Using a Networked Water Level Sensor to Enhance Prediction and Visualization of Extra Tropical Storm driven Coastal Inundation Along the New England Coast

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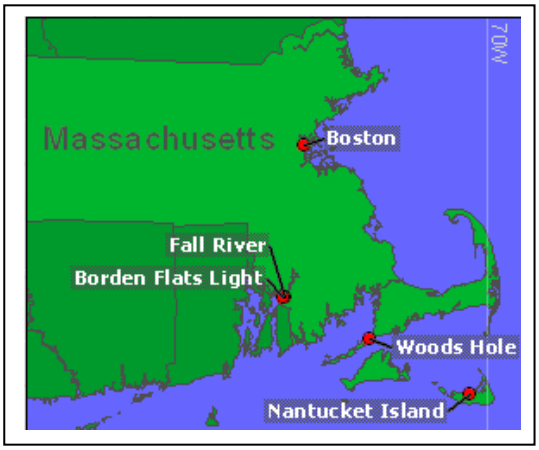
The increase in coastal development combined with potential sea level rise from climate change sets the stage for more frequent high-impact coastal inundation events in the future, and presents an increasing threat to life and property for coastal residents. The effectiveness of current warning and forecast procedures for coastal flooding is limited by several factors. These include a sparse observational network of real-time tidal gauges, use of a coarse-resolution storm surge prediction model which provides limited point data, and the reliance on traditional text bulletins to convey warning and forecast information.

To better meet the needs of a variety of users, from emergency managers to the public, an effort has been underway to enhance the accuracy and resolution of storm surge information and consequent real-time water level predictions along the coastline of Massachusetts and Rhode Island, which encompasses the NOAA/NWS Taunton, MA forecast area. Benefits can also be applied to navigational interests, land-use planners, and ecosystem managers. Internally, procedures have been developed to allow forecaster modification of gridded model storm surge output through the Graphical Forecast Editor (GFE), which is the primary tool used by NOAA/NWS to create forecast information. New models are being applied to a pilot community, Scituate, MA, which has a history of frequent coastal flooding, and will be expanded to other coastal communities in the future after forecast verification, evaluation, and feedback is received. As the project continues, there is a need for higher-resolution model data focused on the southern New England coastline as well as additional real-time tidal gauges.



A PAUCITY OF REAL-TIME DATA

There were only four operational real-time tide gauges on the Massachusetts coast in early 2008 (red dots).

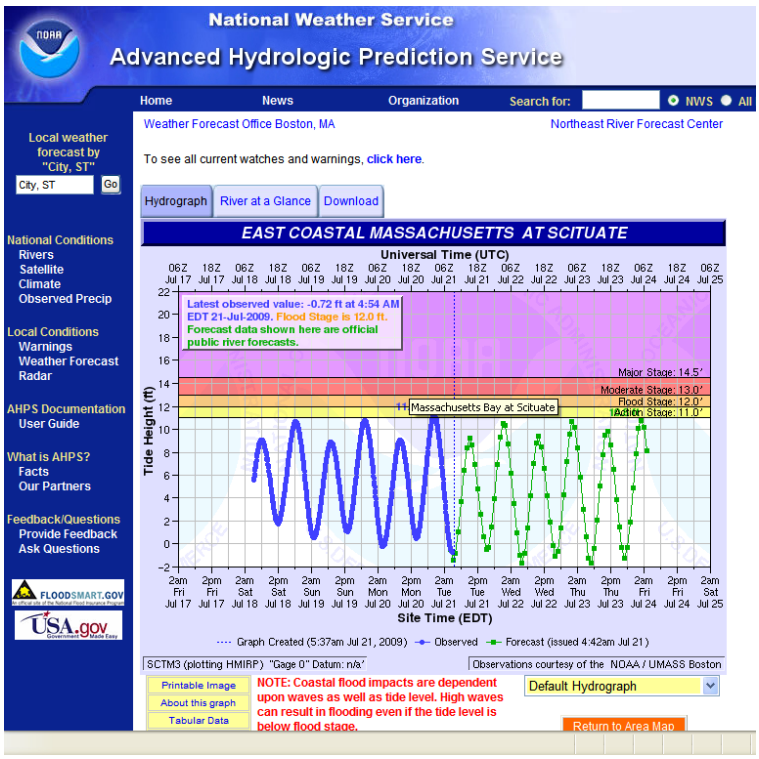
Unfortunately the current NOAA tide gauge technology requires a big investment of infrastructure ($200-300K) and support (~$100K yearly), putting a standard NOAA tide gauge out of reach for this project. Charybdis Group LLC responded to this need by designing a system that slashes the installation cost by an order of magnitude and virtually eliminated the need for maintenance.

The Charybdis group designed and installed a cost effective tide gauge utilizing a NEMA 4X rated radar based sensor accurate to +/- 3.0 mm combined with a an Onset U-30 data logger. This design allows the use of existing low cost cell phone networks to deliver data to a hosted web accessible data storage site. Additional features included in the design: web based programmable alarm limits with email, cell phone or pager notification, built in adjustable averaging, noise rejection and damping. The unit will operate in the rigors of the New England Climate (-30C to +80C) and is entirely solar powered with storage for up to a week of operation without sun. Additionally the small installation footprint allows installation on existing piers with little or no interference.

CHARYBDIS TIDE GAUGE ON NOAA PIER IN SCITUATE MA.

Primary components:
A) Precision time of flight radar sensor
B) Solar panel
C) U-30 logger/telemetry unit

To date, forecasters have been able to more effectively adjust storm surge guidance information in an internally consistent manner and have added value to the raw guidance. Indeed, forecasters have anecdotally noted a low bias with model storm surge guidance. The routine Total Water Level forecasts that appeared in AHPS on a routine basis provided information with potential benefit to navigational interests.



PREDICTED VS OBSERVED:

-The tide gauge logs data every six minutes and posts to a website every 15 minutes

-NOAA consumes the data (blue) and plots it against the predicted (green)

http://newweb.erh.noaa.gov/ahps2/hydrograph.php?wfo=box&gage=sctm3

For the few minor coastal flood episodes that occurred during the winter of 2008-2009, the procedure of generating the CFW product worked well aside from a known issue with the astronomical tide grids (biased one foot too low).

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