II - 179 Unsteady compound-channel flows with or without an embayment

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INTRODUCTION

Natural rivers often have compound cross sections, particularly in the lower reaches. Along the flood plains in these compound channels, there may exist embayments, which are either formed naturally, or made artificially to improve the natural river environment. Unsteady compound-channel flows with or without an embayment on the flood plain have been experimentally investigated by TU et al. [1, 2]. In this communication, based on experimental results, we will examine the effects by an embayment's existence on its nearby water depths and velocities.

EXPERIMENTAL PROCEDURES

Two groups of experiments were conducted in a 25m long, 1m wide, tilting flume (Fig.1). Wooden plates were placed inside the flume to simulate half of a symmetric compound channel, in which were carried out the first group of experiments (without embayment [1]. Next, on the flood plain, 13m from the flume entrance, an embayment of 30cm x 20cm x 5.18cm was made. Unsteady flows were then measured in and near the embayment [2]. With a computer and relevant software specifically for generating unsteady flows in the flume, three hydrographs (see Fig.2) were repeatedly passed in the flume for velocity and water depth measurements, first with then without the embayment on the flood plain.

Both water depths and velocities were measured at 11 positions in and near the embayment. Shown here, however, are only the longitudinal velocities from: p10 on the flood plain and p11 in the main channel. Water depths were measured using limnimeters, and velocities were measured every 5mm (up to a maximum of 15 points in a vertical) with electromagnetic probes, which have a diameter of 5mm. The flume's bottom slope was 1/1000 throughout the experiments. The sampling rate was 5Hz, and the five readings per second were averaged to render the time-mean velocities, though no indication on the turbulence.

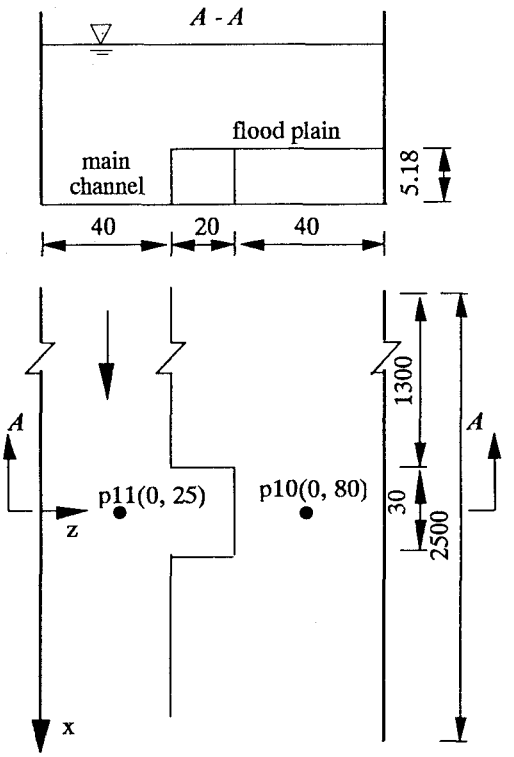

Fig. 1 Experimental setup (in cm)

RESULTS AND CONCLUSIONS

Experimental results from p10 (on the flood plain) and p11 (representing the main channel) are given in Figs.2 and 3. Due to space limit, only the point velocities in Hydrograph 1, at selected heights, are shown here. Before examining the results, we note that p11 in the main channel is 15cm away from the interface (in case of no embayment) or 25 from the center of the embayment, while p10 on the flood plain is 40 cm from the interface (in case of no embayment) or 30cm from the center of the embayment. Thus both p10 and p11 are a little far away from the interface or the embayment, whose influences on the flow may be too weak for the present examination. This being noted, one can still conclude from Fig.2 that, both the water depths in the main channel and on the flood plain are larger when there is an embayment on the flood plain, being on the average 5mm higher than those measured without the embayment. On the other hand, velocities in the main channel (p11)-near the bottom (y=1cm), at about the flood plain's height (y=5cm) and above the flood plain (y=7cm)-do not show discernable difference. Neither do the velocities on the flood plain (p10). Velocities should be probed closer to the interface or the embayment in future studies.

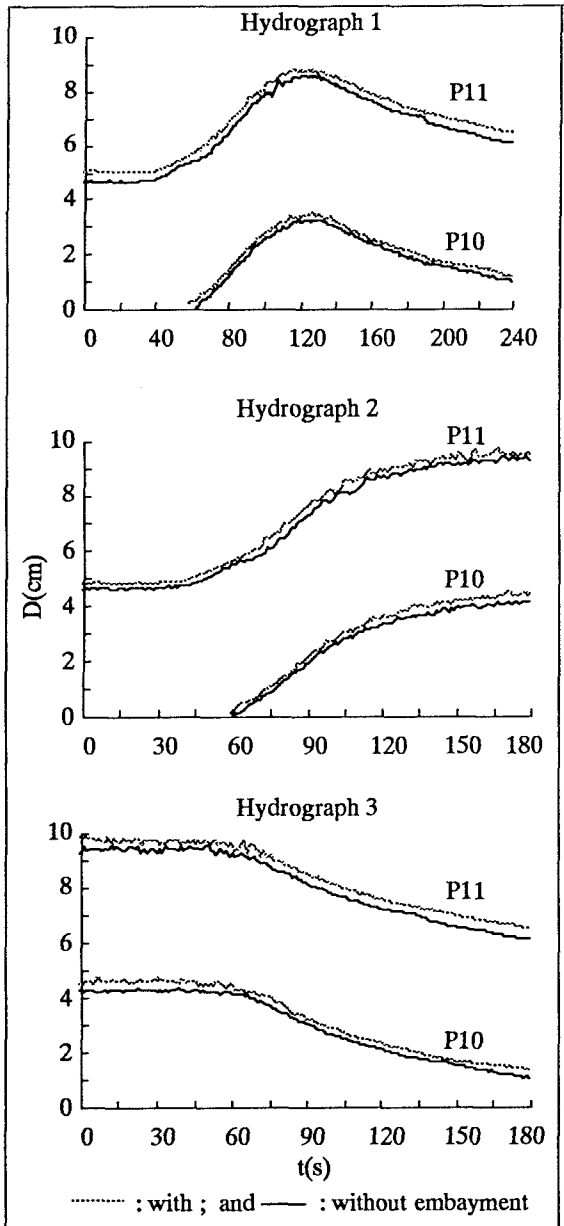

Fig.2 Water depths, measured in the main channel and on the flood plain, are larger when there is an embayment

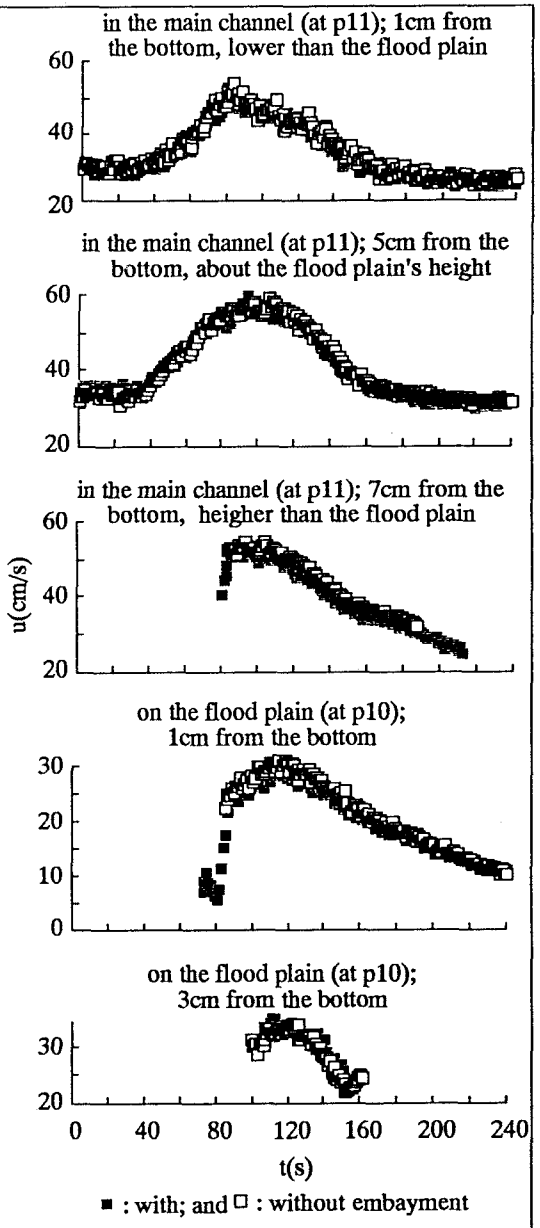

Fig.3 Velocities in Hydrograph 1, measured at different heights, are almost the same with or without the embayment

ACKNOWLEDGEMENT

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REFERENCES

[1] Tu H., N. Tamai and K. Kan (1994), "Velocity variations in unsteady compound open-channel flows", Proc. 9th Congress of the Asian-Pacific Division, IAHR (*accepted for publication*).

[2] Tu H., N. Tamai and K. Kan (1994), "Unsteady-flow velocity variations in and near an embayment", Proc. of Hydr. Eng., JSCE, Vol.38, pp.703-708.