CSHORE: **C**ross-**shore** numerical model

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SUMMARY

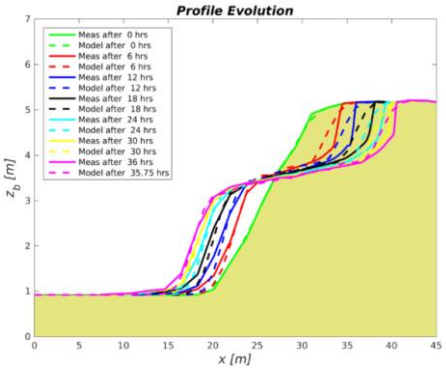
- CSHORE is a one-dimensional time-averaged nearshore profile model for predictions of wave height, water level, wave-induced steady currents, and beach profile evolution and stone structural damage progression.
- This is NOT an open source code, developed by the USACE and Delaware University. Executable and manual can be downloaded from https://sites.google.com/site/cshorecode/
- Applied to spatial scales of 100m to 10 kms and time scales of hours to days (decadal simulation under development)
- Profile change is driven by gradients in alongshore suspended and bed-load sediment transport.
- Shallow water hydrodynamics driven by wind and waves
- Profile can be made of sediment types and three sediment fractions (sand, gravel or stone)
- Representation of swash zone and over-topping

CSHORE consists of the following components: a combined wave and current model based on time-averaged continuity, cross-shore and longshore momentum, wave energy or action, and roller energy equations; a sediment transport model for suspended load and bed load; a permeable layer model to account for porous flow and energy dissipation; formulas for irregular wave run-up; a probabilistic model for an intermittently wet and dry zone on impermeable and permeable bottoms for the purpose of predicting wave overwash of a dune and armor layer damage progression, respectively; a drag force model for piles interacting with waves and sand dunes; and a dike erosion model by irregular wave action.

ASSUMPTIONS

- Local alongshore uniformity is assumed (i.e. this model cannot be applied to a beach with large alongshore variability)
- Cohensionless uniform sediment size distribution (sand, gravel or stone)
- Hydrodynamic modelling in CSHORE for the sediment transport modeling is limited to the mean and standard deviation of the free surface elevation and depth-averaged cross-shore and longshore velocities on the impermeable and permeable bottoms of alongshore uniformity.

Fig. 1: Definition sketch of probabilistic model for irregular wave run-up (left) and permeable layer model (right)



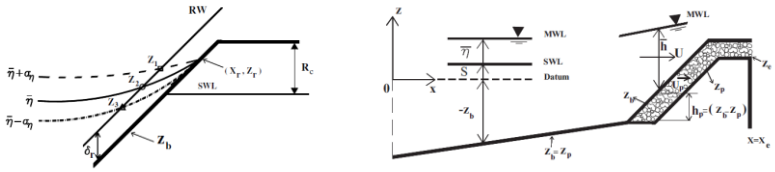


Fig. 2: Example simulated versus measured profile erosion (figure courtesy of Bradley Johnson USACE).

Hydrodinamics at the surf zone and the wet and dry zone are resolved differently. Runup statistics at the wet and dry zone are based on computed mean water surface elevation and its standard deviation at the lower swash-zone. Surf-zone hydrodynamic is calculated resolving the wave action balance (including dissipation and bottom friction) and the phase-avergaed momentum integrated to Still Water Surface. The present version of CSHORE predicts beach/dune erosion or accretion in the presence of an intact structure and damage on a stone structure located on a fixed beach.

DATA

- The model requires an offshore (~unaffected by refraction, shoaling and shadowing) wave data and the Still Water Level at the beginning and the end of the simulated period.
- Natural sediments are represented by the single diameter, specific gravity, and fall velocity.

More info: Kobayashi, N. (2016). "Coastal sediment transport modeling for engineering applications." Journal of Waterway, Port, Coastal, and Ocean Engineering 142(6): 03116001. DOI: http://dx.doi.org/10.1061/(ASCE)WW.1943-5460.0000347