Effect of zigzag walls on mean residence time in a series of lateral dead zones of symmetric open-channel

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Running head: Effect of zigzag walls on mean residence time

Abstract:

Lateral dead zones have an important effect on the long tracer tails observed in natural rivers. In the present study, laboratory experiments were performed to gain new insights into the effects of cavity shape and aspect ratio (WL-1) at 4 different water depths and flow rates, on gyres and mean residence time (MRT) inside the cavity. The experiment was setup as a symmetric channel in order to model a natural river as closely as possible. The LSPIV method was used to obtain velocities. In addition, salinity was injected transversally into the upstream channel and its concentration was measured using 23 probes at the bottom of the cavities. Streamlines, primary and secondary gyres and turbulence intensity, as well as the exchange coefficient (kvel) were calculated from the LSPIV results, while the exchange coefficient (kday) and MRT were obtained based on the probe results. Our study showed that changing the WL-1 has no significant effect on MRT, while changing the cavity shape from regular to irregular is more effective. The maximum intensity was decreased by cavity deformation. Our results suggest that the effect of the cavity shape on secondary gyres is much greater than the effect of the Reynolds number.

Mots clefs : dead zone/ mean residence time/ open channel/ zigzag walls

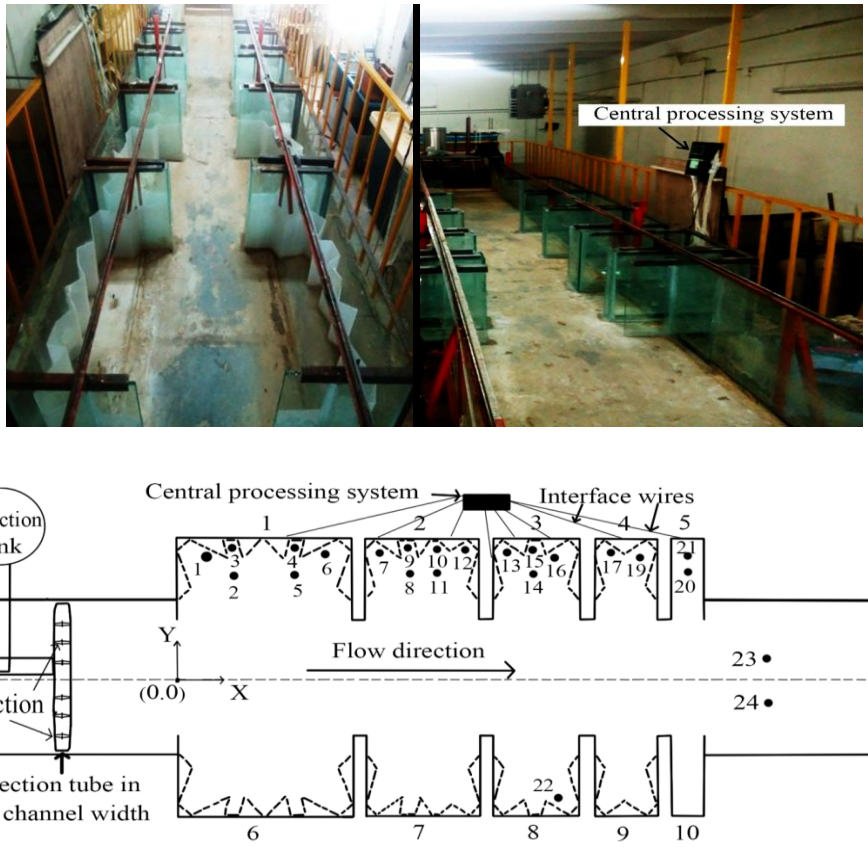

Fig.1. Test flume and its schematic plan with regular and irregular zones

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