Conveying Coastal Inundation Potential Associated with Extratropical (ET) Cyclones

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July 11, 2017
Overview

- Background & Motivation
- Methodology
- Results
- Future Work

Tuckerton, N.J., inundated on Oct. 30 by the storm surge from Superstorm Sandy. Photo: U.S. Coast Guard
Cyclones: Extratropical vs Tropical

“Superstorm”: March 1993

Extratropical Cyclones
- Energy from horizontal temperature gradient
- Frontal features
- “Cold Core”

Hurricane Katrina: August 2005

Tropical Cyclones
- Energy from latent heat release
- No frontal features
- “Warm Core”

Both can cause life threatening storm surge
Employing Geographic Visualization to Convey Risk

Geovisualization – the creation and use of visual representations to facilitate thinking, understanding, and knowledge constructions about geospatial data (Nöllenburg, 2007)
The Need for Visualization

- Irene and Sandy Service Assessments
  - Conveying storm surge information was extremely difficult

“there is considerable confusion on what the datums mean in terms of real world impacts.”

“The storm surge forecast was excellent but we are missing the ability to communicate it more visually”

“Mayor Bloomberg asked me every time, ‘If I walk out of my door, how far will the water be up on my legs’... He doesn’t want to know 12 feet, 8 feet, etc.... The more you can give me about the impact of surge by area—that would be helpful. Graphical inundation forecasts would be helpful.”

“There were forecasts, but there were no details about what the predicted surges would cause... There was no wording in the warning like, ‘Most of lower Manhattan will be under water at a certain point’ or ‘Staten Island will flood up to Beach Street.’”
BACKGROUND
Coastal Population Density

- Increasing population density along the U.S. Coast
- Sea Level Rise

Source: The Third National Climate Assessment, 2014
Vertical Datums

- Ellipsoidal, Geodetic and Tidal
- Tidal = Related to particular stages of ocean tide

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The Battery, NYC

NOAA/NOS/CO-OPS
Observed Water Levels at 8518750, The Battery NY
From 2012/10/29 00:00 GMT to 2012/10/30 23:59 GMT

NOAA, NOS Center for Operational Oceanographic Products and Services

Astronomical Tide Prediction
Verified Storm Surge

Datums (STNO)

MSL
LLW
Storm Surge vs Storm Tide

**Storm surge** = an abnormal rise of water generated by a storm, over and above the predicted astronomical tide level

**Storm Tide** = Astronomical Tide + Storm Surge
Storm Surge - Sandy

- Storm surge is often the greatest threat to life and property from a tropical or extra-tropical storm

- Complex hazard, difficult to convey without visualization tools

**Storm Tide** = Astronomical Tide + Storm Surge
NWS Products

Tropical

Extratropical
METHODOLOGY
Study Area

NWS NYC Area of Responsibility
Digital Elevation Model

- Post-Sandy Hydroflattened DEM
- Horizontal Coordinate System: NAD83, 1/9 Arc Second
- Vertical Coordinate System: NAVD88, meters
Storm Surge Data

- Extract Total Water Level grid from NWS' Graphical Forecast Editor (MLLW, Feet)
- GDAL
VDatum

- TWL grid (MLLW/feet) → DEM (NAVD88/meters)
RESULTS
Results
Results
FUTURE WORK
Future Work

- Compare other impacts to inundation results
- Automate processing
- Minor to moderate coastal flooding event
- Web interface
THANK YOU!

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