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Article, Published Version

**Ranzi, Roberto**

## **1st IAHR-WMO Short course on Stream gauging held in Brescia, Italy**

HydroLink

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Verfügbar unter/Available at: <https://hdl.handle.net/20.500.11970/109123>

Vorgeschlagene Zitierweise/Suggested citation:

Ranzi, Roberto (2011): 1st IAHR-WMO Short course on Stream gauging held in Brescia, Italy. In: HydroLink 2011/5. Madrid: International Association for Hydro-Environment Engineering and Research (IAHR). S. 76-77. [https://iahr.oss-accelerate.aliyuncs.com/library/HydroLink/HydroLink2011\\_05\\_Coastal\\_Maritime\\_Hydraulics.pdf](https://iahr.oss-accelerate.aliyuncs.com/library/HydroLink/HydroLink2011_05_Coastal_Maritime_Hydraulics.pdf).

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# 1<sup>st</sup> IAHR-WMO Short course on

The first edition of the IAHR-WMO Short course on Stream gauging was held last September 6 to 9 at the University of Brescia, in Italy. Stream gauging is one of the critical areas for both routine monitoring of catchment and estuarine environments and for the provision of essential information for hydrological and hydraulic modelling of these environments.

Written by:

**Prof. Roberto Ranzi**  
**University of Brescia, Italy**  
**Chairman of the Organising**  
**Committee of the 1<sup>st</sup> IAHR-WMO Short**  
**course on Stream Gauging**  
**(Brescia, Italy, 6-9 September 2011)**  
[ranzi@ing.unibs.it](mailto:ranzi@ing.unibs.it)



It is recognized that continued education and training on methods for hydrometric data collection, validation and publication are the backbone for the consolidation and dissemination of a 'hydrological culture'. For this reason at the XIII Session of the Hydrology Commission held in Geneva in November 2008, IAHR and WMO agreed to cooperate in the development of a course on stream gauging. The course was based principally on the 2nd edition of the Manual of Stream Gauging (WMO N° 1044), published in 2010 and on recent advancements in research, technology and instrumentation for hydrometry also IAHR contributed to.

Trainers were professors of hydraulics and hydrology and officers of hydrological services in Italy, Claudio Caponi, from WMO, and Marian Muste, Michele Mossa, Roberto Ranzi and Boosik Kang as IAHR experts from the Working Group on Applied Hydrology and the Committee on Experimental Methods and Instrumentation. The 50 registered participants included officers and technicians of hydrological and hydro-meteorological services, water engineers, staff of public water authorities, hydropower companies, Master and PhD students. Both traditional methods of hydrometry, including mechanical current-meters and precalibrated measurement structures and advanced technologies based on ultrasonic, laser and Doppler velocimetry were

the subject of the course, which included also one day of field work (see the photo). The programme can be found at <http://dicata.ing.unibs.it/waterengineering/Events/2011-Stream-Gauging/>.

The course started with an introduction on WMO's activities in hydrology and water resources, focused also on the standardisation efforts: five manuals and guides were prepared since 2008, including the Manual on Stream Gauging. After a review of open channel hydraulics, principles of stage and velocity measurements and of their traceability according to standardised protocols were described. It was pointed out how the difference between an ordinary calibration process and a procedure according to a protocol, is that in the first the instrument or the measurement are calibrated by comparison with a standard reference (supplied by a national or international agency), in the second all the laboratory, including the operators, is calibrated by comparison with a standard reference. Then an example on how the Hydrological Service in Korea is organised was presented.

In the following day, the principles of discharge measurements by conventional current meter methods, according to WMO and ISO 748 standards, were presented. Mechanical current meters are still widely used in the hydrological practice for point velocity measurements, but electromagnetic and acoustic velocimeters, as ADV, are widely used in the recent years. Also the use of ultrasonic flowmeters and acoustic Doppler current profilers, as ADCP, is becoming a standard practice in several countries. In 2009, for example, 67% of streamflow measurements were made with hydroacoustics



Preparation of an Acoustic Doppler Current Profiler measurement in the field survey during the course.

*The use of ultrasonic flowmeters and acoustic Doppler current profilers, as ADCP, is becoming a standard practice in several countries*

# Stream gauging held in Brescia, Italy

by USGS. Advantages and shortcomings of time of flight vs. ultrasonic Doppler flowmeters were reviewed in the course. Also measurement problems due to clear water or moving riverbed geomorphological conditions were pointed out. The LDV systems were also presented mainly for laboratory experiments. This optical technique is ideal for non-intrusive 1D, 2D and 3D point measurement of velocity and turbulence distribution also in free flows. Science and industry apply LDV systems to gain a clearer understanding of fluid mechanics. The measurement results are important steps in fine-tuning product designs to improve efficiency, quality and safety also in river hydrology research and engineering.

The third day was dedicated mainly to uncertainty assessment. Rigorous uncertainty analyses (UA) are relatively new research endeavours in various schools. Currently,

various fora (such as WMO and ISO) look for evaluation and unification of the UA approaches over instruments, research tools, and areas of implementation. The reference framework set by the ISO 25377 Hydrometric Uncertainty Guidance and the way it is implemented in the WMO manual for discharge uncertainty assessment with current meters was first presented. The following lectures pointed out the value and importance of hydraulic control devices, as weir and flumes, as reference standards for uncertainty analyses. In case direct measurements cannot be made, especially during large floods, indirect methods, based on water marks, hydraulic controls and modelling, provide a valuable information. Concerning the assessment of uncertainty in ADCP measurements, in the course it was recognised that, because of the numerous sources of uncertainty, a detailed uncertainty procedure for ADCP is not yet available,

although progresses in the recent years are reported in the literature.

Classroom exercises and a one-day field work aiming at presenting an automatic hydrometric real-time station, an ultrasonic discharge measurement installation, ADV and ADCP measures, a mechanical current meter and a hydraulic control measure completed the course programme.

The course passed the Quality Check as more than 95% of the anonymous evaluations on quality of teaching and organisation were either 'good' or 'very good' on a four-levels scale including also 'insufficient' and 'fair'. The course can serve as a basis to strengthen a long-term cooperation between IAHR and WMO and a second edition is already planned to be organised in Korea, in August 2012.

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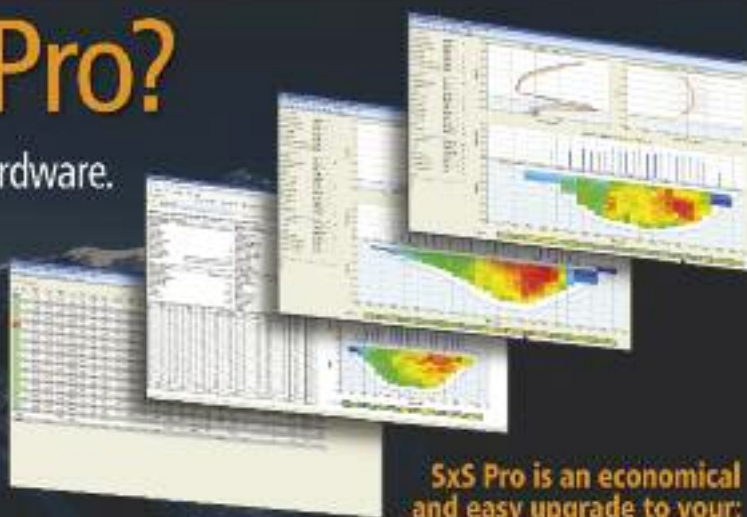
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