The central idea behind the way I've calculated the initial conditions, is that I wanted to have a soliton solution assuming a flat bed transplanted onto the bed profile of the synolakis experiment.

The way I have achieved this is to make the water surface have the soliton surface profile solution (with $h_0 = 0$, since the bed is negative), I then calculate the velocity using this soliton solution (here h_0 is neccessary to give correct speed for depth of water, assuming flat bed).

The depth h is then given as $w - b$.

Initial conditions for synolakis data for h (height of water above bed), w (stage - absolute location of free surface), u (velocity) and b bed.

$$h(x) = w(x) - b(x),$$

$$w(x) = \begin{cases} b(x) & x \leq 0 \\ amp \times \operatorname{sech}^2\left(k(x - xpeak) - c \times t\right) & x > 0 \end{cases}$$

$$u(x) = \begin{cases} 0 & x \leq 0 \\ -c \times \left(1 - \frac{h_0}{w(x)+h_0}\right) & x > 0 \end{cases}$$

$$b(x) = \begin{cases} -x \tan(\beta) & x \leq \cot(\beta) \\ -1 & x > \cot(\beta) \end{cases}$$

where c and k depend on the inputs like so

$$c = \sqrt{g * (h_0 + amp)}$$

$$k = \frac{\sqrt{3 \times amp}}{2h_0\sqrt{h_0 + amp}}$$

the input parameters are t - time (initially 0), h_0 - background height of water (1 for these experiments), amp - height of wave above background water depth, β - slope of linear beach, $xpeak$ - location of wave peak at $t = 0$, g acceleration due to gravity - in the non-dimensionalised experiments this is should be 1.