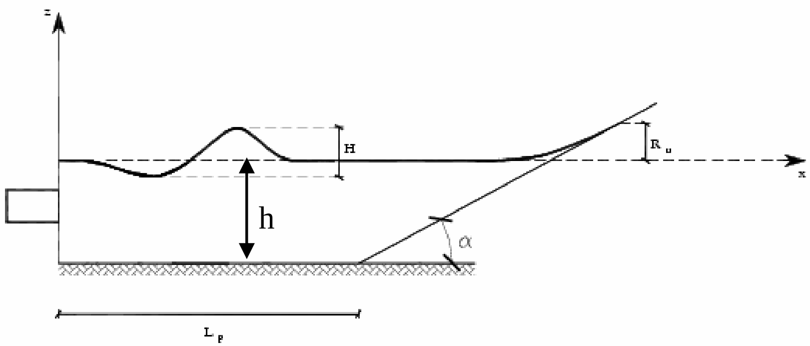
Impulsive wave runup: the experimental procedure

The experiments were performed in two phases

h [m]	L_p [m]	α [°]
0.06	0.85	22°
0.10	1.30	37°
0.18	1.75	84°

Phase 1: **elevation time series were collected without the plane slope into the wave flume to get the correct incident wave parameter**

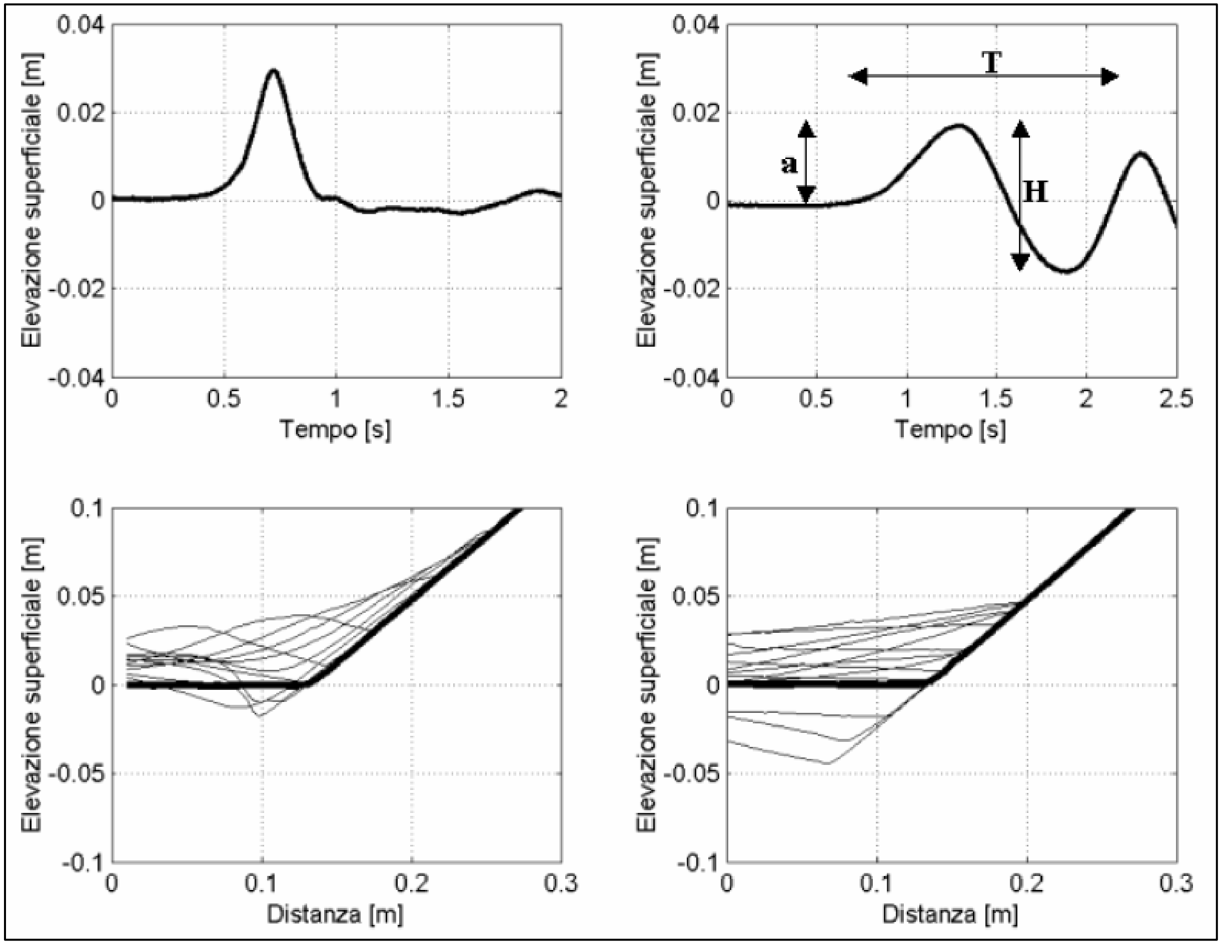
Phase 2: **digital video system was employed to get the runup value on the plane beach without any wave gauges into the wave flume to avoid flow disturbance**



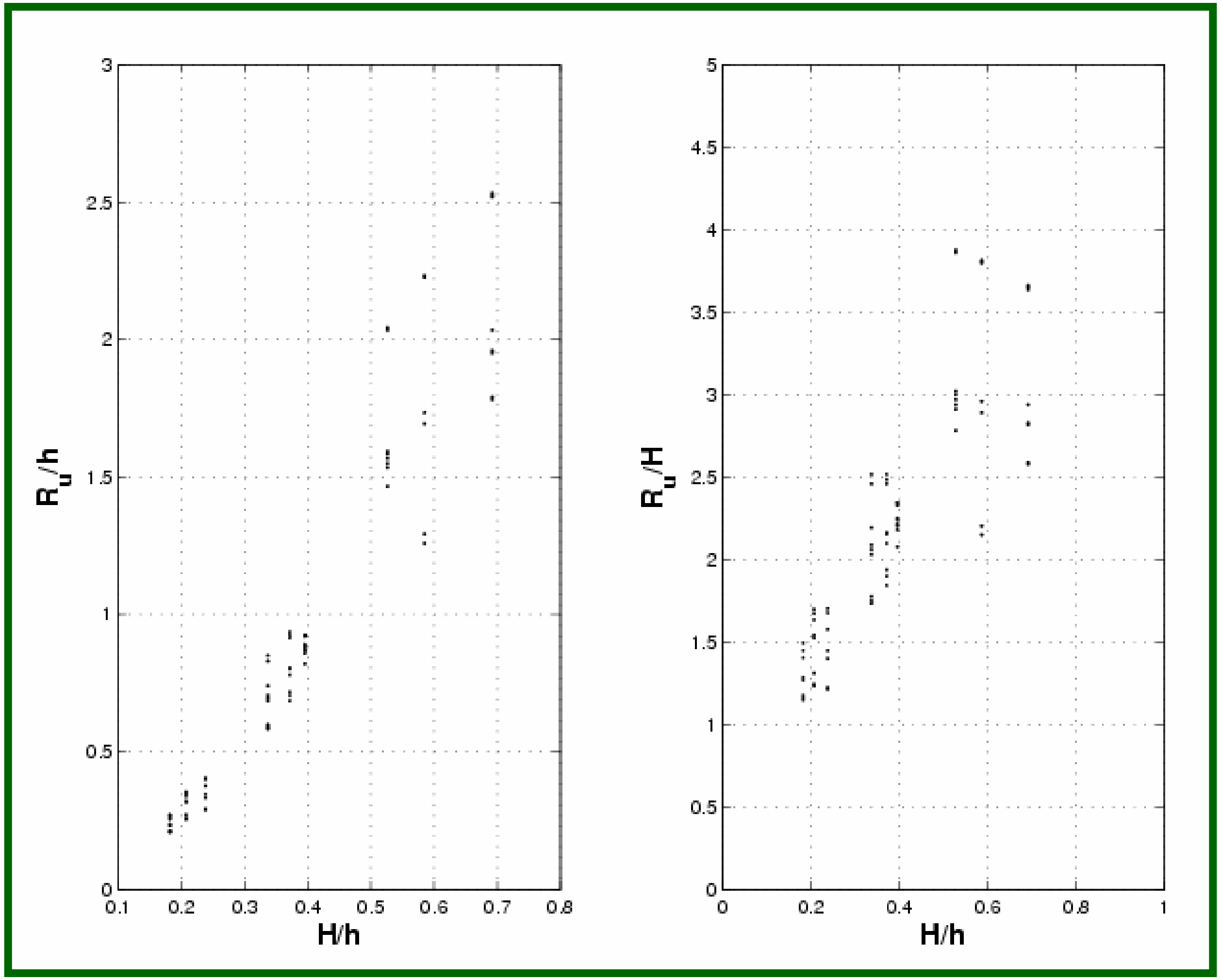
Impulsive wave runup: the experimental procedure

Phase 1:

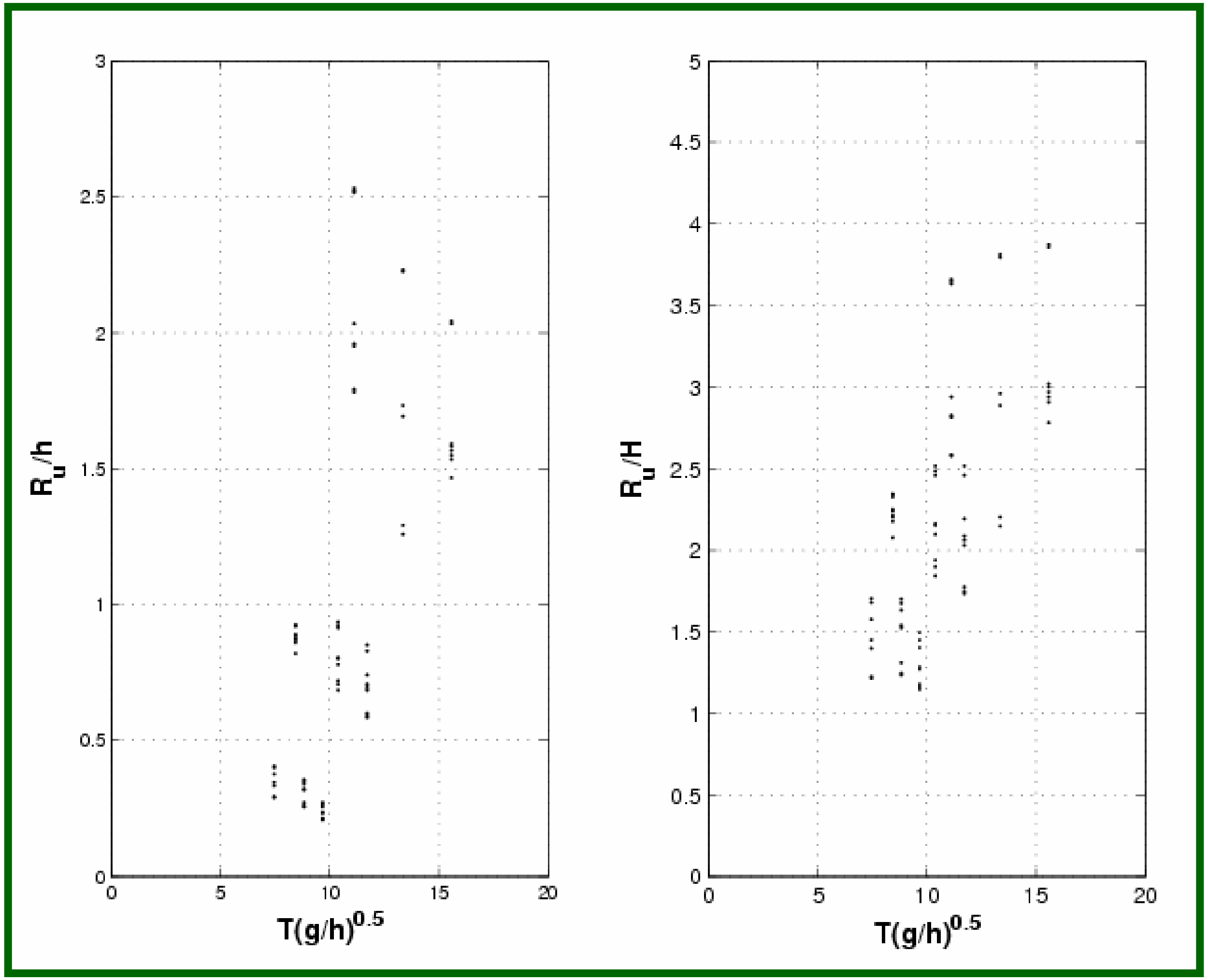
Phase 2:



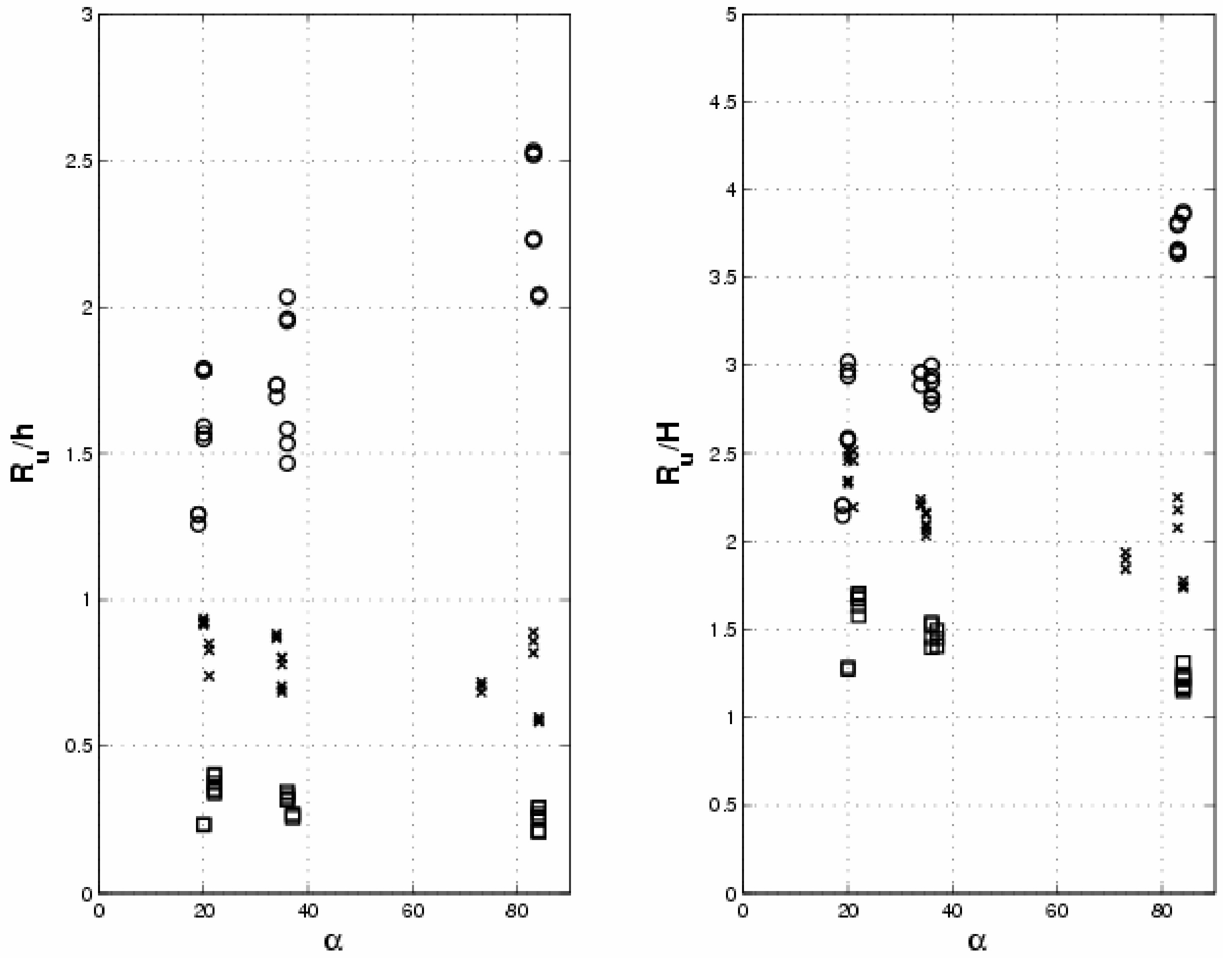
Impulsive wave runup: the experimental findings



Impulsive wave runup: the experimental findings



Impulsive wave runup: the experimental findings



Impulsive wave runup: the experimental findings

- **likebore waves, solitary waves, cnoidal waves and linear waves runup were observed**

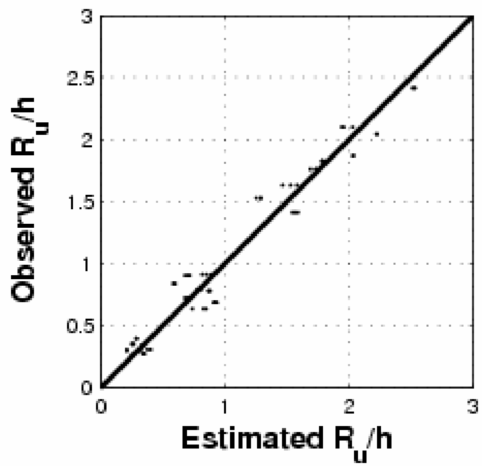
- **wave runup increases as incident wave height increases**

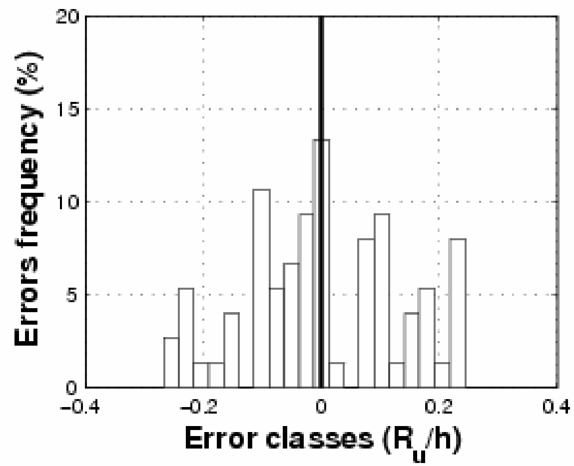
- **wave runup increases as incident wave period increases, the wave period must to be taken into account**

- **beach slope influence is different depending on incident wave type**

Impulsive wave runup: the new empirical formulation

	Factor a_1	H/h a_2	$T(\sqrt{g/h})$ a_3	$\sin(\alpha)$ a_4	R^2	$\bar{\varepsilon}$
R_u	1.3737	1.5149	0.4665	0.2633		
	$\pm$ 0.5838	$\pm$ 0.1078	$\pm$ 0.1632	$\pm$ 0.0636	0.955855	0.11011





Impulsive wave runup: comparison with existing formulae

$$\frac{R_u}{h} = 2.831\sqrt{\frac{1}{\tan\alpha}}\left(\frac{H}{h}\right)^{1.25}$$

Synolakis formula for non breaking solitary waves (1987)

$$\frac{R_u}{h} = 3.86\sqrt{\frac{1}{\tan\alpha}}\left(\frac{H}{h}\right)^{1.25}$$

Tadepalli & Synolakis formula for non breaking N-waves (1994)

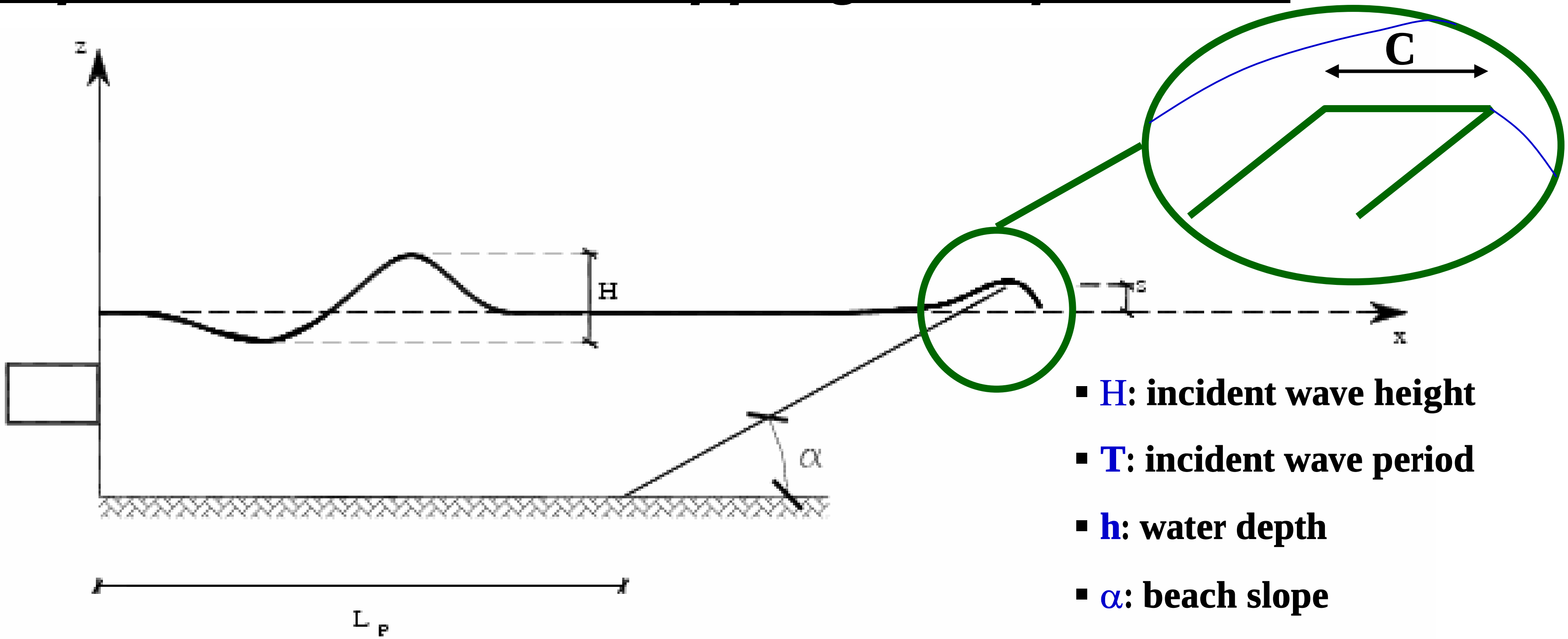
$$\frac{R_u}{h} = 1.3681\left(\frac{H}{h}\right)^{1.25}\left(\frac{H}{L}\right)^{-0.15}\alpha^{-0.20}$$

Muller empirical formulation (1995)

	Factor a_1	H/h a_2	$T(\sqrt{g/h})$ a_3	$\sin(\alpha)$ a_4	R^2	$\bar{\varepsilon}$
R_u	1.3737 $\pm$ 0.5838	1.5149 $\pm$ 0.1078	0.4665 $\pm$ 0.1632	0.2633 $\pm$ 0.0636	0.955855	0.11011

The present empirical formulation is valid for a wide range of wave type and for breaking and non breaking waves. It takes into account wave period influence

Impulsive wave overtopping: the problem



$$\Omega = f\left(H, T, w, h, \alpha, s, \rho, \mu, g, \delta, C\right)$$

$$\frac{\Omega}{h^2 w} = \phi\left(\frac{H}{h}, T\sqrt{\frac{g}{h}}, \cancel{\frac{w}{h}}, \alpha, \cancel{\frac{\mu}{\rho h\sqrt{gh}}}, \frac{s}{h}, \delta\sqrt{\frac{\rho\sqrt{gh}}{\mu h}}, \frac{C}{h}\right).$$

- **H: incident wave height**
- **T: incident wave period**
- **h: water depth**
- **α: beach slope**
- **ρ: water density**
- **μ: water viscosity**
- **g: gravitational acceleration**
- **δ: beach roughness**
- **C: crest thickness**

Impulsive wave overtopping: the experiments

h	L_p	α	s
$[m]$	$[m]$	$[^o]$	
0.06	0.85	22^o	$0.25\ R_u$
0.10	1.30	37^o	$0.50\ R_u$
0.18	1.75	84^o	$0.75\ R_u$

The overtopped water volume is collected by means of a small tank