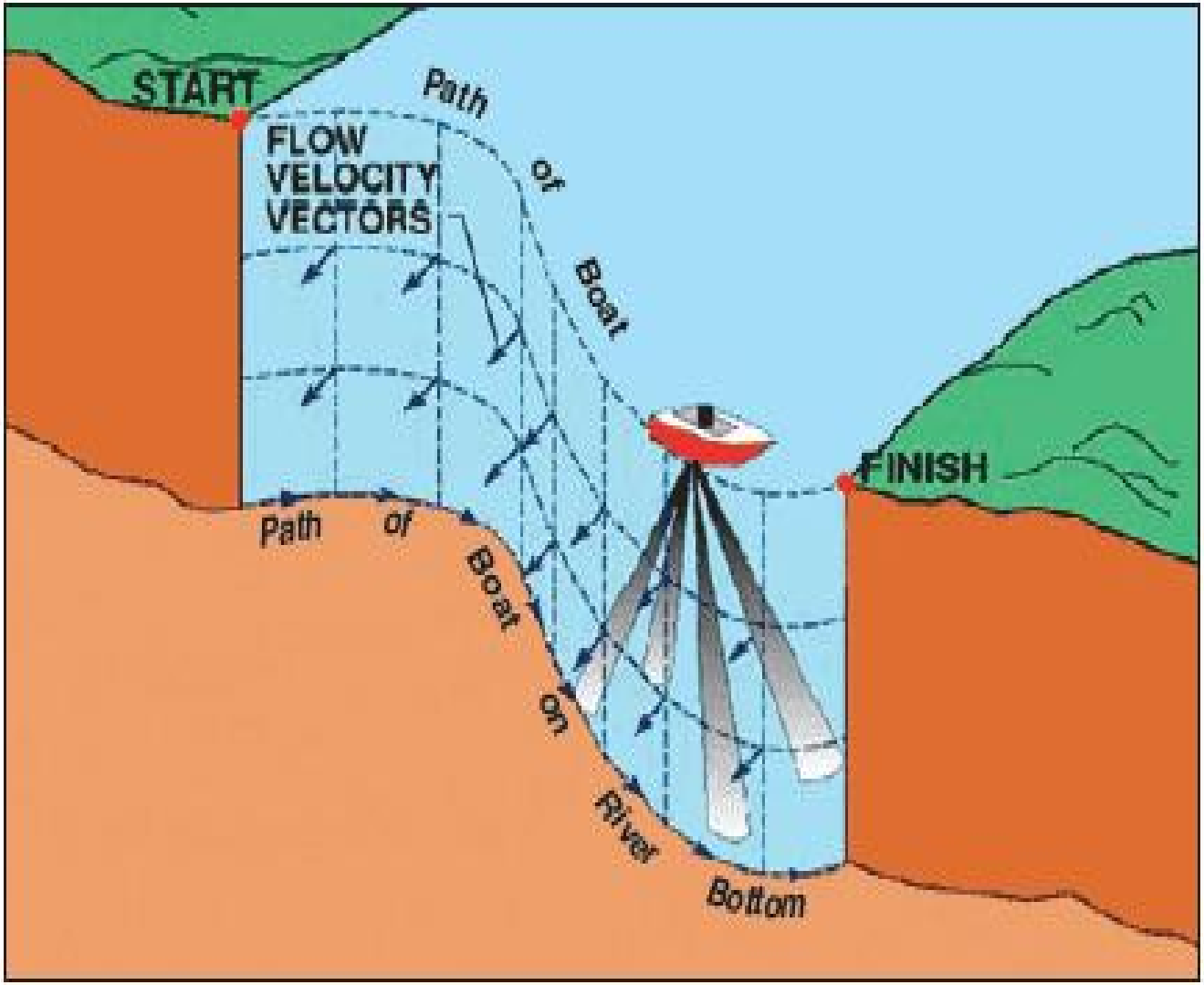


Acoustic Doppler Current Profiler (ADCP) mounted in a small watercraft, is used for measuring the discharge of a river. The ADCP acoustic beams are directed down into the water as it is guided across a river channel.

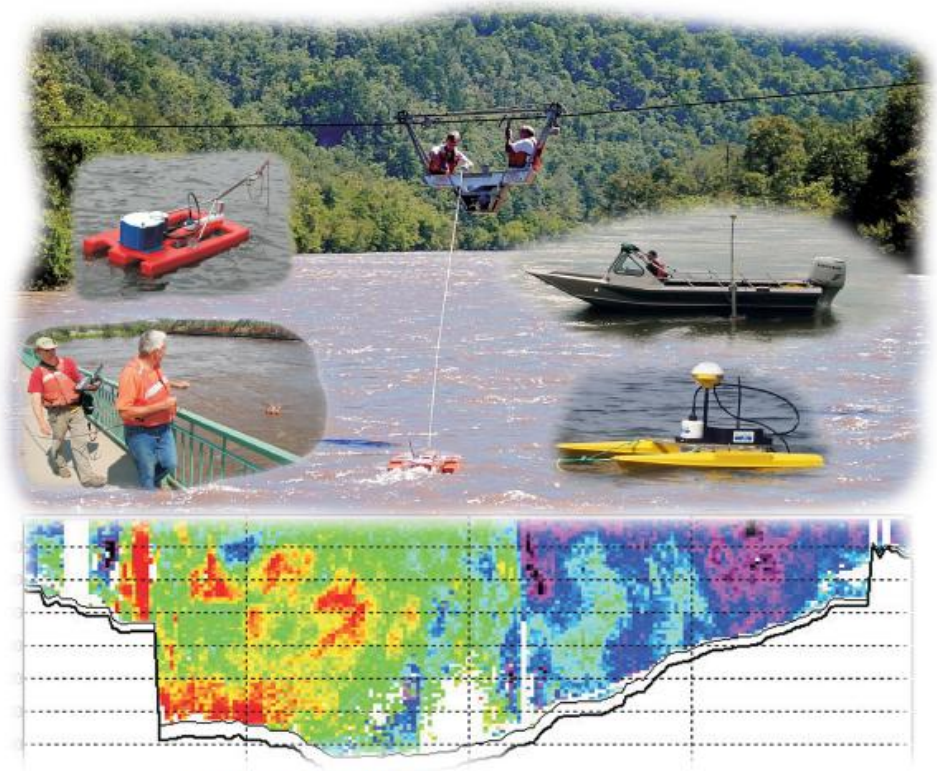
Advantages of using ADCP

- Better data
- Quick measurements
- Less exposer time in water
- Safety

USGS
science for a changing world

Measuring Discharge with Acoustic Doppler Current Profilers from a Moving Boat

Chapter 22 of Book 3, Section A

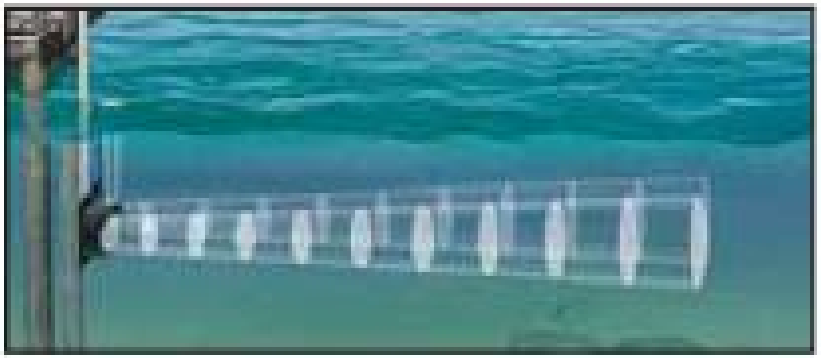


Techniques and Methods 3–A22

U.S. Department of the Interior
U.S. Geological Survey

Deployments

- Pole mount off side of boat man boat
- Tether boat off side of man boat
- Tether boat from downstream side of bridge
- Tether boat from cableway
- Tether boat from temporary cableway



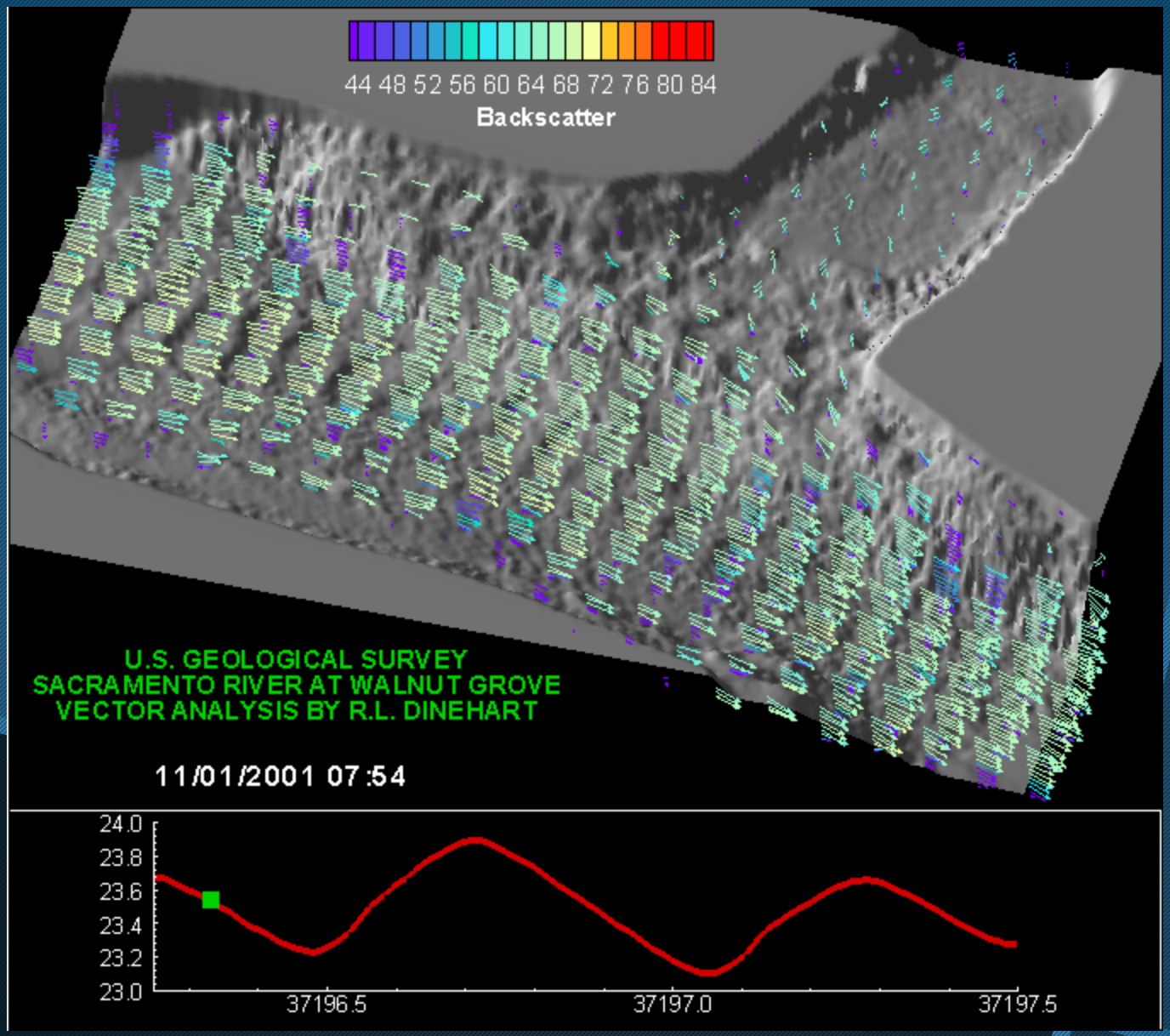
Argonaut-SL in the Field

Applications

- River Discharge Monitoring
- Irrigation Canals
- Ports and Harbors
- Shallow Streams and Estuaries
- Water Supply

Features

- Water Velocity and Level
- MultiCell Current Profiling
- PowerPing Hi-precision Sampling
- Mounting and Display, and I/O
- Velocity-Indexing Software


44 48 52 56 60 64 68 72 76 80 84
Backscatter
U.S. GEOLOGICAL SURVEY
SACRAMENTO RIVER AT WALNUT GROVE
VECTOR ANALYSIS BY R.L. DINEHART
11/01/2001 07:54
24.0
23.8
23.6
23.4
23.2
23.0
37196.5
37197.0
37197.5