SLOSH

- Sea, Lake, and Overland Surges from Hurricanes
- A computerized numerical model developed by the National Weather Service (NWS) to estimate storm surge heights (and winds) resulting from historical, hypothetical, or predicted hurricanes
**SLOSH**
**Strengths and Limitations**

- **SLOSH does include:**
  - Flow through barriers/gaps/passes
  - Deep passes between bodies of water
  - Inland inundation (wet/dry cell)
  - Overtopping of barrier systems, levees, and roads
  - Coastal reflection (coastally trapped Kelvin waves)
  - Astronomical tide
  - Wave setup in U.S. island states and territories

- **SLOSH does not include:**
  - Wave run-up (efforts underway)
  - Normal river flow and rain
Operational Storm Surge Basins for the Sea, Lake, and Overland Surges from Hurricanes (SLOSH) Model
Updated: June 1, 2018
Forecasting Storm Surge

- All storm surge models are STRONGLY dependent on the accuracy of the meteorological input.
- Meteorological uncertainty will dominate over storm surge model specifications (physics, resolution, etc).
- Be aware of different vertical datums.
- Storm surge is only one component in the real water level rise.

Total water rise = surge + tides + waves + freshwater flow.
Effects of Waves on Total Water Level Rise

- Waves can be a significant contributor to the total water level rise and cause substantial damage to property.

- Waves-effects can be grouped into two main categories:
  - Wave setup
  - Wave runup

- Not all wave models can resolve both wave setup and wave runup.

- Waves are not as important in all regions (bathymetric profile).
Wave setup is comprised of two components:

- **Static/mean**: transfer of breaking wave momentum to the water column (averaged over a time period)

- **Dynamic/fluctuating**: nonlinear transfer of energy and momentum (wave groups/infragravity waves)

FEMA 2003
Wave Runup

- Maximum vertical extent of wave uprush (swash zone) above the still water level (tide and surge)

- Extremely complex phenomenon that is difficult to model
  - Function of the local water level, incident wave conditions and beach characteristics (slope, permeability, reflectively, roughness, etc.)
  - Individual wave crests and slowly varying wave groups (infragravity waves) can penetrate well beyond the still-water inundation

- Important to coastal engineering, structural analysis and vulnerability, and beach/buff erosion, etc.
To extend the present operational surge forecasting capability from mild-sloped coastal areas such as the US East and Gulf of Mexico coasts to steep-sloped areas such as Caribbean and Pacific islands, and study the contribution of waves. Identify models or techniques to transition to NOAA’s National Hurricane Center and local WFOs.

www.nhc.noaa.gov/climo

www.caricoos.org
Computational Efficiency is Key

H. George (1998), Cat 4, landfall NE Puerto Rico (48 h sim)

Run time = 55 min
(540 proc)

Run time = 35 min
(1 proc)

Run time = 14.9 h
(540 proc)

Run time = 11.2 h
(12 proc)
Ensemble Guidance

- **MEOWs**
  - Maximum Envelopes Of Water

- **MOMs**
  - Maximum Of the MEOWs

- **P-surge**
  - Probabilistic Storm Surge

Pre-Computed

Real-Time
MEOW
Maximum Envelope Of Water
Maximum Envelope of Water (MEOW)

- Products available in HVX (replaces SLOSH Display Program [SDP])
- Composite of the maximum storm surge for all surge simulations for a given set of parameters (by basin)
- Used as guidance for planning and operations

<table>
<thead>
<tr>
<th>SS Category</th>
<th>Forward Speed</th>
<th>Storm Direction</th>
<th>Tide Anomaly</th>
<th>RMW</th>
<th>Landfall Location</th>
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<td>Selected By User</td>
<td>Built-In</td>
<td></td>
<td></td>
<td></td>
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</table>
Maximum Envelope of Water (MEOW)

User selects:
1) Category (Cat 3)
2) Landfall direction (WNW)
3) Forward speed (15 mph)
4) Initial tide (High)
MOM
Maximum Of the MEOWs
Maximum of the MEOWs (MOMs)

User selects:
1) Category (Cat 3)
When to Use MOMs and MEOWs?

Neither MOMs nor MEOWs should be thought of as a “forecast” since they are a composite of storms - should be considered as risk maps

MOMs: Used to design evacuation zones and when uncertainty is high

MEOWs: Use when you can narrow down to specific scenarios