The Nature Conservancy
Protecting nature. Preserving life.

COASTAL RESILIENCE
Adapting Natural and Human Communities to Sea Level Rise and Coastal Hazards

Florida Keys Flood Scenarios

Developing Storm Surge Scenarios for the Florida Keys

The overall vertical accuracy of the DEM used to perform a bathtub model analysis was determined to be 0.46 ft by the Southeast Florida Region Climate Compact. For this reason, modeling a 6 inch sea level rise scenario or less was not performed given this root mean square error. Instead, The Nature Conservancy started off with a 1 ft sea level rise (SLR) scenario and increased this by 1 ft until a 4 ft sea level rise scenario was reached. In addition to a 1 ft increment bathtub analysis, The Nature Conservancy also used the Sea, Lake and Overland Surges from Hurricanes (SLOSH) model to determine the inundation from a Hurricane similar to Wilma in 2005. The SLOSH scenarios were performed using a category 3 storm traveling at 05 mph forward speed in an east north east direction at mean tide. The interpolated storm layers were then calibrated to mean higher high water (MHHW) using the Southeast Florida Region Climate Compact generated tidal surface layer. The surge height determine using the SLOSH model was then added to the 1 – 4 ft SLR scenarios. In total there were nine scenarios (1 ft SLR, 2 ft SLR, 3 ft SLR, 4 ft SLR, Wilma-like storm surge, Wilma-like storm surge on top of 1 ft SLR, Wilma-like storm surge on top of 2 ft SLR, Wilma-like storm surge on top of 3 ft SLR, Wilma-like storm surge on top of 4 ft SLR).

The Southeast Florida Region Climate Compact tidal surface reflects the variability in height between the vertical datum and mean higher high water (MHHW). The Climate Compact worked with NOAA's Coastal Services Center to generate a tidal surface for south Florida that isn't just a flat surface or one value. The complexity of this surface is seen in the upper Florida Keys where the difference in values from the Florida Bay to the Atlantic Ocean is relatively large compared to other areas. Methodology for how the tidal surface was generated can be found in Climate Compact report **"**Analysis of the Vulnerability of Southeast Florida to Sea Level Rise" pages 113 to 162 of the pdf (available at: http://southeastfloridaclimatecompact.org/compact-documents/).

Storm Raster Preparation

Step 1: Run Slosh Display v1.65d using MEOW display for Florida Bay 3 SLOSH Basin. Parameters set to Category 3 storm at mean tide from East North East direction at 05 mph. Run conducted on Thursday, April 12, 1012 at 0830 by The Nature Conservancy using ke2 basin (updated 04/20/2010) and MEOW data downloaded on Wednesday, April 11, 2012. Download site: http://slosh.nws.noaa.gov/sloshPriv
Storm identifier: ene305i0 (ene=direction-east north east; 3= category-category 3; 05=forward speed-05mph; i0=tide-mean tide)

Step 2: Set projection of storm polygon to storm basin projection (GCS_North_American_1983; imported from ke2 basin datum file, downloaded from: http://slosh.nws.noaa.gov/sloshPriv/meowShp.php?L=6)
Filename: ene305i0_GCS1983.shp

Step 3: project storm polygon (ene305i0_GCS1983.shp) to Florida state plane (imported projection from SLR raster and used NAD_1983_To_HARN_Florida transformation)
Filename: ene305i0_sp.shp

Step 4: Create a mask to use for clipping storm polygon for use in interpolation. Created polygon larger than the study area.
Filename: storm_interpolation_mask.shp

Step 5: Clip storm polygon to masked extent.
Filename: "ene305i0_sp_sim"

Step 6: Extract features to point using Feature to Point tool.
Input Feature: "ene505i0_sp_sim"
Output Feature: "ene505i0_sp_sim_" (point file)
Inside (optional): left unchecked
Filename: (see output feature)

Step 7: Remove 99.9 value fields. Select all features = 99.9 and export inverse of selection.
Filename: "ene505i0_sp_simn99"

Step 8: Interpolate storm point file to raster using Natural Neighbor Interpolation tool in the Spatial Analyst Tools.
Input point features: "ene505i0_sp_simn99"
Z value field: ene505i0
Output raster: "ene505i0_n99"
Output cell size (optional): 90
Filename: (see output raster)
Note: This is the storm raster at mean tide (msl)

Step 9: Calibrate interpolated storm raster to MHHW using the mhhw conversion raster ("mhhw_con_sp") using Rater Calculator, Map Algebra tool in Spatial Analyst Toolbox.
Map Algebra expression: "ene305i0_n99" + "mhhw_con_sp"
Filename: ene305i0_mh
Note: This is the storm at mhhw

Step 10: Calculate storm with 1, 2, 3, and 4 feet of SLR using Rater Calculator, Map Algebra tool in Spatial Analyst Toolbox.
Map Algebra expression: ("ene305i0_n99" + "mhhw_con_sp") + *x*   *where x=slr interval*
Environments:

Processing Extent:
    Extent: Union of Inputs
    Snap Raster: "flk_10ftsp" raster file
Raster Analysis:
    Cell Size: 10
Filename: ene305i0_mh*x where x-slr interval*
Note: These are the storm raster files with the SLR intervals with a cell size of 10 and snapped to the 10ft LiDAR DEM.

Note: Path name for SLOSH ene305i0 storm: C:/slosh.pkg/sloshdsp/data/ke2.kit.mount/data/ke2