Candidate CHARTS Model Summary

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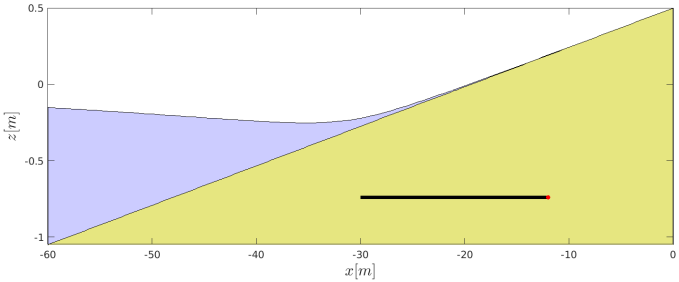

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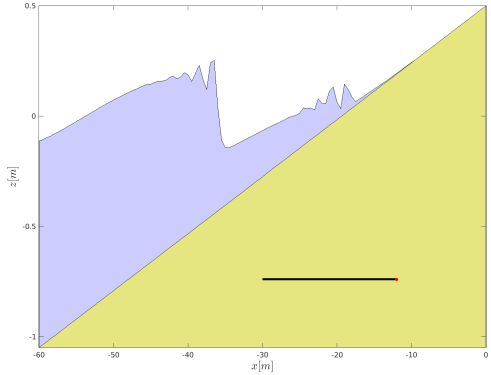
Model Objectives

The CHART effort requires simple, stable, and computationally efficient hydrodynamics framework that can be customized to meet USACE needs.

First incarnation model:

- One-dimensional
- Phase-averaged but low-frequency resolving
- Based on NLSW
- Heuristic wet/dry
- Emphasis on simple and efficient
- Somewhat numerically diffusive, but requires additional 'viscosity' if we extend to short waves–see angry wave fronts for 10 sec waves



Model Formulation

$$\frac{\partial h}{\partial t} + \frac{\partial q}{\partial x} - \frac{k}{\mu}\frac{\partial \hat{P}}{\partial z} = 0$$

$$\frac{\partial q}{\partial t} + \frac{\partial}{\partial x}\left\{\frac{q^2}{h} + \frac{S_{xx}}{\rho}\right\} = -gh\frac{\partial \eta}{\partial x} - \frac{\tau_b}{\rho} + \frac{\tau_s}{\rho}$$

Represents

- A NLSW set (hydrostatic, depth-uniform, etc)
- Infiltration by Darcy's law
- Steady Waves through rad stress, no IG generation, no W/C interaction
- Quadratic wind stress
- Quadratic current-dominated bottom shear stress

Numerical Apparatus

FD Soln:

- Time: 1st order by Fisher's method
- Pressure: 2nd order centered, except at boundaries
- Advective: 1st order upwinding

Left boundary options

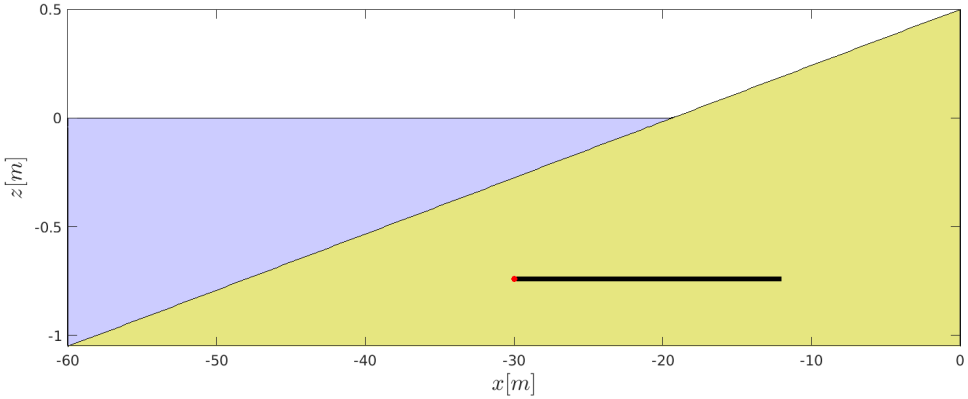
- Generation
- Transmitting
- Gen/Trans
- Reflective
- User-defined water level

Right boundary options

- Reflective
- Tail-water

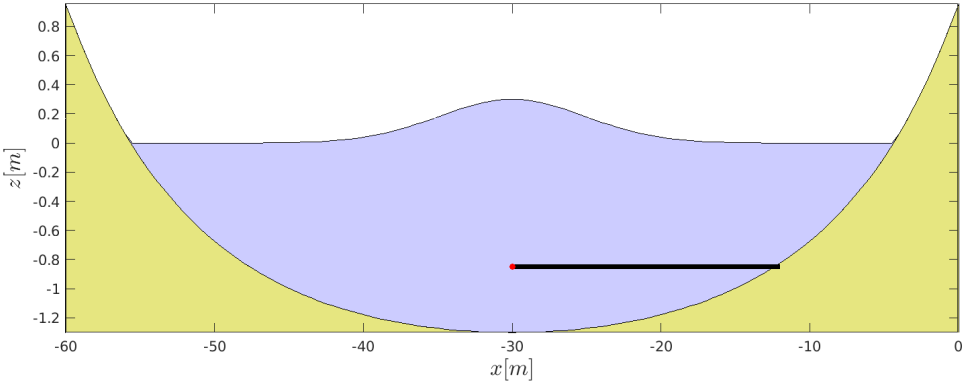
Runup on Planar Slope

With periodic offshore BC of 150s, gen/trans



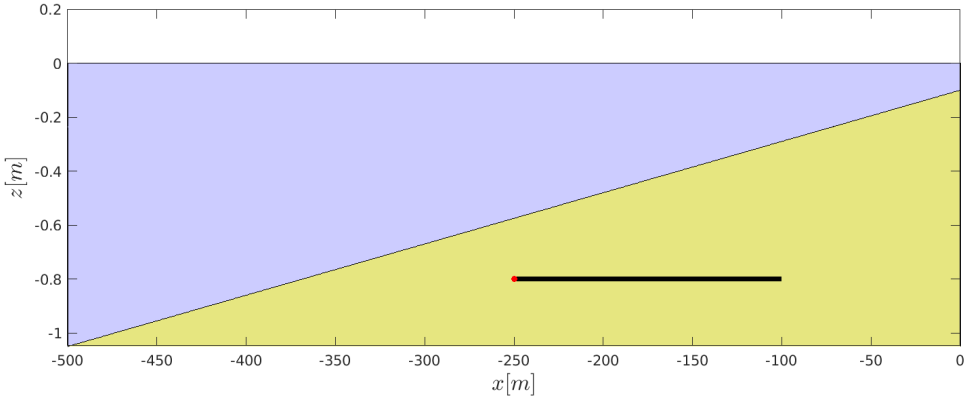
Left and Right MBC

Fully reflective BC on Left and Right + initial displacement of η



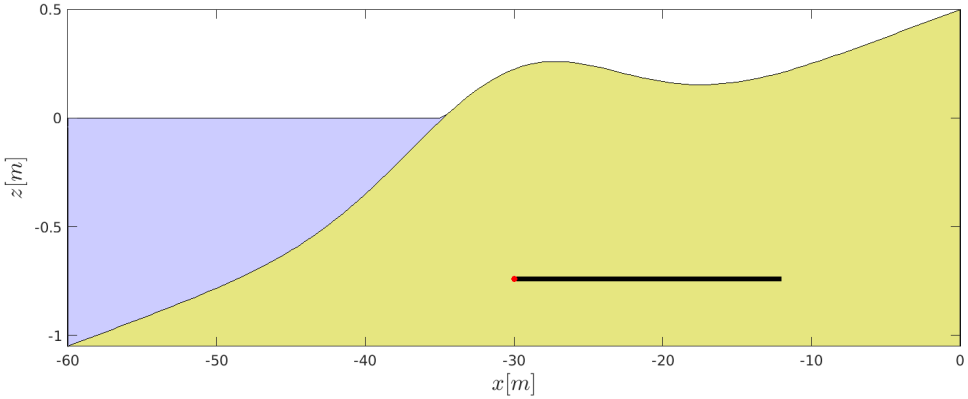
Wind-driven Setup

Unrealistically large τ_s



Ponding

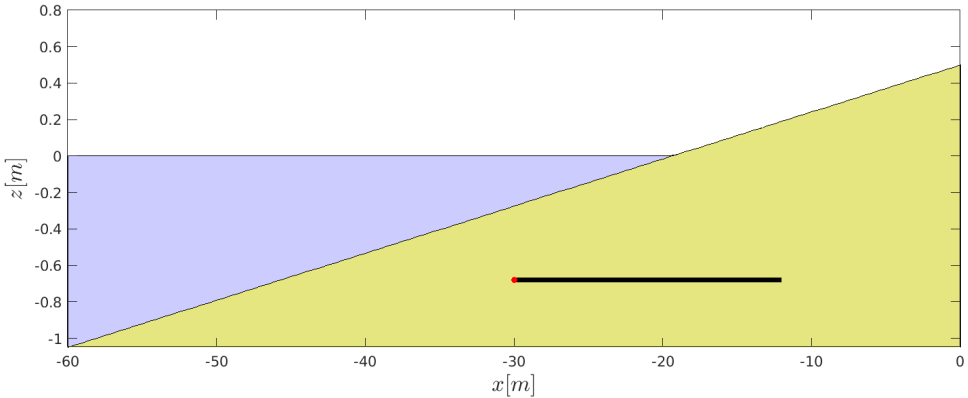
Overtopping capture, but no infiltration



Wave forcing

A one-line wave model:

$$H_{i+1} = \min\left(\left\{H_i^2 \frac{c_i n_i}{c_{i+1} n_{i+1}}\right\}^{1/2}, \gamma h_i\right)$$



Next Steps

Major concerns

- No morphology
- Overtopping doesn't include impact of waves (other than forced MWL)
- No 2DH
- Runtimes: 1 day simulation $\sim$ 1 min
- No account for reflective structures
- Not perfectly conservative

Minor concerns

- No infiltration
- Constant waves at boundary
- no impact on waves on τ_b

Kill or Continue?