Announcement of a Master thesis

For the topic:

CFD modelling of side Weirs using REEF 3D

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Background

A side weir removes water from a main channel to a side channel or reservoir. The flow is attracted to this structure due to differences in pressure. This attraction is not equal over depth. The near surface flow has a higher momentum and it is less affected by the presence of the side weir than slower moving water near the bottom (Neary et al., 1999; Neary & Odgaard, 1993). Thus the side weir can give rise to 3D spiral flows. A complete description of this flow structure and exchange mechanisms in a side weir is important to, for example, understand the morphodynamic effect of side weirs in rivers.

Research Objectives

The goal of the research is to develop a three-dimensional model of side weir based on a previously conducted laboratory experiment (Figure 1). The student will be using the open source CFD model REEF 3D (Bihs,2020). The student will have to answer the following research questions:

1) How can the side weir be modelled in REEF 3D? (Challenges and limitations of the code)
2) What is the 3D flow structure at the main-channel side of the side weir?
3) What is the impact of changes in flow, submergence, and slope conditions on the flow structure?

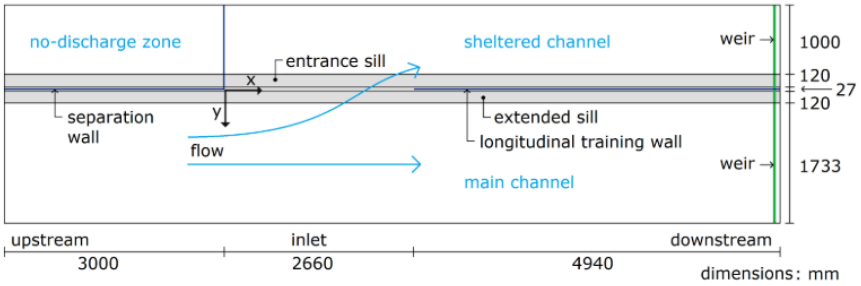

Figure 1. Schematic view of the experimental setup from Van Os, W.(2020) where the blue arrow indicates the flow direction, the grey area represents the sill (side weir), the blue lines are the wooden plates and the green lines represent the downstream weirs

References:

Bihs, H. (2020). REEF3D :: User Guide v20.10. https://reef3d.wordpress.com/user-guide/

Neary, V. S., & Odgaard, A. J. (1993). Three-Dimensional Flow Structure at Open-Channel Diversions. *Journal of Hydraulic Engineering*, *119*(11), 1223–1230.

Neary, V. S., Sotiropoulos, F., & Odgaarg, A. J. (1999). Three-dimensional numerical model of lateral intake inflows. *Journal of Hydraulic Engineering*, *125*(February), 126–140.

Os, W. J. Van. (n.d.). *Bed-material transport over inlet sills of longitudinal training walls*.