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Hydrometry's classical and Innovative methods and tools comparison for Stara river flows at Agios Germanos monitoring station in north-west Greece.

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Abstract

The aim of the present study is a thorough comparison of hydrometry's conventional and innovative methods-tools for river flow monitoring. A case study was conducted in Stara river at Agios Germanos monitoring station (northwest Greece), in order to investigate possible deviations between conventional and innovative methods-tools on river flow velocity and discharge. For this study, two flowmeters were used, which manufac-tured in 2013 (OTT Messtechnik Gmbh, 2013), as follows:

a) A conventional propeller flow velocity meter (OTT-Model C2) which is a me-chanical current flow meter with a certification of calibration BARGO, operated with a rod and a relocating device, along with a digital measuring device including an elec-tronic flow calculator, data logger and real time control display unit. The flowmeter has a measurement velocity range 0.025-4.000 m/s.

b) An innovative electromagnetic flowmeter (OTT-Model MF pro) which it is con-sisted of a compact and light-weight sensor and a robust handheld unit. Both system components are designed to be attached to conventional wading rods. The electromag-netic flowmeter uses Faraday's Law of electromagnetic induction to measure the process flow. When an electrically conductive fluid flows along the meter, an electrode voltage is induced between a pair of electrodes placed at right angles to the direction of mag-netic field. The electrode voltage is directly proportional to the average fluid velocity. The electromagnetic flowmeter was operated with a rod and relocating device, along with a digital measuring device with various logging and graphical capabilities and vari-ous methods of velocity measurement (ISO/USGS standards). The flowmeter has a measurement velocity range 0.000-6.000 m/s.

The river flow data were averaged over a pair measurement of 60+60 seconds and the measured river water flow velocity, depths and widths of the segments were used for the estimation of cross-section's mean flow velocity in each measured segment. Then it was used the mid-section method for the overall discharge calculation of all segments flow area. The cross-section characteristics, the river flow velocity of segments and the mean water flow velocity and discharge total profile were measured, calculated and an-notated respectively. A series of concurrent conventional and innovative (electromag-netic) flow measurements were performed during 2014.

The results and statistical analysis showed that Froude number during the measurement period in all cases was Fr<1 which means that the water flow of the Stara river is classified as subcritical flow. The 12 months' study showed various advantages for the elec-tromagnetic sensor that is virtually maintenance-free because there are no moving parts, no calibration was required in practice, and it can be used even in the lowest water ve-locities from 0.000 m/s.

Moreover, based on the concurrent hydromeasurements of the Stara River, on the velocity and discharge modelling and the statistical analysis, it was found that there was not a significant statistical difference (α=0.05) between mean velocity measured with a) conventional and b) electromagnetic method which seems to be more accurate in low velocities where a significant statistical difference was found.

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