Discharge - Group 2

Karen Chen
David Haasnoot
Emma Oosterveld
Jesse van Leeuwen
Sophie van Velzen

Introduction

Discharge of a stream can be measured in different ways. Our group used four different techniques: The propeller method, float method, electromagnetic method, video method and the bathymetry is measured. The weather during the experiments was windy (6-7 m/s), sunny, dry and cold (6-12 degrees celsius). The wind was in the direction of the streamflow.

Velocity measurement propellor method

The velocity of the stream is measured with the propeller method at two locations: upstream at the bridge and around 100 meters downstream of the bridge. As stated in the manual, at 5 sections in the cross section and at two depths (10 cm and 20 cm from surface) the velocity is measured with 10 measurements per depth. In this way a velocity profile of the cross section can be computed. The results are shown below.

It should be noted that at the upstream at the bridge the measurements were not started at the initial point. So measurement 4 is at the other side of the stream.
Furthermore, some locations have more than 10 measurements. At some points downstream of the bridge it was not possible to measure at 20 cm depth because the water was too shallow.

Upstream

10 cm depth	4	5	6	7	8
	0.55	0.75	1.21	0.73	0.39
	0.33	0.93	0.95	0.88	0.35
	0.40	0.82	1.50	0.60	0.32
	0.36	0.91	0.98	0.81	0.43
	0.57	0.71	1.08	0.76	0.21
	0.63	0.81	1.06	0.80	0.33
	0.65	1.10	0.86	0.79	0.34
	0.41	0.87	0.89	0.74	0.49
	0.54	0.70	0.98	0.66	0.39

	0.37	0.49	1.05	0.67	0.41
	0.68	0.75		0.82	0.40
	0.47				
20 cm depth	**4**	**5**	**6**	**7**	**8**
	0.29	0.92	0.88	0.51	0.15
	0.47	0.65	1.14	0.58	0.25
	0.32	0.72	1.03	0.81	0.22
	0.52	0.52	1.14	0.70	0.18
	0.44	0.68	1.01	0.62	0.17
	0.49	0.79	0.92	0.47	0.26
	0.77	0.62	0.76	0.44	0.22
	0.52	0.88	0.81	0.52	0.30
	0.48	0.93	0.89	0.41	0.22
	0.28	0.78	0.70	0.70	0.15
	0.54	0.54	1.10	0.63	0.25
	0.51	0.42	0.83	0.26	
		0.84	0.95		

Downstream

10 cm depth	**1**	**2**	**3**	**4**	**5**	**6**	**7**
	0.51	0.84	0.91	0.93	0.78	0.78	0.49
	0.65	0.73	1.21	0.72	0.91	0.91	0.35
	0.60	0.82	0.70	0.89	0.93	0.88	0.54
	0.49	0.78	0.82	0.77	0.96	0.68	0.31
	0.64	0.81	0.63	0.95	0.82	0.71	0.34
	0.59	0.73	1.03	0.88	1.03	0.74	0.24
	0.50	0.71	0.88	1.01	1.06	0.87	0.43
	0.44	0.71	0.87	0.92	0.92	0.72	0.40
	0.53	0.82	0.76	0.83	1.05	0.81	0.48
	0.56	0.66	0.91	0.95	1.05	0.75	0.50

20 cm depth	1	2	3	4	5	6	7
	None	None	0.59	0.66	0.58	0.60	None
			0.58	0.63	0.68	0.67	
			0.70	0.71	0.45	0.63	
			0.62	0.68	0.50	0.55	
			0.63	0.65	0.52	0.51	
			0.56	0.53	0.47	0.56	
			0.71	0.66	0.59	0.54	
			0.70	0.80	0.52	0.50	
			0.54	0.76	0.59	0.47	
			0.70	0.68	0.46	0.61	
			0.62	0.60	0.46	0.43	
			0.63	0.76	0.50	0.64	

Float method

The velocity is measured with two types of bottles: a small red one and a big green bottle. At a predefined distance (the locations from the manual are used) the bottles are released in the water and collected further downstream. The time it took for the bottles to reach the destination in the 6 experiments are shown in the table below.

Red left (s)	Green right (s)		Red right (s)	Green left (s)
47,34	51,59		60,33	49,03
74,58	49,23		51,21	55,64
53,75	116,09		52,68	65,9

Electromagnetic method

The velocity is measured at the location of the bridge with the electromagnetic method. At one location, the velocity is measured 3 times (maximum depth, 0.2 m and 0.1 m below the surface). The device measures the velocity in m/s and the depth (m) every 2-3 seconds. A small part of the complete table obtained from the device is shown below.

It is important to note that the measurement device was not attached to the bridge, but held by hand. This can have caused the changes in measured depths.

Timestamp	Velocity (m/s)	Depth (m)
10:47:31 05.16.2023	0.277	0.018
10:47:34 05.16.2023	0.178	0.019
10:47:36 05.16.2023	0.244	0.014
10:47:39 05.16.2023	0.189	0.014
10:47:41 05.16.2023	0.210	0.010
10:47:43 05.16.2023	0.188	0.017
10:47:45 05.16.2023	0.216	0.010
10:47:47 05.16.2023	0.203	0.005
10:47:49 05.16.2023	0.170	0.018
10:47:50 05.16.2023	0.170	0.019

Bathymetry experiment

The heights of the water at 5 locations in the cross section at the bridge are measured (75cm between the locations). This is done to calculate the discharge (m3/s) from velocity measurements (m/s), as with the bathymetry method the cross sectional area of the water can be obtained. The results are shown below.

Measurement	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	distance left (m)	distance right (m)	width (m)
1	30	35	33	32	34	0,6	0,6	4,22
2	30	34	33	32	25			
3	29	37	33	32	34			
4	30	33	33	36	27			
5	29	35	32	31	25			

Experiment Video Measurement

With software, the velocity of a stream can be obtained from a video. The steps of the manual are followed carefully. However, the plates were not available so orange life jackets are used as marking points at the same locations as where the plates are located in photo 1 of the manual. Nine videos are made of 30 seconds, with starting times:

Start times
12:01:30
12:03:45
12:04:12
12:04:45
12:05:20
12:05:50
12:06:30

12:06:57
12:07:33

Height difference between water and theodolite: 25.9 dm

Yellow level staff: 28.5 dm