

5. Results

Regardless of the frequency used, a relatively constant and oscillating value of the depth-averaged velocity was observed in the first seconds of the bore, followed by a deceleration far behind the water front. The values obtained were also successfully compared with the wave average velocity derived from the US probes ($V_{\text{front}} \approx 2.5$ m/s), obtaining similar results and therefore proving the consistency of the measurements. All 104 instantaneous velocity profiles between $1 < x/t\sqrt{gd_0} < 2.5$ were normalized using the depth-averaged velocity (V_i) and the maximum height ($h_{i,\text{max}}$). Results are presented in Figure 8, showing a profile typical of open channel flows. The experimental points were also successfully compared with the Prandtl's power law with an exponent $n = 11.5$, obtained with a friction factor $f = 0.01$ [13]. The scattering in the upper part of the flow is attributed to secondary turbulence in the flow surface.

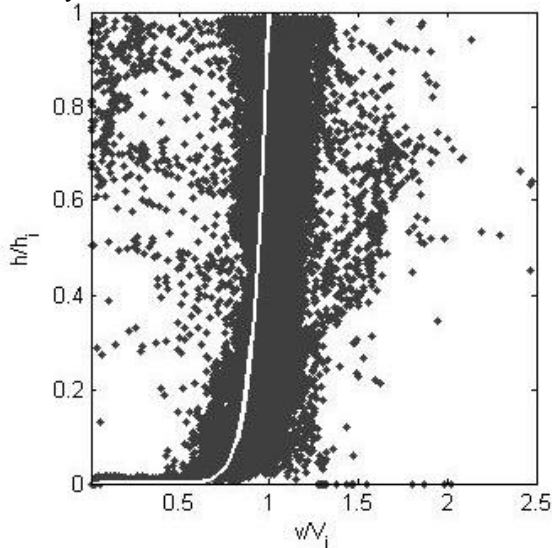


Figure 8 : Dimensionless velocity profiles for a wet bed bore propagating over a $h_0 = 5$ cm still water initial depth

6. Conclusion

Bore waves can be found in nature in dam break waves, impulse waves and tsunamis propagating on a wet bed. This paper is based on an experimental approach and it focuses on the techniques used to measure instantaneous velocity profiles using Ultrasonic Velocity Profilers (UVP). Bore formation is achieved through a vertical release technique and its propagation took place in a 14 m long and 1.4 m wide horizontal channel. A UVP transducer with an emitting frequency of 2 MHz was installed in the channel bottom at an angle of 20° in the upstream direction at a distance of 13.35 m from the channel inlet. Being the flow highly unsteady, the acquisition frequency needed to be sufficiently high to fully capture the properties of the flow and the acquisition time sufficiently long to provide quality results. Thus a compromise needed to be found. To evaluate the influence of these parameters a sensitivity analysis was carried out on three identical bores with different acquisition frequencies. Results showed that for increasing frequencies a higher scattering was observed,

nevertheless the overall behaviour remained unchanged. The quality of the instantaneous profiles was higher for longer acquisition times. Furthermore, the velocity profiles showed an excellent agreement with Prandtl's power law, typical of open channel flows.

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Notation

f	Darcy-Weisbach friction factor
g	gravity constant
h	Bore height [m]
h_0	Initial still water depth [m]
n	exponent in the Prandtl's power law
N	number of measures in the vertical direction
\emptyset	wire diameter [m]
t	time [s]
v	instantaneous profile velocity [m/s]
V	Depth-averaged Velocity [m/s]
V_{front}	bore front velocity, measured with US [m/s]
x	longitudinal direction along the channel [m]

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