Hydrodynamic Interaction of Submerged Slotted Barrier under Solitary Wave

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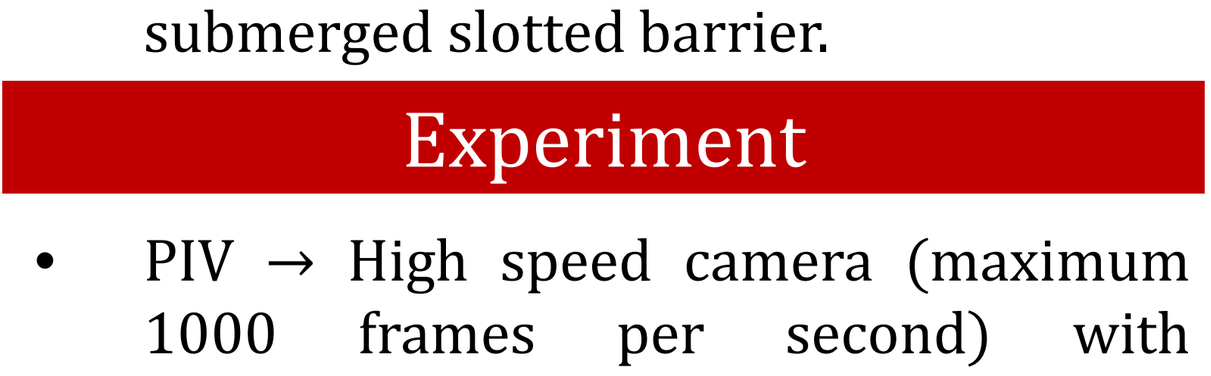
Introduction

- Slotted barrier features thin, rigid, vertical and permeable which may enhance the water circulation and sediment movements.
- Solitary wave only has a single crest so the hydrodynamic interaction is undisturbed by previous and following waves.
- Vortices would be generated due to flow separation and the flow field in the vicinity of the object would become turbulent as water waves pass over an obstacle.
- This motived the current study to investigate hydrodynamic interaction between a solitary wave and a submerged slotted barrier.

Experiment

- PIV → High speed camera (maximum 1000 frames per second) with continuous laser.
- Mean quantities are ensemble-averaging over 20 repeated trials.



Locations of wave gauges	
WG1	x = -2.08 m
WG2	x = -0.59 m
WG3	x = +0.68 m
WG4	x = +2.10 m

Figure 1. Experimental set-up

Wave Gauge Data

- All of the measurements are almost overlapped which indicates high degree of repeatability in present experiments.

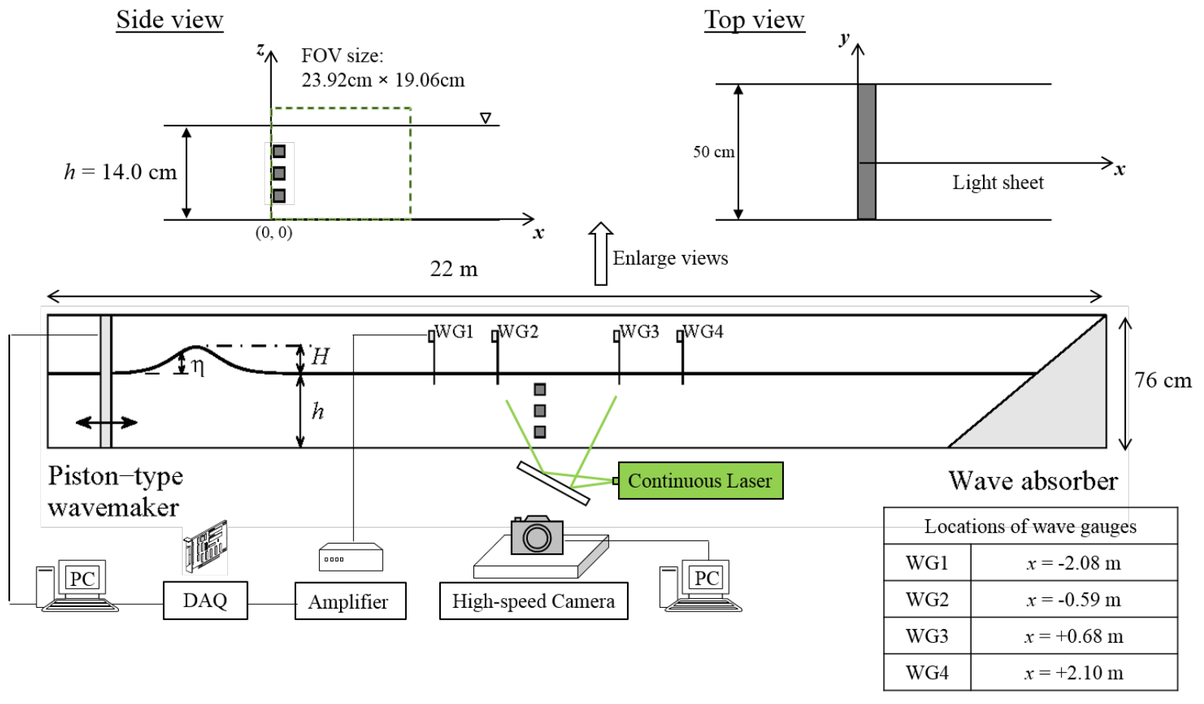


Figure 2. Time histories of the free surface elevation

Mean Velocity Fields

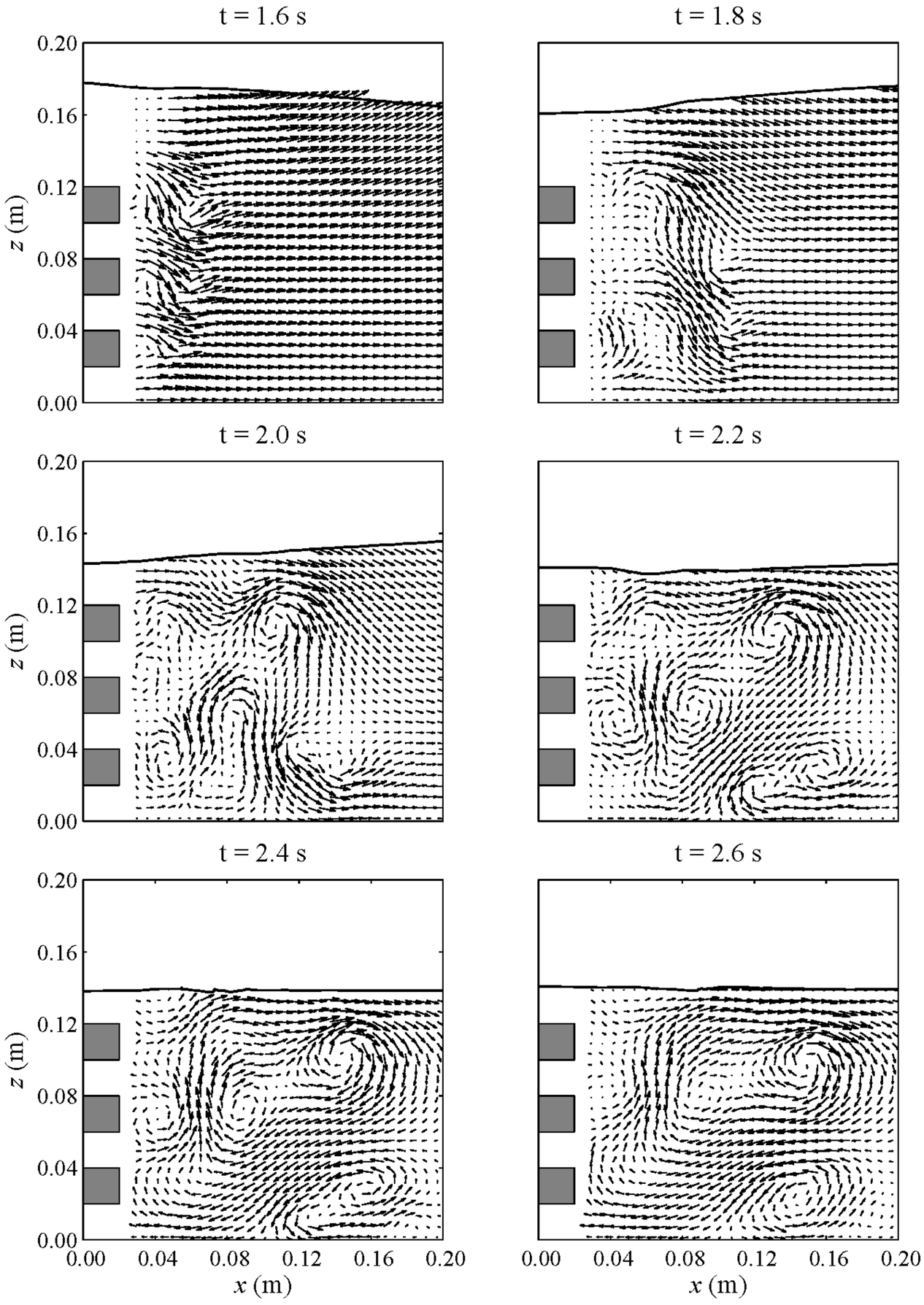


Figure 3. Measured ensemble-averaged velocity fields at various time instants

Conclusions and Future Work

- Vortex shedding processes are observed during solitary wave passing over a submerged slotted barrier.
- High temporal and spatial resolution of mean velocity fields are recorded by PIV system.
- Further attempts are made to reproduce this setup numerically using both RANS (Lin and Liu, 1998) and LES model (Wu et al., 2014).

References

Lin, P., Liu, P.L.F., 1998. A numerical study of breaking waves in the surf zone. J. Fluid Mech. 359, 239-264.

Wu, Y.-T., Yeh, C.-L., Hsiao, S.-C., 2014. Three-dimensional numerical simulation on the interaction of solitary waves and porous breakwaters. Coast. Eng. 85, 12-29.

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