7th IAHR/WMO/IAHS INTERNATIONAL STREAMGAUGING COURSE

Liverpool, UK

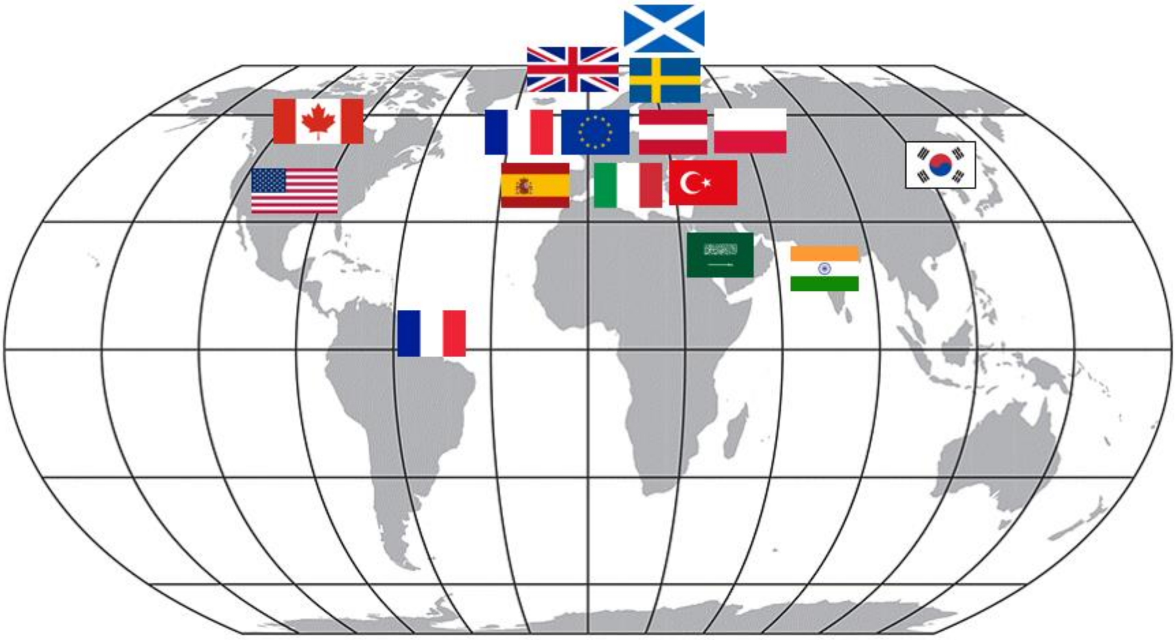
Saturday 31 August to Monday 2 September 2024

Organized by the IAHR RiverFlow2024 conference, webpage here

BRIEF REPORT – J. Le Coz, A. Hauet (13/09/2024)

Since 2011, the international IAHR/WMO/IAHS training course on stream gauging has been organized in six countries around the world by recognized hydrometry experts. The three-day course consists of lectures covering topics including field operations (gauging station, discharge measurements), data management (rating curves, uncertainty estimation, data review) and field exercises. The course is designed for students, academics and professional hydrologists who want to gain a clear picture of both classic and innovative hydrometry technologies, and get involved in the international community of hydrometry experts.

The 7th course was held from 31 August to 2 September in Liverpool, UK, with 33 participants coming from 13 countries around the world, both students and professionals, including staff from the national hydrological service of England (Environment agency) and Scotland (SEPA).



The general programme included:

- Day 1 - Lectures on hydrometric field measurements (gauging station, stream gauging, measurement quality and uncertainty).
- Day 2 - Hands-on exercises in the field (visit of a hydrometric station, discharge measurements using conventional and innovating techniques: ADCP, radar and image velocimetry, salt dilution, weir equation, low-cost streamgauging ruler).
- Day 3 - Discharge computation and hydrometric data management: rating curves, hydrographs, data QA/QC, uncertainty analysis and publication.

The international speakers and teachers were:

- Alexandre Hauet (EDF and Grenoble Alpes University, France)
- Marian Muste (IIHR, Iowa University, USA)
- Dongsu Kim (Dankook University, Seoul, Korea)
- Olly Baldwyn (Environment Agency, UK)
- Jérôme Le Coz (INRAE, France)

Experts from the National Hydrometry Team (Olly Baldwyn, Andrew Shaw, Rebecca Brown, Dan Hulme UK Environment Agency) have been instrumental for the success of the course: selection of the adequate site for field training, presentation of the national hydrological service, field operations and instrumentation.

Benoît Camenen (INRAE) and commercial sponsors (Fathom, Sommer, Teledyne RDI, vortex-IO, SEBA) actively contributed to the field training.

The Local organising committee of the IAHR RiverFlow 2024 conference (Iacopo Carnacina helped by Tricia Waterson, Anna Hodgkinson, Manolia Andredaki) brought a huge support for the practical organization of the course: venue, rooms, catering, registration, budget, coach rental, etc.

The course would not have been possible without the appreciated financial and technical support of commercial sponsors. Most of them attending the event, presenting their products in the room and in the field, which added a significant value to the course:

- Jean-Christophe Poisson (vortex-io)
- William Castaings (Tenevia)
- Kevin Grangier (Teledyne RDI Europe)
- Issa Hansen (Seba)
- Joan Petringer (Paratronic)
- Rob Thomson (SonTek / Xylem)
- Gabe Sentlinger (Fathom)
- Christoph Sommer (Sommer)

The international steering committee of the IAHR/WMO/IAHS training course on stream gauging is deeply grateful to all the people that helped and made this 7th course possible and successful.

Thank you!

Report of the field day

Introduction

During the 7th IAHR/WMO/IAHS International Streamgauging Course, in Liverpool from Saturday 31st August to Monday 2nd September, as part of the IAHR RiverFlow2024 conference, a field day was organized on Sunday 1st September. The participants, separated in 6 subgroups, conducted discharge measurements using various methods at two different sites (Figure 1):

- Douglas River at Wanes Blades Bridge:
  - The UK Environment Agency (UK EA) manages a hydrometric station, equipped with a weir and ultrasonic transit-time discharge measurement. A visit of the station was offered by UK EA, and Vortex.io demonstrated their portable hydrometric station
  - ADCP measurement using a Teledyne RDI StreamPro and a SonTek M9 upstream the weir
  - Non-intrusive surface velocity measurements using image-based method (open-source software Fudaa-LSPIV and Seba Discharge App) and Sommer surface velocity radar RG30

- River Tawd at Tawd Vale Adventure Centre:
  - The [streamgauging ruler](), a low-cost currentmeter produced by INRAE
  - Salt dilution using [Fathom QiQuac]() and [Sommer TQ-S]()
  - Weir equation on a small tributary of River Tawd.

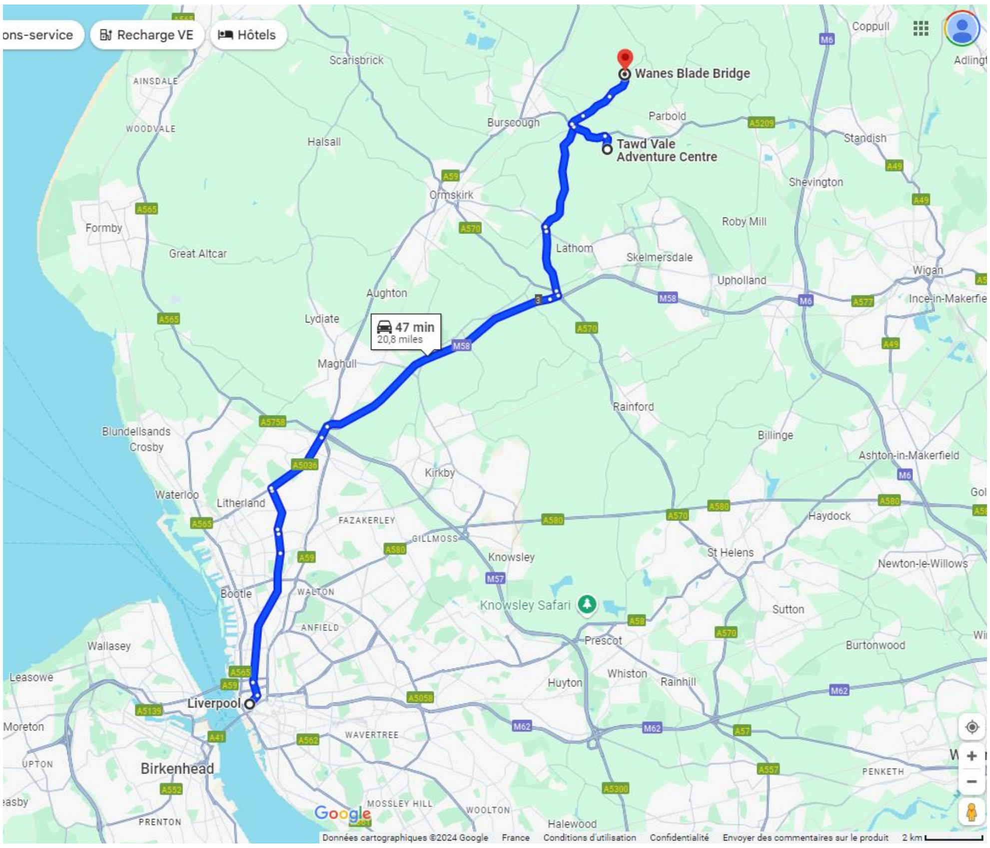


Figure 1: Location of the measurement sites and route from Liverpool centre

Results

All the results are detailed in the excel file “Streamgauging_course_field.xlsx”.

Douglas River at Wanes Blades Bridge

Figure 2 shows the results of the different discharge measurements conducted at Wanes Blades.

The hydrometric station gives a continuous real-time discharge estimation, every 15 minutes. The discharge increased during the day, from about 0.8 to 1.2 m^3/s.

The ADCP measurements with the different instruments, TRDI StreamPro and Sontek M9, show very consistent results. The uncertainty of the ADCP gaugings, computed using QRevInt, is about ± 10% (at the 95% confidence level), as shown in Figure 3.

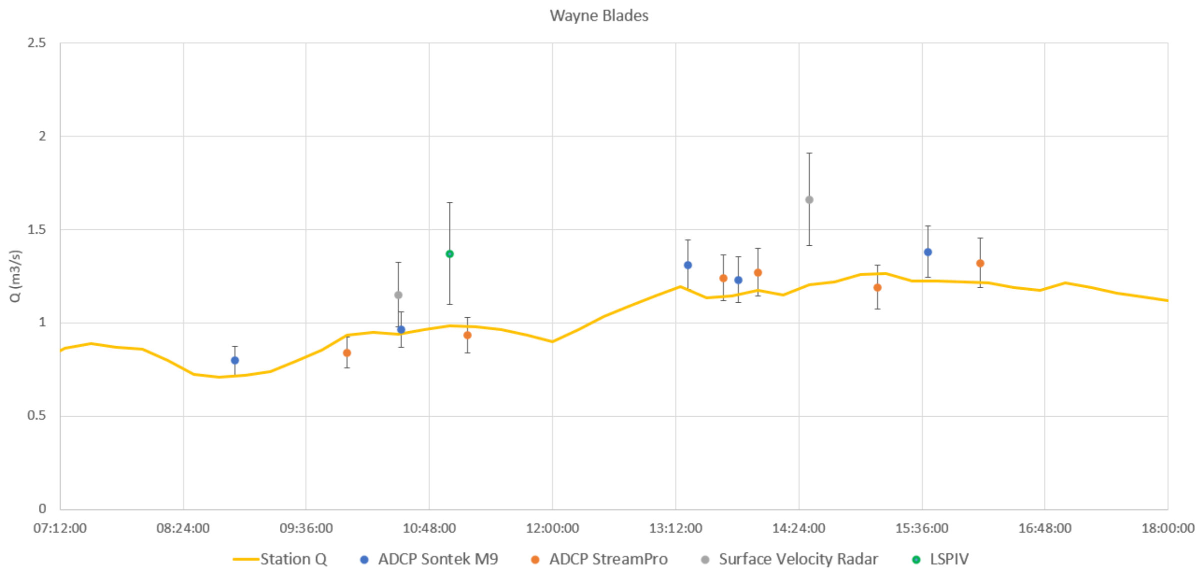


Figure 2 : Discharge measured at Wanes Blades Bridge

Figure 3 : Postprocessing of ADCP gaugings using QRevInt

The Surface Velocity Radar (SVR) measured surface velocities, that were converted into depth-averaged velocities using a coefficient of 0.85. SVR shows an overestimation of the discharge compared to the hydrometric station and the ADCP. The strong wind, flowing in the downstream direction, during the measurements created waves with higher velocities than the flow speed, that explains the discharge overestimation.

Image-based analysis was conducted using the Fudaa-LSPIV software. Figure 4 shows the surface velocity field. The wind effect can be clearly seen, pushing the tracer in the right bank direction, and increasing the surface velocity. Due to the weir downstream, the flow velocity was slow and very few tracers were visible. Artificial seeding (biodegradable corn chips) was added to the flow, but they are very sensitive to wind, as they are floating and sticking out above the water. Consequently, the discharges measured with the LSPIV method are overestimated.

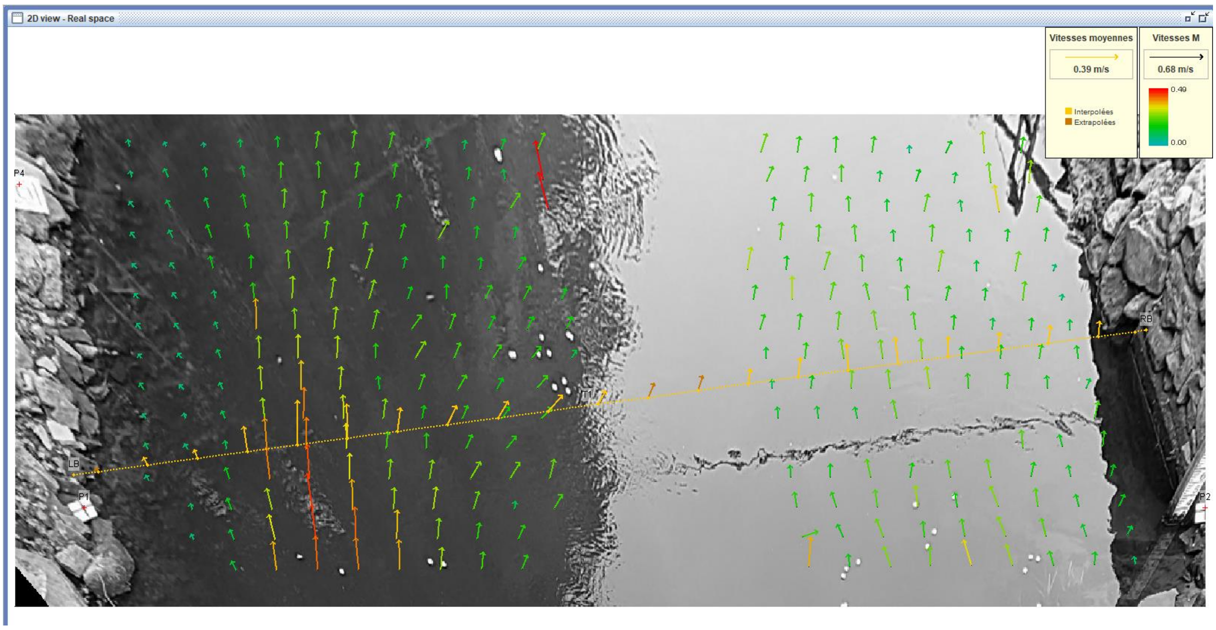


Figure 4: Fudaa-LSPIV image-based analysis

Tawd Vale

Figure 5 shows the results of the gauging conducted on the Tawd River at Tawd Vale, using the streamgauging ruler and salt dilution.

Salt dilution measured with Sommer and Fathom instruments shows consistent results, with a steady discharge of 71 L/s. Two probes (close to each bank) were used for each measurement, to check the good mixing. The uncertainty of salt dilution, computed with the manufacturers' softwares, was about ± 6%.

The streamgauing ruler results show a large dispersion, with values ranging 50 to 130 L/s. The site for such a low discharge did not offer good operational conditions for this instrument. As the velocities were slow, the measurements had to be conducted at very shallow cross-sections (to have higher velocities), but with large relative uncertainty on the measurement of the depth. Moreover, the flows at the measurement cross-sections were very complex (often oblique) and not uniform, increasing the uncertainty of the velocity-head reading and conversion to depth-average velocity. At the end, an average uncertainty of about 20% was affected to each streamgauging ruler measurement. Measurement sites were not the same in the morning and in the afternoon. Figure 5 shows that the measurements conducted at site 1, in the afternoon, are more consistent with the reference (taken as the average of the dilution measurements). This site was selected as offering better conditions than site 2 chosen in the morning session.

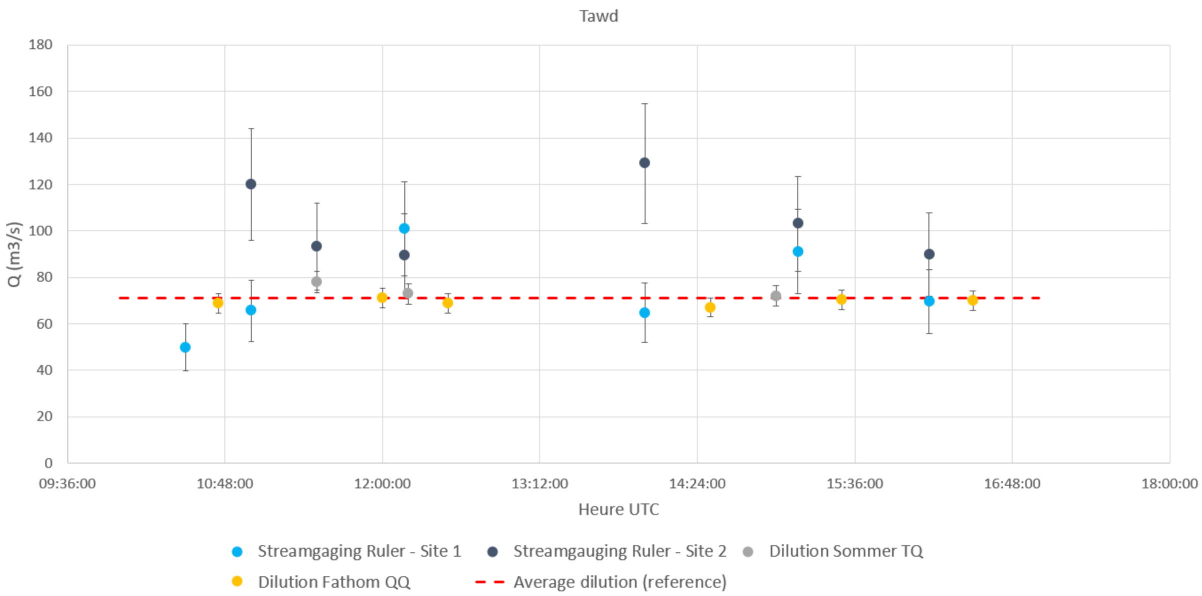


Figure 5 : Discharge measurements on the Tawd River at Tawd Vale

Tributary of the River Tawd

A rectangular weir controls the flow of a tributary of the River Tawd, upstream inside the Tawd Vale Adventure Center. Discharge was computed using a broad-crested weir equation as $Q = C * B * \sqrt{2g} * H^{1.5}$, where C is the weir coefficient (taken as 0.4 for a broad-crested weir), B is the width of the weir, and H is the head above the weir. The subgroups measured the weir width using a ruler tape, and the head (upstream the weir, at a distance of 3 times the thickness of the weir) was measured using a level and a measuring tape. The measurements of the width are consistent, ranging 2.62 to 2.67 m, but the head measurements show huge dispersion, ranging 0.6 to 2cm. Therefore, the discharge estimations range from 3.3 to 13.4 L/s, as shown in Figure 6.

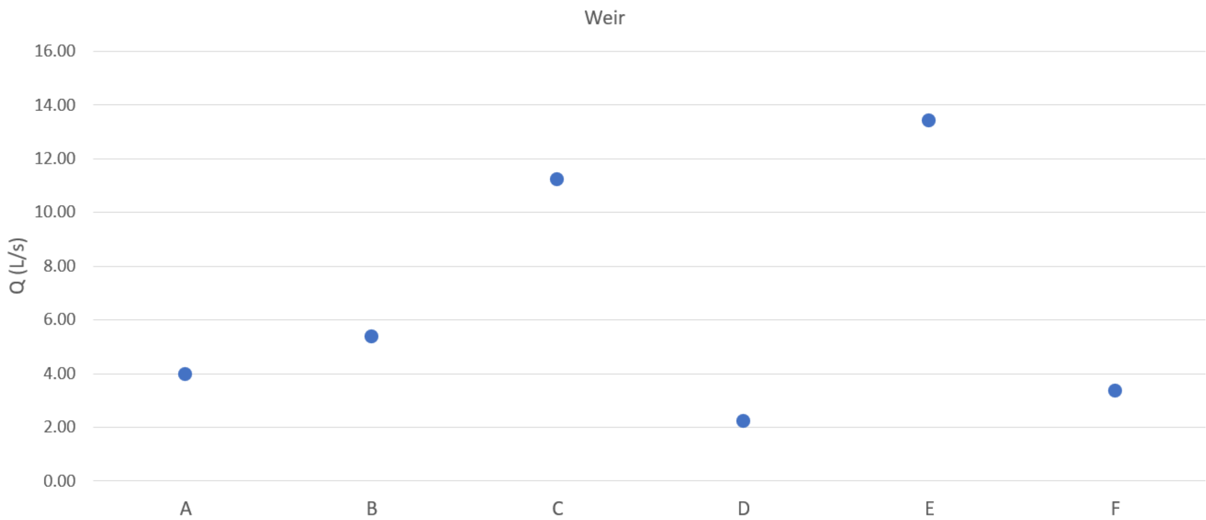


Figure 6: Discharge measurements at the weir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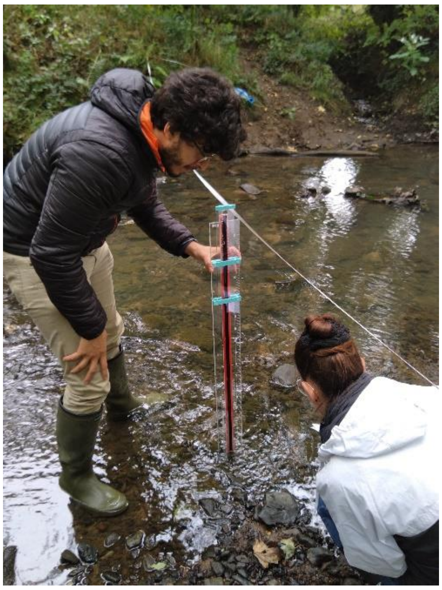


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