# 砕波帯における波浪伝播モデル

(A model of water wave breaking based on the energy flux equation)

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1.Introduction: It is well known that the construction of breaking wave theory is strongly needed in the field of surf zone dynamics. This should be one of the most important subjects for us. Nevertheless difficulty in ordering the Navier-Stokes equation for motions of multi-phases, i.e. turbulence,waves and mean currents, has been an obstacle in progressing the theory.

In this paper, we have tried to calculate the wave fields in the surfzone in terms of the energy flux conservation equation, which is based on the Svendsens theory. Improvements of the theory are attempted in expressions of wave shape and dissipation parameters.

2.Basic equations: The simplest way to calculate the variation of the wave height in the surf zone is to solve combined equations of momentum and energy flux, which are given by,

$$\partial S_{xx}/\partial x = -\rho g(h_0+h)\partial h/\partial x + \mu_1(\partial^2 U/\partial x^2) - \tau_b \cdots (1) \qquad \partial E_{wf}/\partial x = D_{iss.} \cdots (2)$$

In this system, three effects exist. (a)changes in water depth, (b) energy dissipation (momentum mixing) and (c)changes in wave shape. The shoaling effects(a) may be introduced into the energy flux eq. by defining the shoaling coefficient Ks for the inviscid component of waves. The dissipation coefficient Kd is also introduced as an known coefficients.The resulting energy flux equation is the form;

$$H = H_b K_s / \left(1 - H_b/8 C_b B_b T \cdot \int_{x_b}^{x} D \cdot K_s^3/(h_0+h)\, dx\right) \cdots (3)$$

Futhermorer, neglecting the momentum transfer due to turblence,the momentum equation is described as:

$$\partial S_{xx}/\partial x = -\rho g(h_0+h)\cdot \partial h/\partial x \cdots (4)$$

These are the basic equations used here.

3. Dissipation and wave shape parameters: Svendsens theory employs the assumptions of two important parameters pertaining to the wave shape B and dissipation D, which will be related to breaker type and water depth. According to the Hansen et al.s experiments,

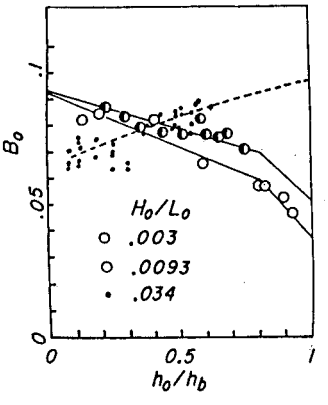


Fig.1

we can recognize it as shown in Figs. 1 and 2. We showed the portrate of the parameter B in Fig.3, which should be very important for calculation of wave and currents fields in the surfzone.

4. Calibration of the model: The basic equations can be solved numerically by using the iteration method. Eq.(3) is solved by assuming zero wave set-up and constant B and D. Then, employing the experimental formulation for them, new wave height is obtained within a couple of iterations. Thirdly, we obtain the 1st solution coupled with wave set-up of the solution to the momentum eq.(4). Repeating these procedures, in a several times, the final solution is obtained. Figs.4 and 5 are the comparisons between the Hansen et.al.s experimental results. It can be recognized that good agreement is achieved in spite of the calculation including the so-called outer region.

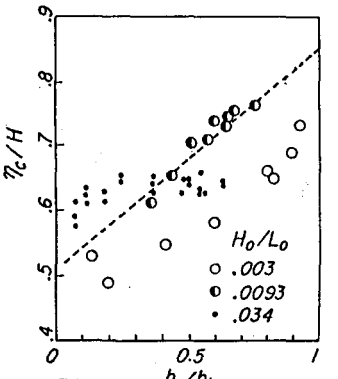

Fig.2

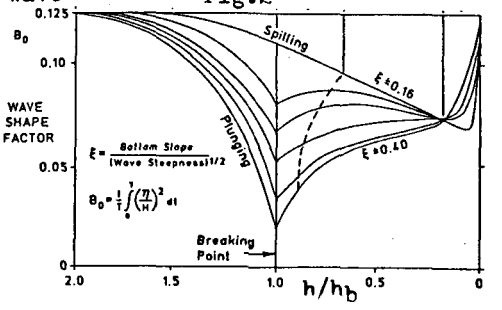

Fig. 3

5. Conclusions: We have pointed out the efficiency of the B and D portrates to the breaking wave calculation based on the energy flux equation. The simple model will be effective to analize the surfzone dynamics before the comming multi-phases breaking wave theory.

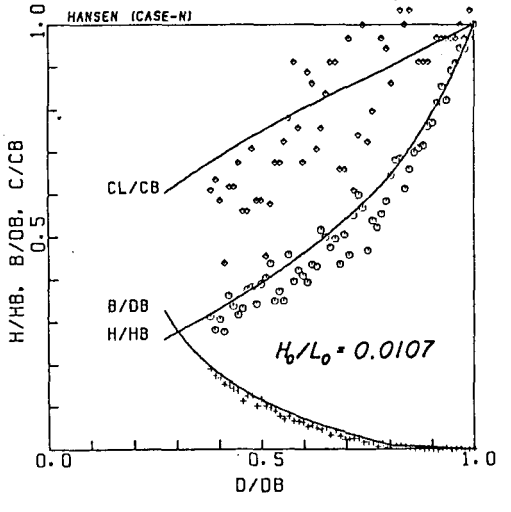

Fig. 4

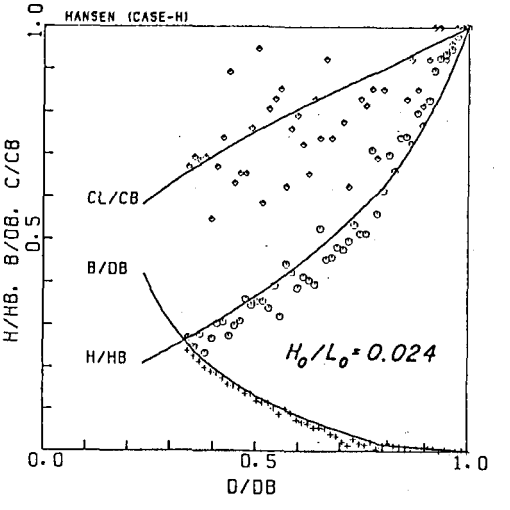

Fig. 5

References: 1)Svendsen,Coasral Eng.,Vol.8,1984,pp.303-329. 2)Hansen & Svendsen,Inst. Hydrodyn. Hydr. Eng., Series Paper 21,1979. 3)Basco & Yamashita,20th ICCE,1986.