NUMERICAL MODELLING OF COASTAL STRUCTURES USING SPH-BASED DUALSPHYSICS MODEL

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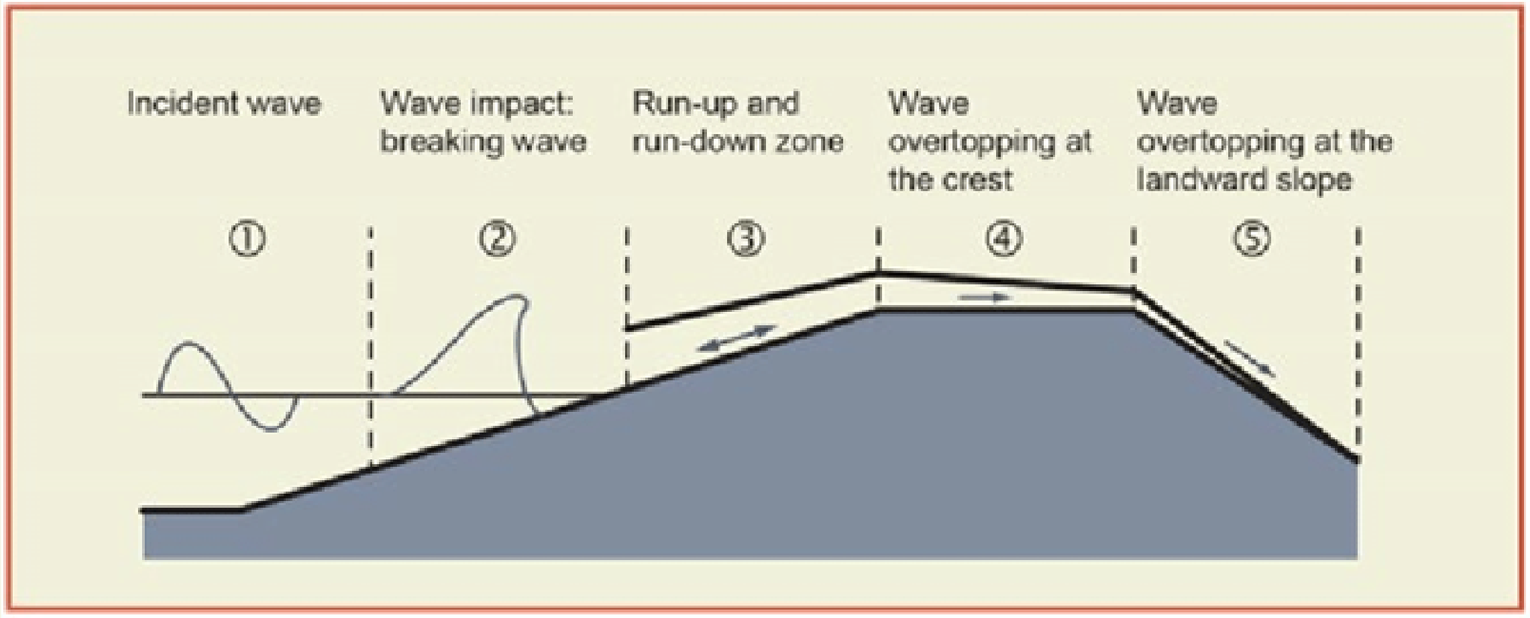
Wave Overtopping

•Important hydraulic response of a coastal structure.

•Occurs when crest height is lower than the run-up level of the highest waves.

•Significantly affect functional efficiency and structural safety of structures.



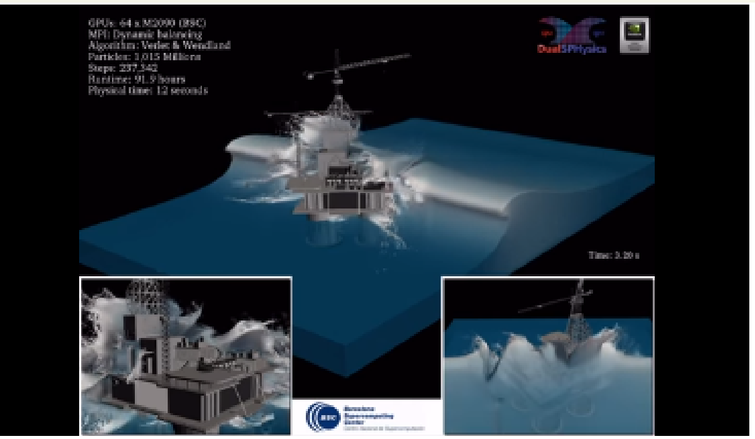
Measuring Overtopping & Forces

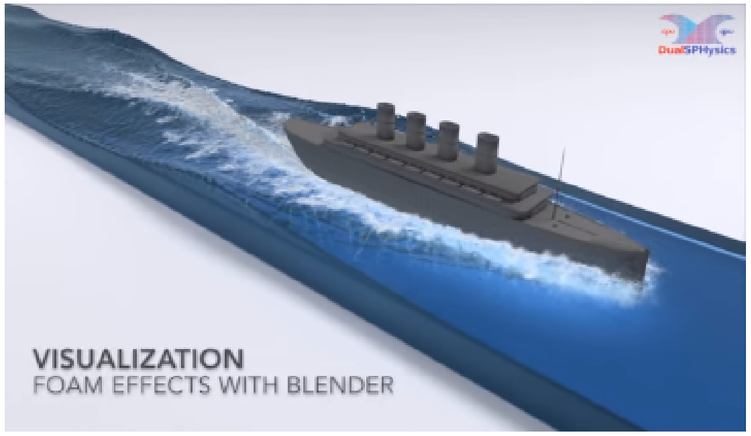
OVERTOPPING

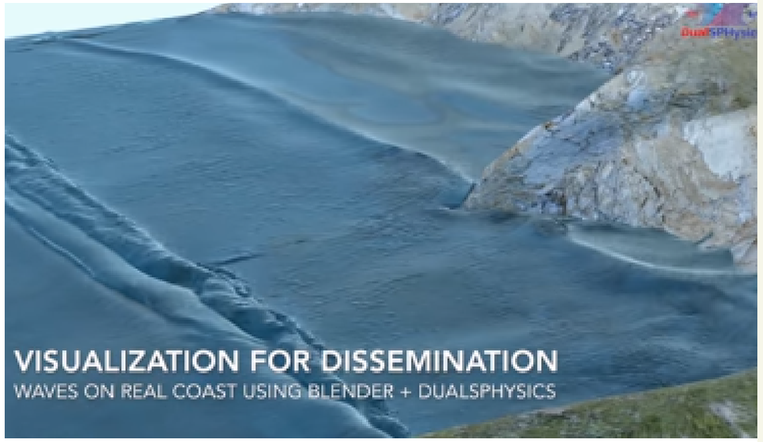
- Referring to the available database (CLASH and Neural Network)
- Undergoing experiment in wave flume/ Physical Model.
- Numerical modelling

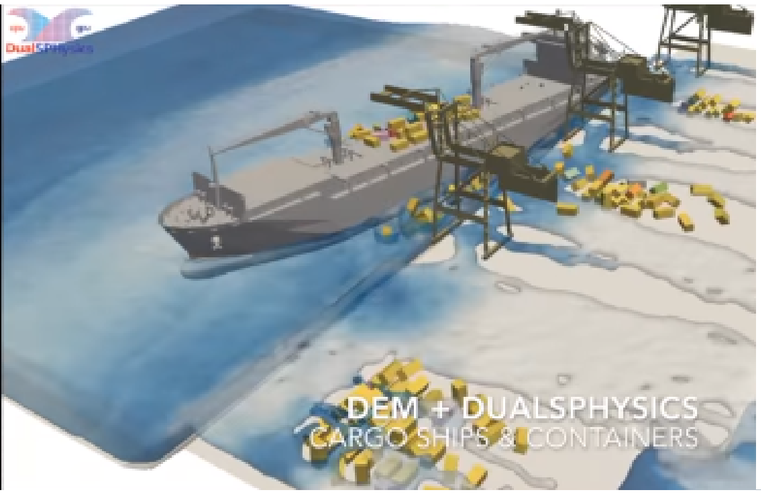
FORCES

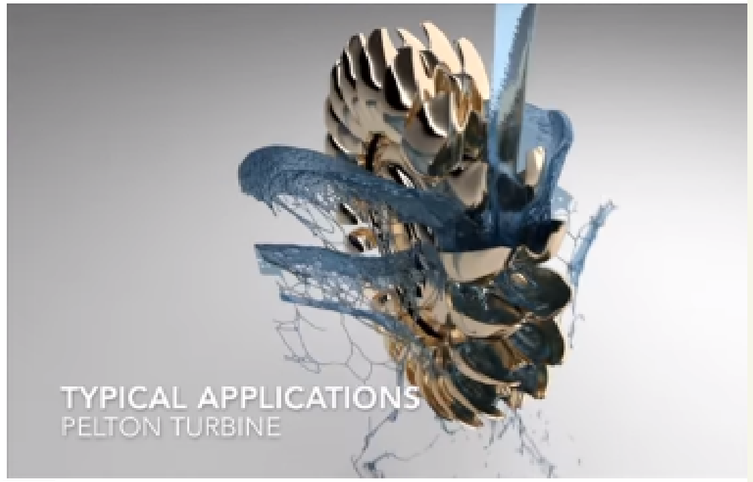
- Application of Formulas
- Numerical model











DualSPHysics

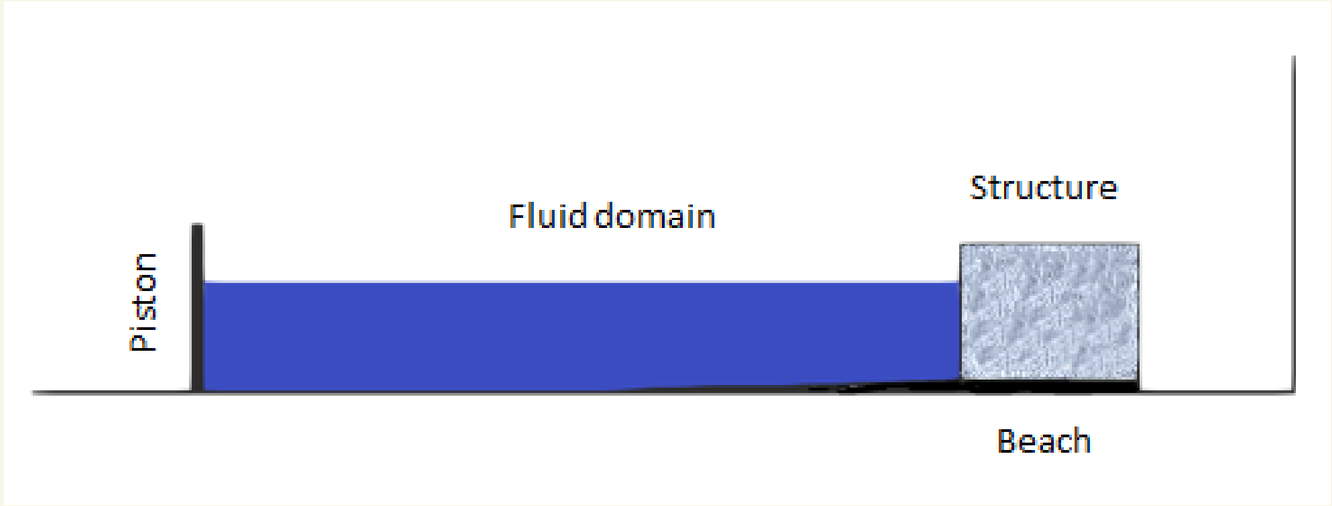
- Is a software based on the Smoothed Particle Hydrodynamic model known as SPHysics.

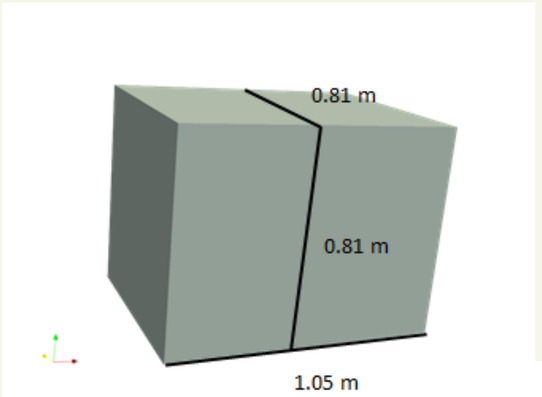
- It is developed to study free-surface flow phenomena where Eulerian methods are difficult in application.

DesignSPHysics

ParaView

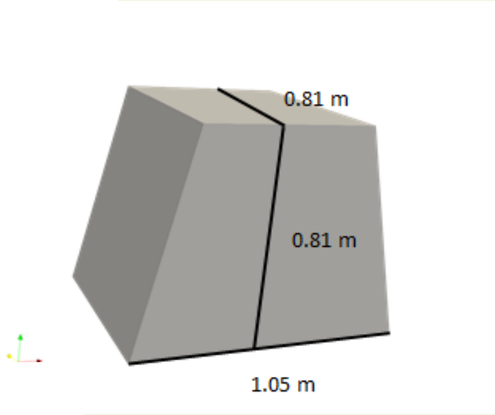
Numerical Setup

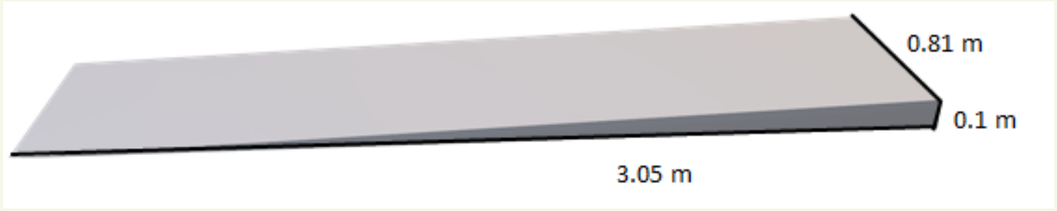




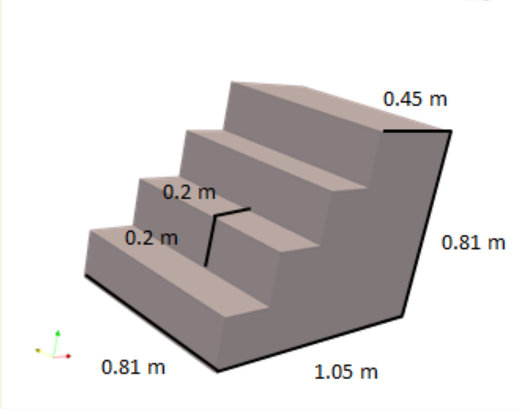
VERTICAL WALL

TRAPEZOIDAL WALL





BEACH



STAIRED WALL

Wave Parameters

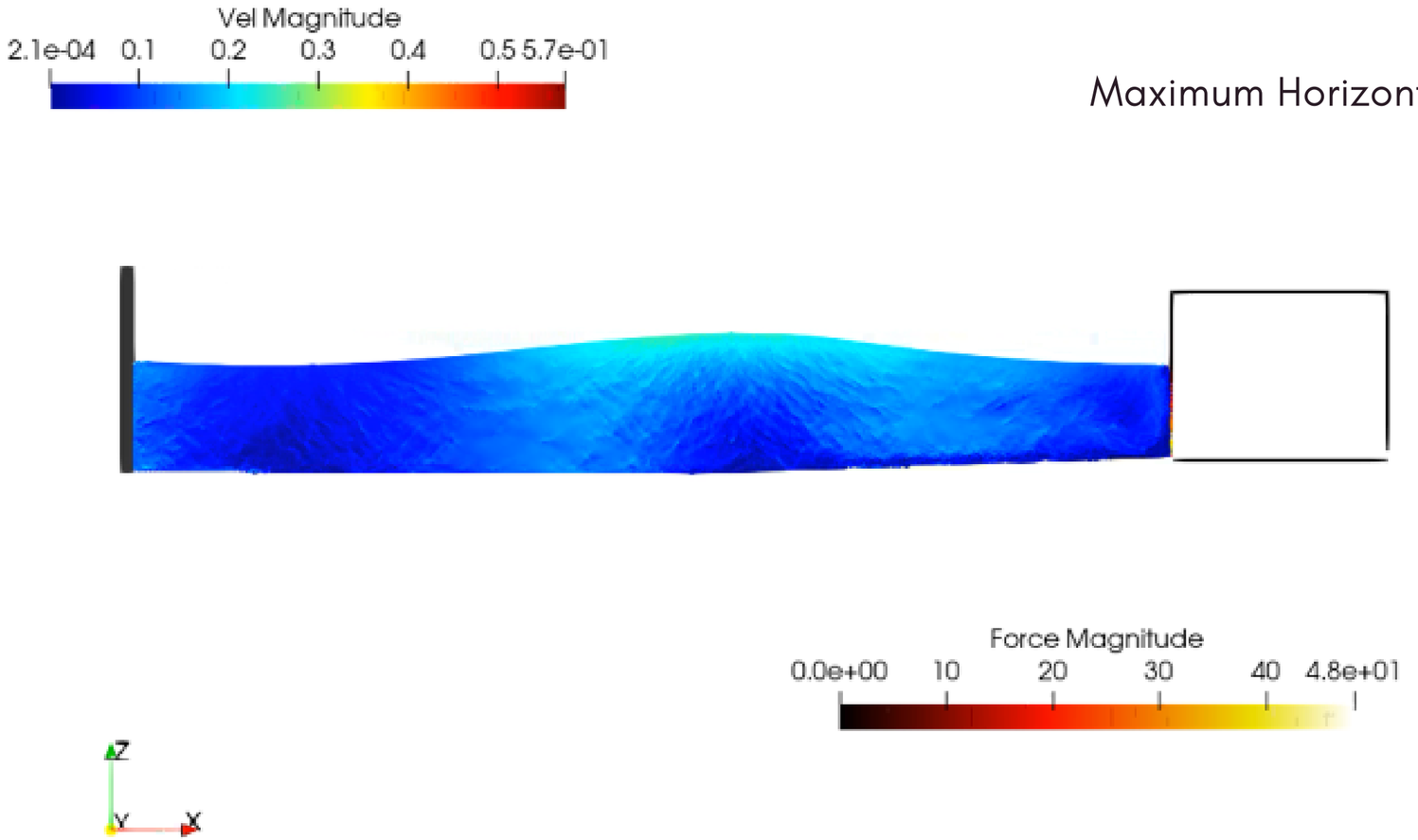
Non-Breaking Wave Parameters:

1) ***H: 0.10 m, T: 2.0 s, d: 0.60 m***
2) H: 0.11 m, T: 2.2 s, d: 0.60 m
3) H: 0.12 m, T: 1.8 s, d: 0.60 m

Breaking Wave Parameter:

1) ***H: 0.25 m, T: 2.2 s, d: 0.65 m***

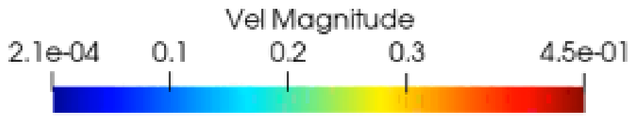
Non-Breaking Wave - Vertical Wall



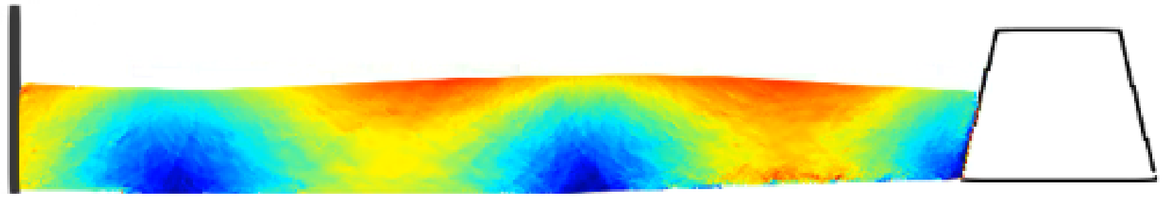
Maximum Horizontal Force: 4.1 sec, 1773 N/m

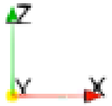
T: 11 SEC

Non-Breaking Wave - Trapezoidal Wall



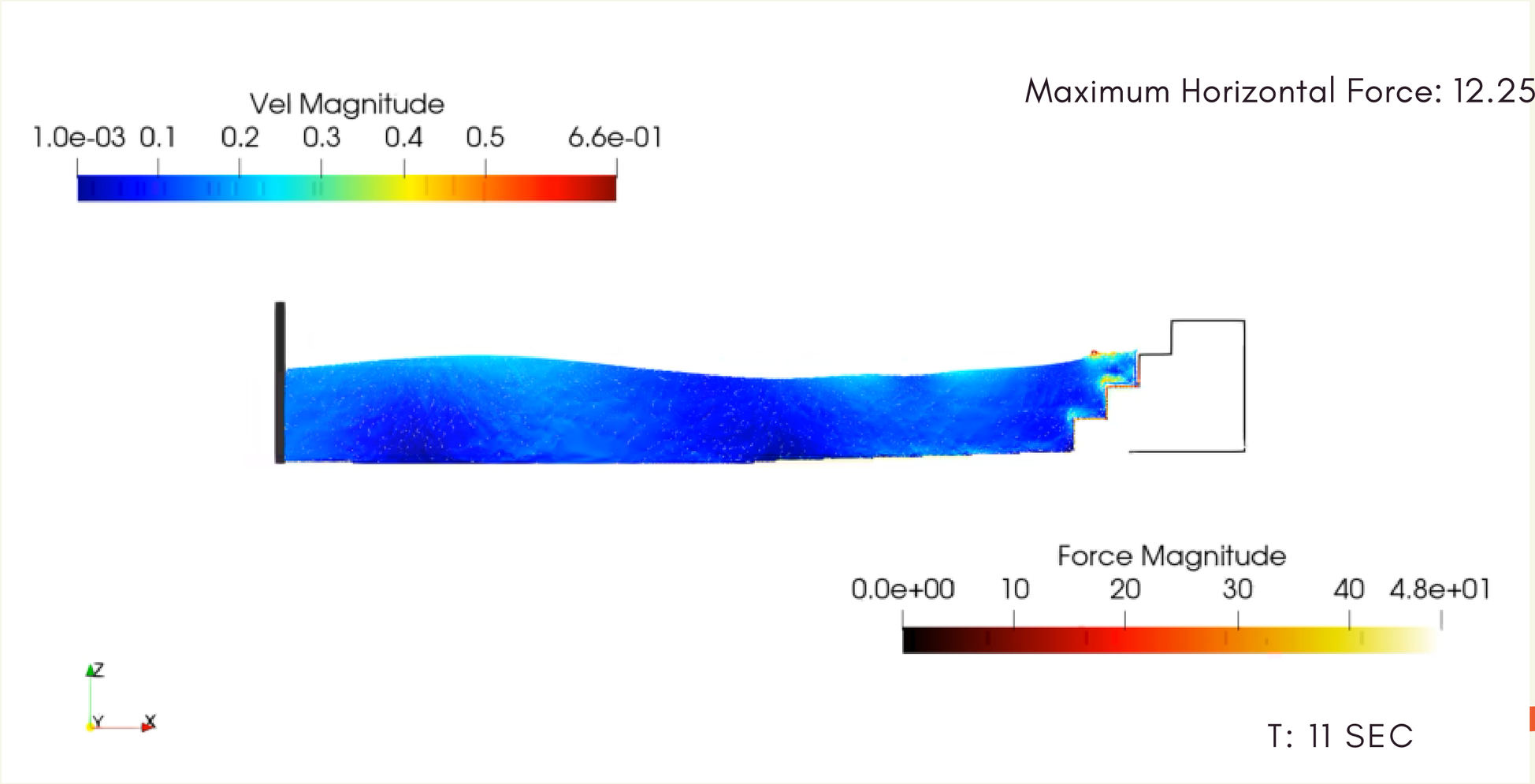
Maximum Horizontal Force: 14.15 sec, 1778 N/m





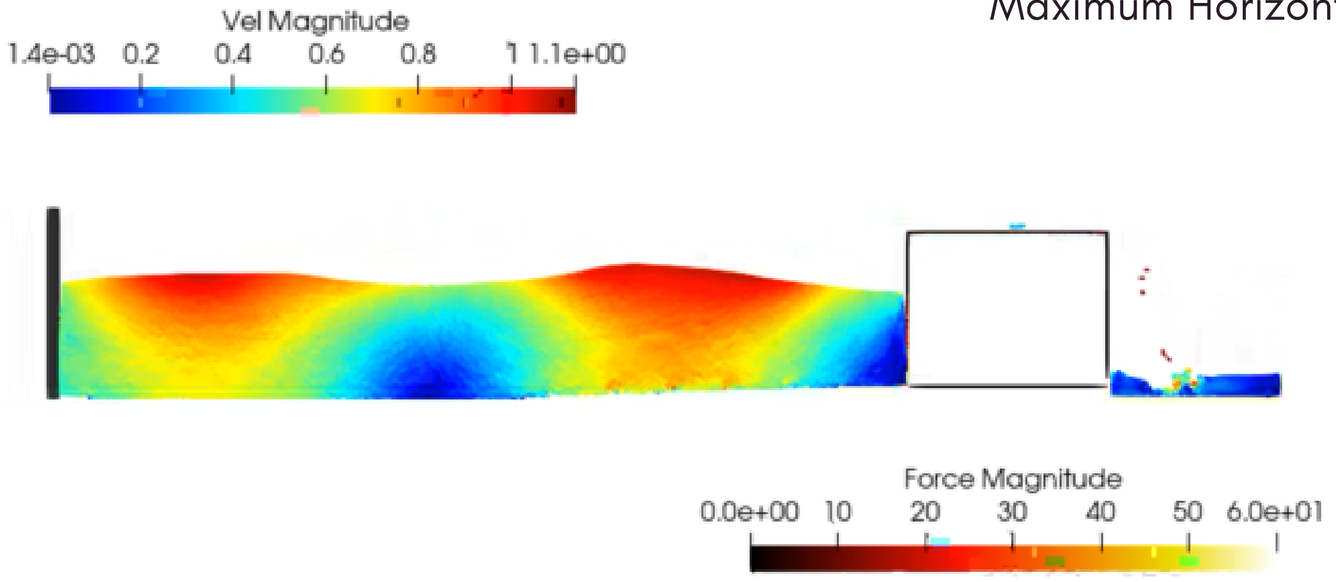
T: 11 SEC

Non-Breaking Wave - Stained Wall



	Vertical Wall			Trapezoidal		
	W1	W2	W3	W1	W2	W3
Numerical-Maximum Horizontal Force [N/m]	1773.57	1954.73	1846.77	1778.61	1926.29	1821.90
Analytical Bao-Maximum Horizontal Force [N/m]	1734.70	1817.50	1793.70	1715.20	1794.60	1772.10
Error (%)	2.24	7.55	2.96	3.70	7.34	2.81
Average Error (%)		4.25			4.62	

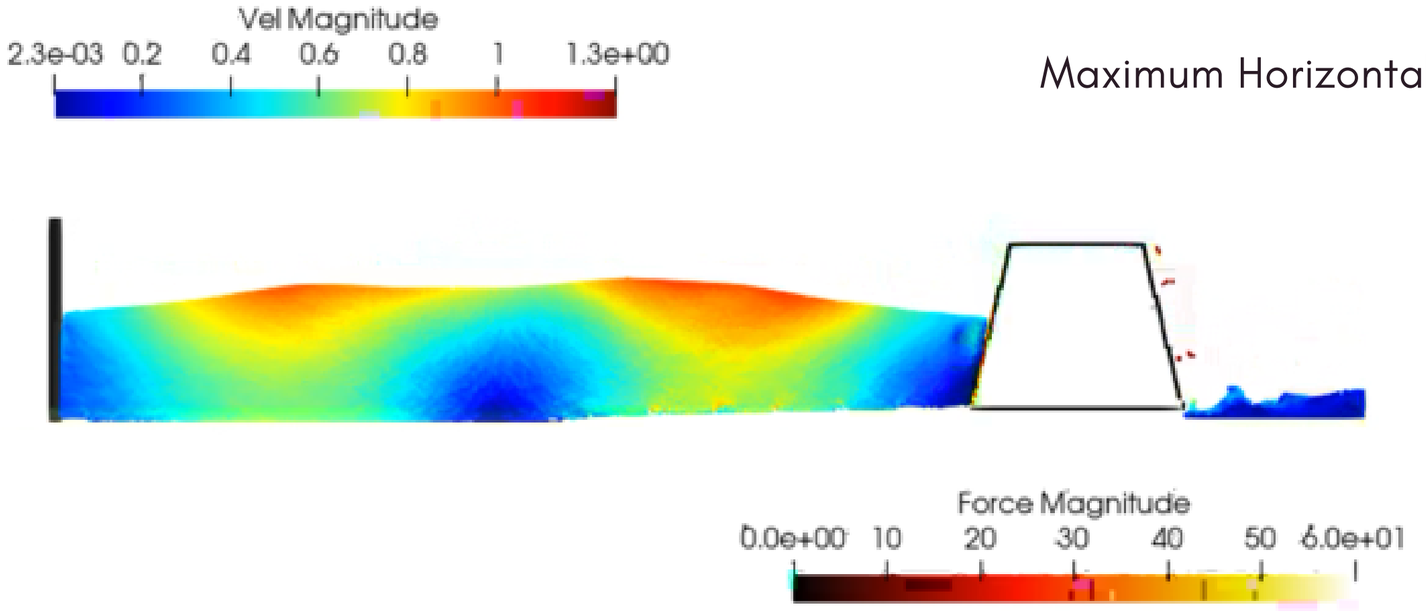
Breaking Wave - Vertical Wall



Maximum Horizontal Force: 6.2 sec, 2875 N/m

T: 30 SEC

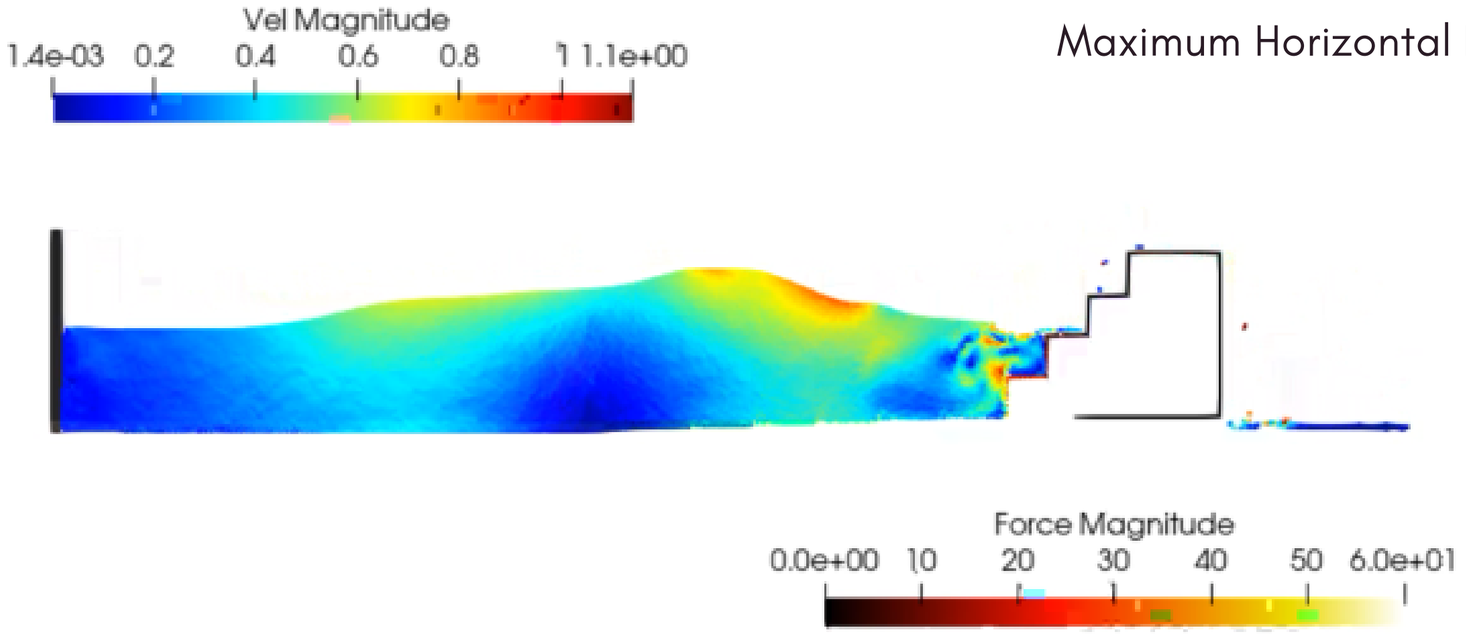
Breaking Wave - Trapezoidal Wall



Maximum Horizontal Force: 15.1 sec, 3033 N/m

T: 30 SEC

Breaking Wave - Staired Wall



Maximum Horizontal Force: 19.8 sec, 3609 N/m

T: 30 SEC