INTERACTION BETWEEN WATER SURFACE OSCILLATIONS AND LARGE EDDIES IN AN OPEN CHANNEL WITH SPUR DIKES

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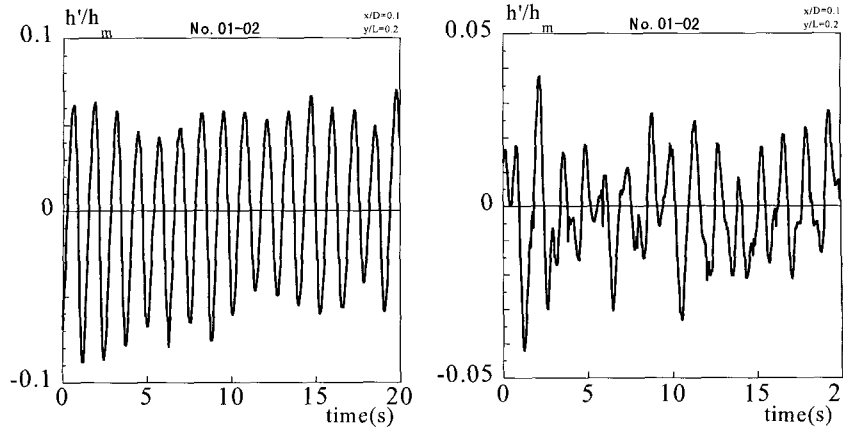
Spur dikes have been used to realign a channel or redirect main flow away from a streambank to protect it from erosive tractive forces. They are also used to increase channel roughness at locations that lack roughness elements. In certain cases, spur dikes can be used to narrow the channel in low-gradient, aggrading reaches causing flow velocities and sediment transport rates to increase.

Authors discussed that the directions of the submerged dikes give influence on the bed scour and the interaction between dikes and main flow region (Ohmoto and Hirakawa, 1998) (Ohmoto and Hirakawa, 1999). Non-submerged dike have been investigated that the scale of vortices is increased while they move downstream (Chen and Ikeda, 1998). The characteristics of open channel flow with two-dikes are also studies. For the case that dikes set up in one side wall, momentum transport is affected by the interval of dikes in equilibrium region (Ikeda, Sugimoto and Yoshida, 2000). Although a number of studies have been made on non-submerged dike, little is known about influence that water surface oscillating gives flow field. The water surface oscillation was attributed to the interaction of large scale eddies formed in the spur dike fields along both banks, and was probably triggered by the separation eddies behind the first spur dike. This study focused on the interaction between water surface oscillation and large eddies in both cases of spur dike set up along both banks and one bank. The result showed that when a remarkable water surface oscillation was observed, the interaction of the large eddies in both banks was strong.

This study focused on the different of water surface oscillations to changing the 1st and 2nd dikes interval. It analyzed the large eddies interaction between dikes region and main flow region. Findings of this study can be summarized as follows:

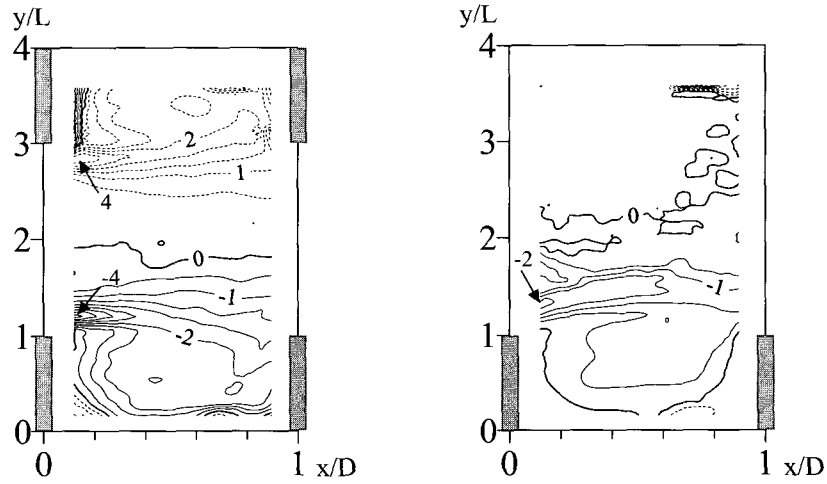
Spur dikes was installed at intervals of the twice of length. When it installs symmetrically with both banks, a remarkable water surface oscillations will appear (Fig.1-a), and in the case of one bank, water surface oscillations will hardly be occurred (Fig.1-b).

It was found from the time-averaged distribution of vorticity that vortices with a vertical axis on both banks shed at the heads of the spur dikes are advected toward the heads of downstream spur dikes in case with large water surface oscillation (Fig.2-a). In case with small water surface oscillation, strong vortices were toward the main flow region (Fig.2-b).



(a) both bank (b) one bank

Fig. 1 Time-series of water surface oscillations.



(a) both bank (b) one bank

Fig. 2 Distributions of time averaged vorticity.