climada storm surge from tropical cyclones

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### TC storm surge literature

Slosh homepage (Nomograms vom Jelesnianski)

NOAA

<http://www.ngdc.noaa.gov/mgg/coastal/coastal.html>

<http://www.csc.noaa.gov/digitalcoast/data/search/elevation/high-resolution>

<http://www.csc.noaa.gov/digitalcoast/dataregistry/#/shallowwaterbathy>

<http://maps.ngdc.noaa.gov/viewers/wcs-client/>

<http://www.ngdc.noaa.gov/mgg/coastal/grddas03/grddas03.htm>

THE APPLICATION OF SPLASH MODEL NOMOGRAM METHOD TO THE COAST OF CHINA

<http://slosh.nws.noaa.gov/sloshPub/>

<http://en.cnki.com.cn/Article_en/CJFDTOTAL-HUTB198304004.htm>

The Influence of Storm Size on Hurricane Surge

<http://journals.ametsoc.org/doi/pdf/10.1175/2008JPO3727.1>

On the importance of the forward speed of hurricanes in storm surge forecasting: a numerical study

<http://onlinelibrary.wiley.com/doi/10.1029/2008GL036953/abstract;jsessionid=BD9468BD70717722AE80B0194C9A4644.d04t04?deniedAccessCustomisedMessage=&userIsAuthenticated=false>

PROBABILISTIC GUIDANCE FOR HURRICANE STORM SURGE

<http://slosh.nws.noaa.gov/sloshPub/pubs/psurge_ofcl_200801_AMS.pdf>

Data for validation

Peaksuge database "surgedat"

### SLOSH

An operational forecast model for extraropical storm surges along the US: East Coast

<http://slosh.nws.noaa.gov/sloshPub/pubs/etsurge_1996OpnlForecast.pdf>

SLOSH – a hurricane storm surge forecast model

<http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=1152341&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D1152341>

<http://www.nhc.noaa.gov/surge/slosh.php#INTRO>

hurricanes by taking into account the atmospheric pressure, size, forward speed, and track data. These parameters are used to create a model of the wind field which drives the storm surge.

<http://www.nhc.noaa.gov/surge/>

Jelesnianski 1992

<http://slosh.nws.noaa.gov/sloshPub/pubs/SLOSH_TR48.pdf>

### Important Factors

What impacts storm surge and how are these impacts generalized?

* Intensity (higher winds speeds=increased storm surge)
* Central pressure (little impact)
* Forward speed (slower storms=higher and broader storm surge inland including bays and estuaries; faster storms=more storm surge along the open coast)
* Size (storm with large wind field=more storm surge; storm with small wind field=less storm surge)
* Angle of approach (perpendicular to coastline=more storm surge; parallel to coastline=less storm surge)
* Width and slope of continental shelf (wide shelf/gentle slope=more storm surge with relatively small waves; narrow shelf/sharp slope=less storm surge with relatively big waves)

Topography of ocean bed, depth of the sea 🡪 Digital elevation model (DEM), transform steep versus shallow sea bed into a factor

SRTM 90m Digital Elevation Data

<http://srtm.csi.cgiar.org/>

Resampled SRTM data to 250m resolutions for the entire globe are available (Password: ThanksCSI!)

<https://hc.box.net/shared/1yidaheouv>

<https://hc.box.com/shared/1yidaheouv#/s/1yidaheouv/1/34252608/353949440/1>

<http://srtm.jrc.ec.europa.eu/>

<http://nationalmap.gov/viewer.html>

* Local features (concavity of coastlines, bays, rivers, headlands, islands, etc.=greater storm surge impact); Type of coastline: concave versus convex

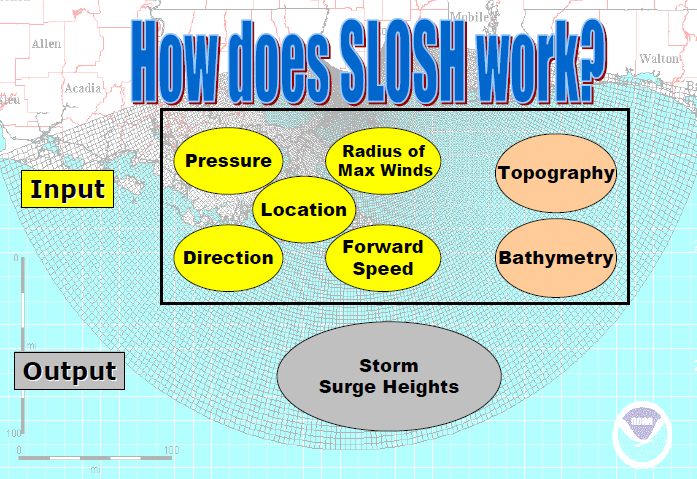


Figure 1. Source <http://slosh.nws.noaa.gov/sloshPub/SLOSH-Display-Training.pdf#page=14>

Several generalizations can be drawn from SLOSH models.

* More intense storms cause higher surges.
* The highest surges usually occur to the right of the storm track (traveling with the storm) at approximately the radius of maximum wind.
* Fast moving storms cause high surges along open coast and lower surges in sheltered bays and estuaries.
* Slow moving storms usually result in greater flooding inside bays and estuaries, with smaller values along the open coast.
* Larger storms affect longer stretches of the coastline. A larger storm is defined as a storm having a greater radius of maximum wind.
* The direction of storm approach often impacts the extent of flooding. Depending on location, storms from one direction may cause inundation, while a storm of the same magnitude from a different direction may cause little flooding.
* The slope of the continental shelf will affect the level of surge in a particular area. Areas with shallow slopes of the continental shelf will allow a greater storm surge, but waves are small.
* Areas with deep water just offshore experience large waves, but little storm surge.

### Nomograms

Global Guide to Tropical Cyclone Forecasting:

CHAPTER 4: THE HABITATION LAYER

4.2 STORM SURGES

<http://cawcr.gov.au/bmrc/pubs/tcguide/ch4/ch4_2.htm>

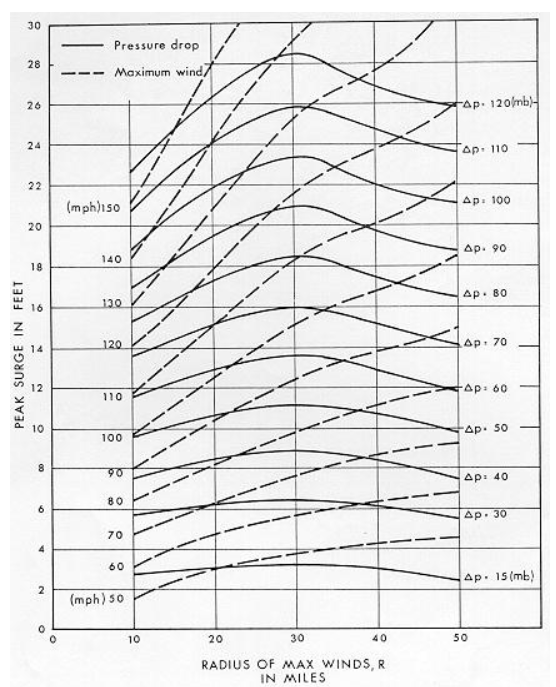


Figure 2: Nomogram for peak surge on the open coast. Entering arguments are **pressure drop** and **radius of maximum winds**. The maximum winds are valid for 10-min average at 10 m elevation for a stationary cyclone over water. The curves were computed for a standard tropical cyclone motion across a standard basin, as described in the main text. Source: <http://cawcr.gov.au/bmrc/pubs/tcguide/ch4/ch4_figures/figure4_3.htm>

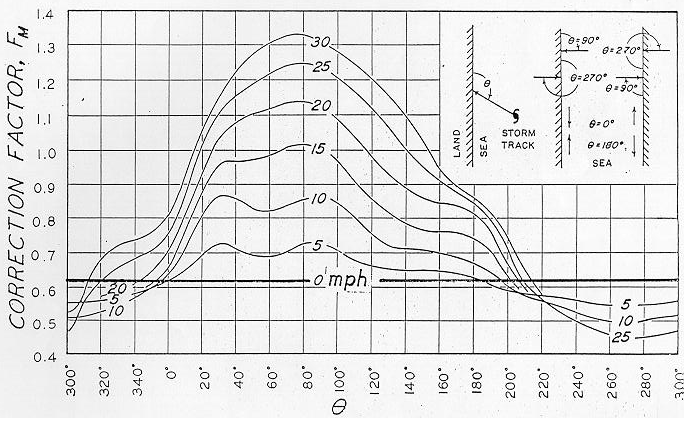


Figure 3: Nomogram of correction factors against vector tropical cyclone motion. The factor corrects Fig. 4.3 for non-standard tropical cyclone motion and the inset orientates the cyclone track angle relative to a coast. Source: <http://cawcr.gov.au/bmrc/pubs/tcguide/ch4/ch4_figures/figure4_4.htm>

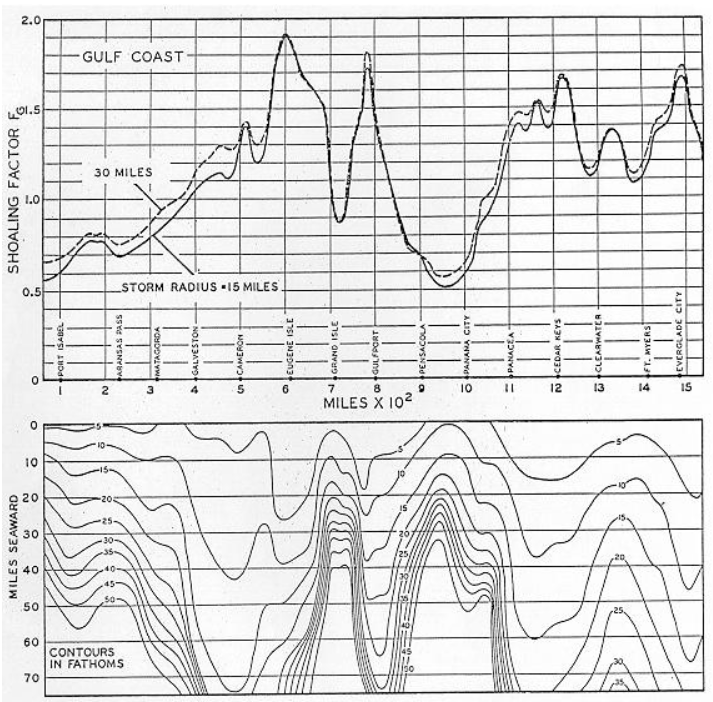


Figure 4: Nomogram of shoaling correction factors for the Gulf coast of the USA. The factor corrects Fig. 4.3 for real, non-standard basins. Source: <http://cawcr.gov.au/bmrc/pubs/tcguide/ch4/ch4_figures/figure4_5.htm>

### Elevation data

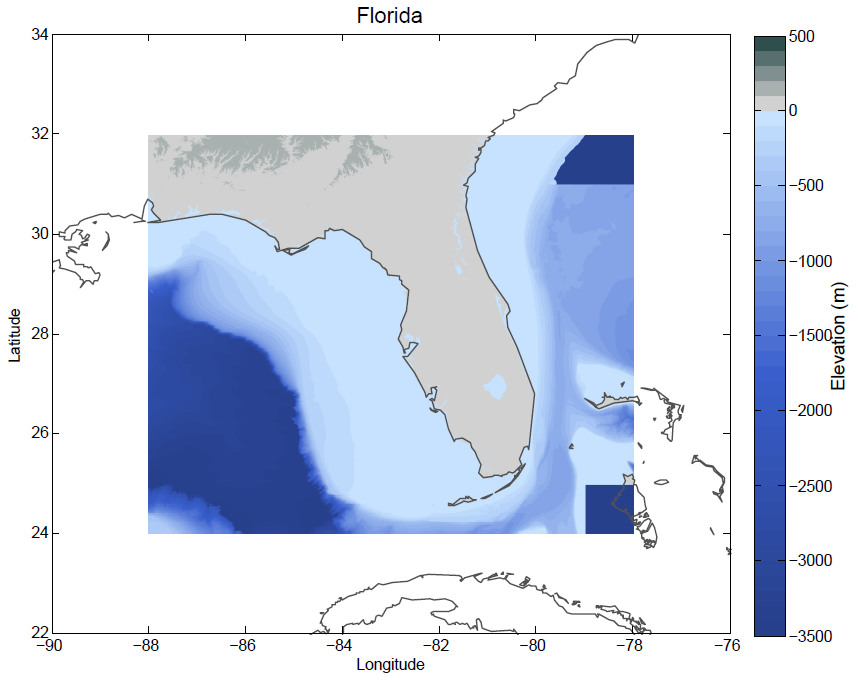


Figure 5: Elevation model of Florida. Data source: NOAA, US Coastal Relief Model, Florida and Eastern Gulf of Mexico, <http://www.ngdc.noaa.gov/mgg/coastal/grddas03/grddas03.htm>, <http://www.ngdc.noaa.gov/mgg/coastal/crm/data/arc_ascii/fl_east_gom_crm_v1.asc.zip> . The region was selected through the map interface <http://ngdc.noaa.gov/dem/squareCellGrid/map#>

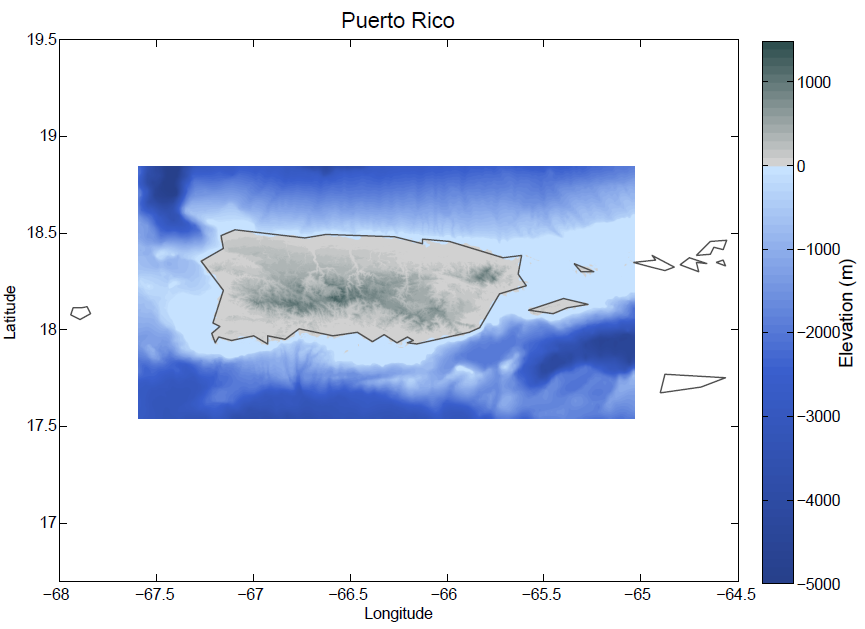


Figure 6: Elevation model of Puerto Rice. Data source: NOAA, 2004 USACE: Puerto Rico. <http://www.csc.noaa.gov/digitalcoast/dataregistry/#/>, <http://maps.ngdc.noaa.gov/viewers/wcs-client/>