ANALYSIS OF THE VELOCITY FILED INSIDE A SEDIMENTARY BED ASSOCIATED TO A FREE SURFACE STEADY FLOW

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Abstract:

The sedimentary transport phenomenon is very complex and the physical processes which are associated to it are still badly known.

Indeed, fault of an adapted instrumentation, the modelling of this phenomenon is still based on two types of independent studies but exploited as complementary:

- Analysis of the velocity field in the free flow. However the large majority of the studies which led to the modelling of the velocity field in ¯the free flow were carried out on impermeable bottom (i.e. with an assumption of zero velocity at the wall).
- The measurement of interstitial velocity within a porous solid mass, but the studies carried out on this subject relate to only uniform flows with constant hydraulic gradient. They have as a reference work of Darcy and those of Forchhheimer.

In order to better understand the physical processes associated with this phenomenon, we adapted the technique of Velocimetry Doppler Ultrasonore (VDU) to the instantaneous measurement of local interstitial velocity within a porous sedimentary bottom, in the case of a permanent flow with a free surface.

The device consists of a channel of an overall length of 3,5 m and rectangular section of (0,10 m X 0,25 m). The walls and the bottom of the channel are glazed, thus making it possible to also make observations.

The velocity measurements are taken by velocimeter DOP 1000.

We materialized the sedimentary bed by various materials, alveolar foams, balls of glass, sands, having different structures and porosities.

Our results highlight:

- A "discontinuity" of the velocity at the interface water/sediment, i.e: a very important gradient function of the flow and nature of the sediment, (Figure 1).
- A no zero velocity on the bottom for the fluid vein, (Figure 1).
- An exponential evolution of the velocities within the sediment (Figure 2)

These results show that the traditional models of determination of the shear-stress *Tp* at the wall are not well adapted because they are based mainly on the characteristics -of the free flow.