Impact of an intrusive sensor on discharge determination in open channels

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ABSTRACT

Ultrasonic devices such as profilers (pulse Doppler, cross correlation) are installed in sewer systems to comply with guidelines and regulations. Smaller sewers (from DN 200-500) should also be equipped and manufacturers propose new sensors with smaller dimensions to measure with acceptable accuracy in such measurement points. Most of the measurement systems are not integrating the conditions of the application. One main issue is the intrusive nature of the sensor. The sensor is installed as a mouse in the system and itself influences the flow field. This article proposes a Computational Fluid Dynamics based method to evaluate and compensate the influence of an existing device (produced by NIVUS GmbH) on the velocity profile. The correction function is validated against measurements of velocity profiles. Finally, the correction function is integrated into two methods of discharge determination, namely the POME and a modified log wake law based methodology. Comparisons are done with independent discharge measurements.

KEYWORDS

Computational Fluid Dynamics (CFD), Flow rate measurement, Modified Log Wake Law, Obstacle influence, Principle of the Maximal Entropy, Velocity profiles.