COASTAL INUNDATION PROJECT

Enhancing Coastal Community Resiliency

Northeast Region

Coastal Hazards Workshop

November 20, 2008

COASTAL INUNDATION PROJECT OVERVIEW

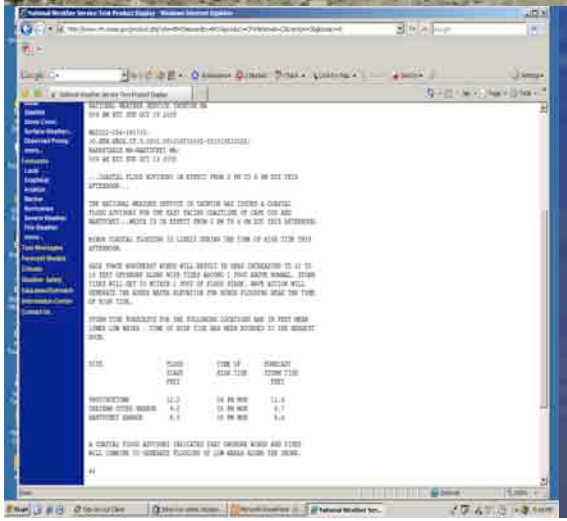
- Why
- Goals
- Pilot Communities
- New/Enhanced Services and Products
  - Including visualization tools
- Vision

WHY?

October 1991 Perfect Storm

Evoke more effective response

October 1991 Perfect Storm



Enhance text with visualization maps

PROJECT OVERVIEW
PRIMARY GOALS

- Improve forecasts of coastal inundation
  - Storm surge forecasts
  - Near shore wave forecasts
  - Wave run-up
- Provide coastal inundation visualization tools for decision-makers
  - Partner with NOAA's Coastal Service Center (CSC)
  - Communicate uncertainty

PROJECT OVERVIEW
Other Applications

- Land use planning, especially in context of sea level rise
- Impact on habitats/benthic resources
- Predictive erosion/sediment transport capability

PILOT COMMUNITIES
SCITUATE AND SACO

History provides a clue to the future

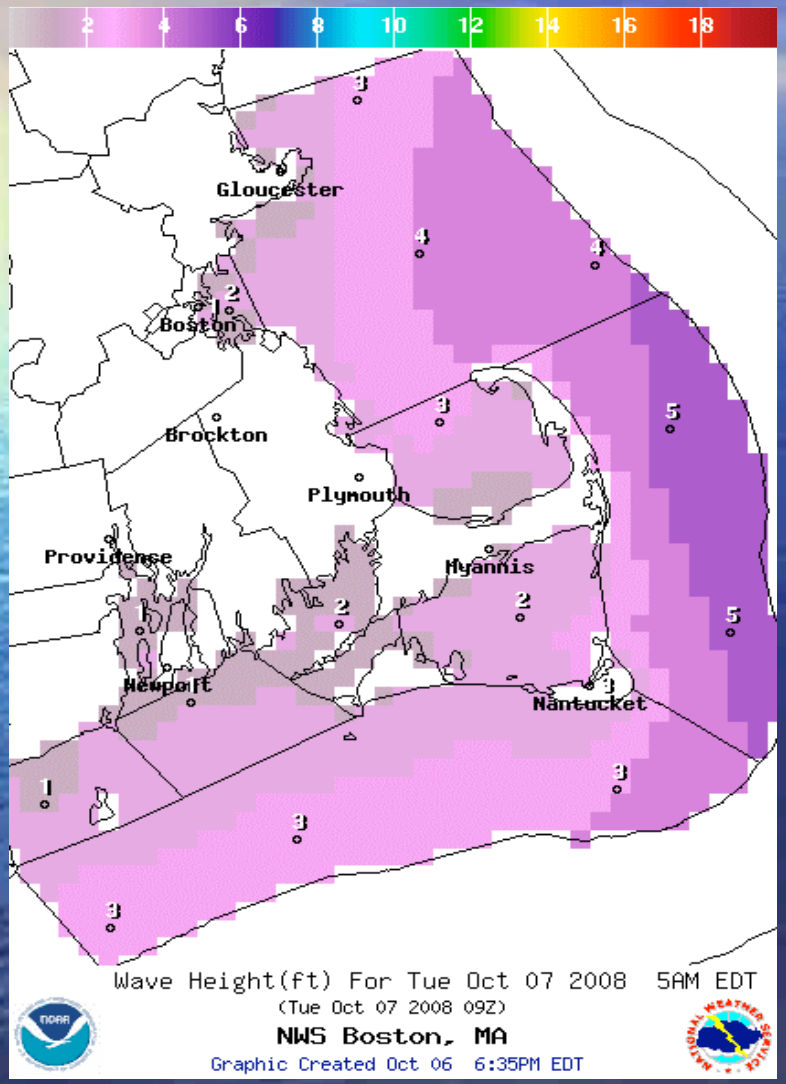
WHY SCITUATE AND SACO

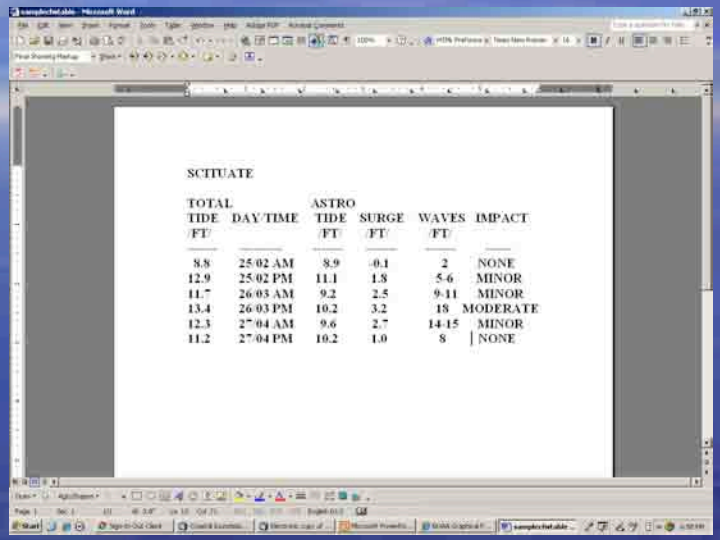
- Frequent flooders – larger sample size to work with
- Allows focus on extratropical storms (nor'asters)
  - Major problem for New England east coast
  - Fewer studies/tools than with hurricane issue
- Two pilot communities allow focus on entire coastal inundation forecast/visualization challenge

ACCOMPLISHMENTS TO DATE

- Forecast Process Improvements
  - SWAN Model implemented
  - Gridded storm surge output can be modified by forecasters
  - Total water level forecast
    - Gridded astro. tide + gridded storm surge
- Visualization of inundation
  - Reference maps from Coastal Services Center for pilot communities coming to web

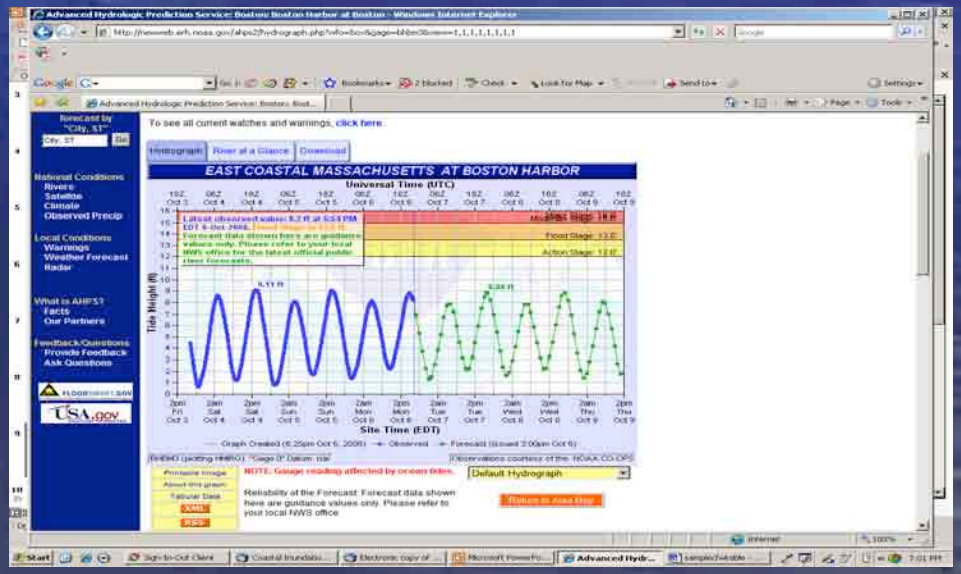
INFORMATION DISSEMINATION





SCITUATE

TOTAL TIDE /FT/	DAY/TIME	ASTRO TIDE /FT/	SURGE /FT/	WAVES /FT/	IMPACT
8.8	25/02 AM	8.9	-0.1	2	NONE
12.9	25/02 PM	11.1	1.8	5-6	MINOR
11.7	26/03 AM	9.2	2.5	9-11	MINOR
13.4	26/03 PM	10.2	3.2	18	MODERATE
12.3	27/04 AM	9.6	2.7	14-15	MINOR
11.2	27/04 PM	10.2	1.0	8	NONE



Sample of internal product used to construct tables in Coastal Flood Warning Product

File Edit Options Version Tools Scripts Products Help

AFOS Browser | Load History | WMO Search | Enter Editor | Accum | Update Obs | Clear

AFOS Cmd: | WMO TTAAii CCCC: | AWIPS ID:

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TTAA00 KBOX 221835
TWLBOX

TOTAL COASTAL WATER LEVEL FORECAST
NATIONAL WEATHER SERVICE TAUNTON MA
235 PM EDT WED OCT 22 2008

ALL TIDE HEIGHTS ARE REFERENCED TO MEAN LOWER LOW WATER.
TIME OF HIGH TOTAL TIDE IS APPROXIMATE TO NEAREST HOUR.

NEWBURYPORT

    TOTAL                ASTRO
     TIDE    DAY/TIME     TIDE    SURGE    WAVES      FLOOD
     /FT/                 /FT/     /FT/     /FT/    CATEGORY
   -------  ----------  -------  -------  -------  ----------
      9.1    22/06 PM     8.7      0.4       8        NONE
     10.5    23/07 AM     9.8      0.7      6-7       NONE
      9.1    23/07 PM     8.9      0.2       4        NONE
      9.3    24/08 AM     9.7     -0.4      2-4       NONE
      8.8    25/08 PM     9.2     -0.4       1        NONE
      9.4    25/09 AM     9.7     -0.3       1        NONE
:

GLOUCESTER HARBOR

    TOTAL                ASTRO
     TIDE    DAY/TIME     TIDE    SURGE    WAVES      FLOOD
     /FT/                 /FT/     /FT/     /FT/    CATEGORY
   -------  ----------  -------  -------  -------  ----------
      9.1    22/06 PM     8.7      0.4      10        NONE
     10.5    23/07 AM     9.7      0.8      7-9       NONE
      9.0    23/07 PM     8.8      0.2       5        NONE
      9.2    24/08 AM     9.6     -0.4      3-5       NONE
      8.7    25/08 PM     9.1     -0.4       2        NONE
      9.3    25/09 AM     9.6     -0.3       1        NONE
:

BOSTON HARBOR

    TOTAL                ASTRO
     TIDE    DAY/TIME     TIDE    SURGE    WAVES      FLOOD
     /FT/                 /FT/     /FT/     /FT/    CATEGORY
   -------  ----------  -------  -------  -------  ----------
      9.4    22/06 PM     8.9      0.5       2        NONE
     10.8    23/07 AM    10.0      0.8      1-2       NONE
      9.3    23/07 PM     9.1      0.2       1        NONE
      9.5    24/08 AM     9.9     -0.4       1        NONE
      9.0    25/08 PM     9.4     -0.4       1        NONE
      9.5    25/09 AM     9.8     -0.3       1        NONE
:

SANDWICH HARBOR

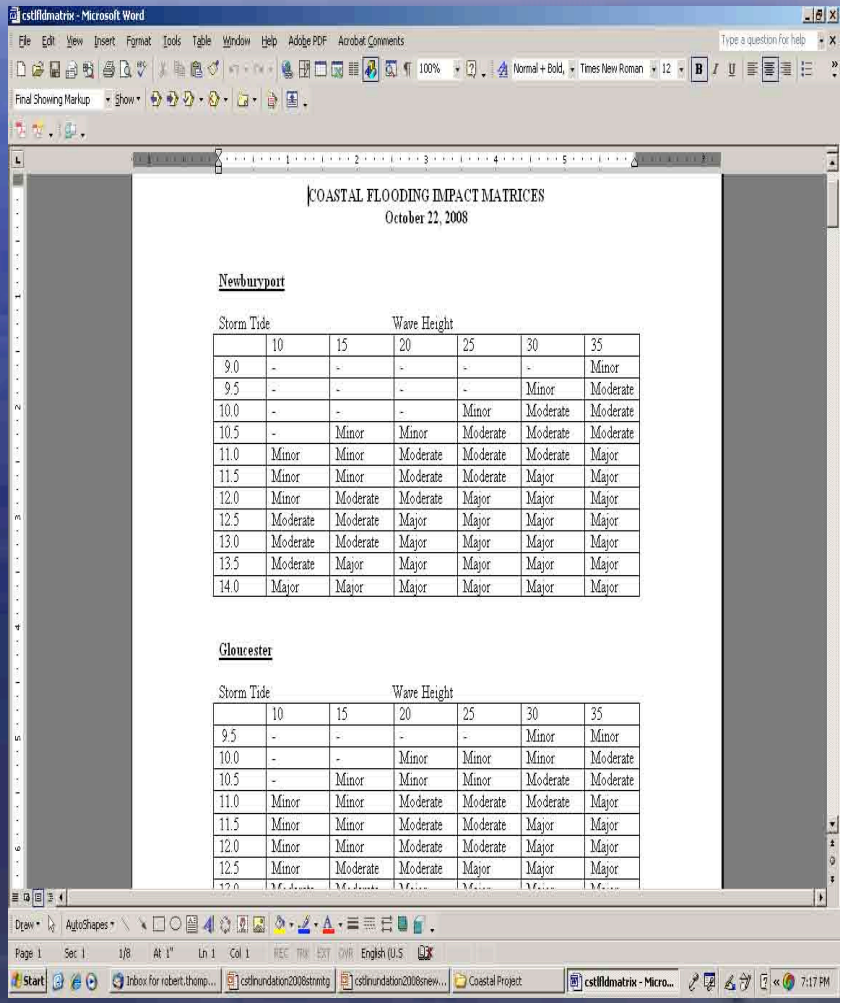
    TOTAL                ASTRO
     TIDE    DAY/TIME     TIDE    SURGE    WAVES      FLOOD
```

CAUTION:

Flood categories are first guess only, based on collective experience of several staff. Staff encouraged to modify as necessary.

Matrices for Flood Category First Guess

- Collective experience
- A couple of studies on moderate coastal flood events
- Forecasters encouraged to adjust
- New guidance
  - GOMOOS "Splashover Nomogram" (available now)
  - Regression analysis (collaborate project this winter with Wheaton College)



COASTAL FLOODING IMPACT MATRICES
October 22, 2008

Newburyport

Storm Tide	Wave Height 10	15	20	25	30	35
9.0	-	-	-	-	-	Minor
9.5	-	-	-	-	Minor	Moderate
10.0	-	-	-	Minor	Moderate	Moderate
10.5	-	Minor	Minor	Moderate	Moderate	Moderate
11.0	Minor	Minor	Moderate	Moderate	Moderate	Major
11.5	Minor	Minor	Moderate	Moderate	Major	Major
12.0	Minor	Moderate	Moderate	Major	Major	Major
12.5	Moderate	Moderate	Major	Major	Major	Major
13.0	Moderate	Moderate	Major	Major	Major	Major
13.5	Moderate	Major	Major	Major	Major	Major
14.0	Major	Major	Major	Major	Major	Major

Gloucester

Storm Tide	Wave Height 10	15	20	25	30	35
9.5	-	-	-	-	Minor	Minor
10.0	-	-	Minor	Minor	Minor	Moderate
10.5	-	Minor	Minor	Minor	Moderate	Moderate
11.0	Minor	Minor	Moderate	Moderate	Moderate	Major
11.5	Minor	Minor	Moderate	Moderate	Major	Major
12.0	Minor	Minor	Moderate	Moderate	Major	Major
12.5	Minor	Moderate	Moderate	Major	Major	Major

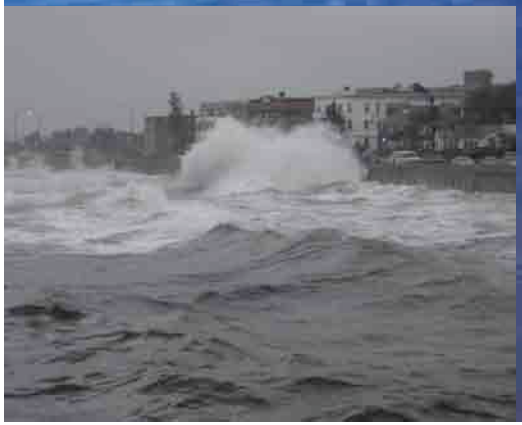
HEADLINE CRITERIA

- Minor – Coastal Flood Advisory
- Moderate or Major = Coastal Flood Warning

Minor

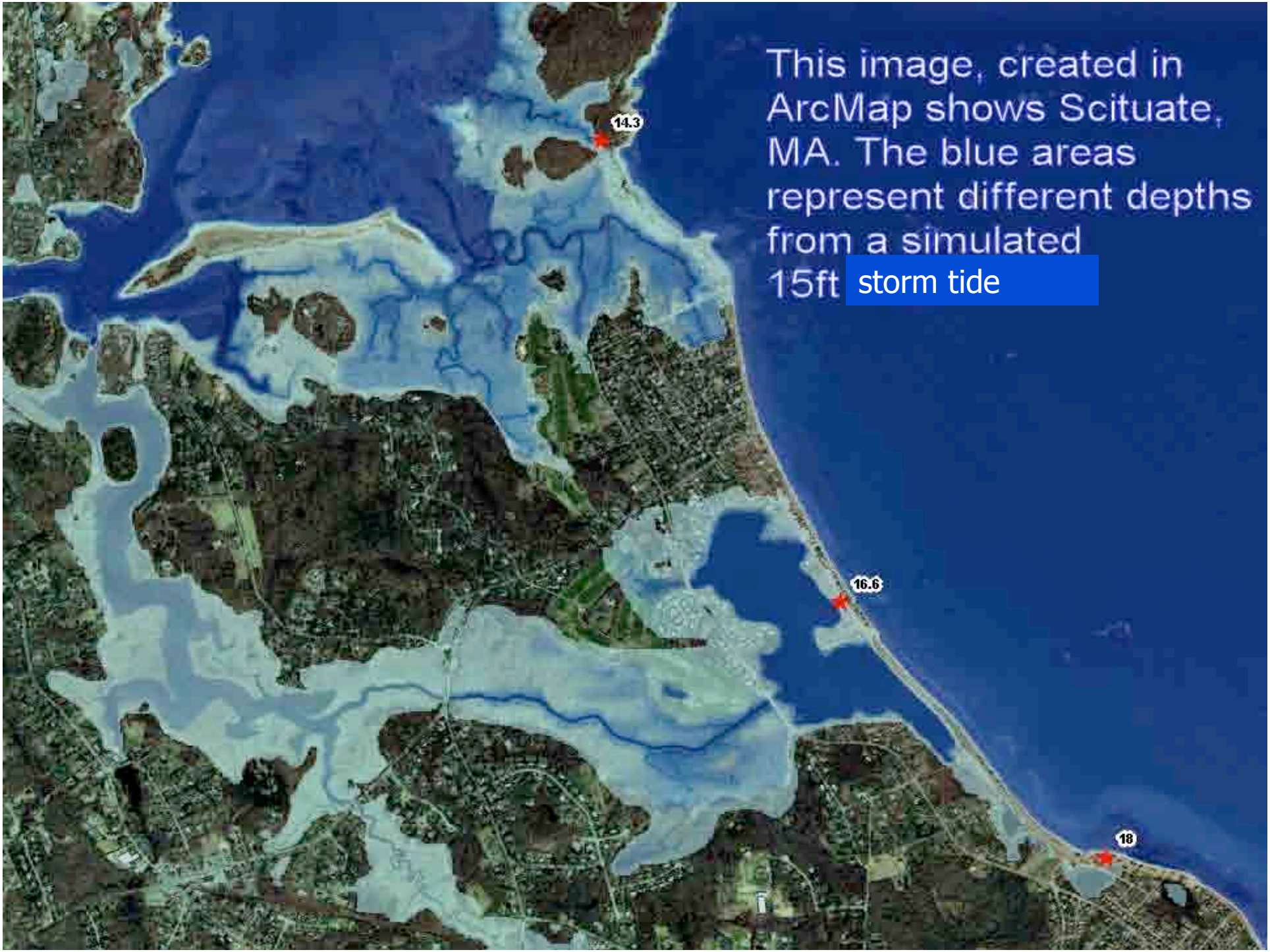
Moderate

Major



VISUALIZATION

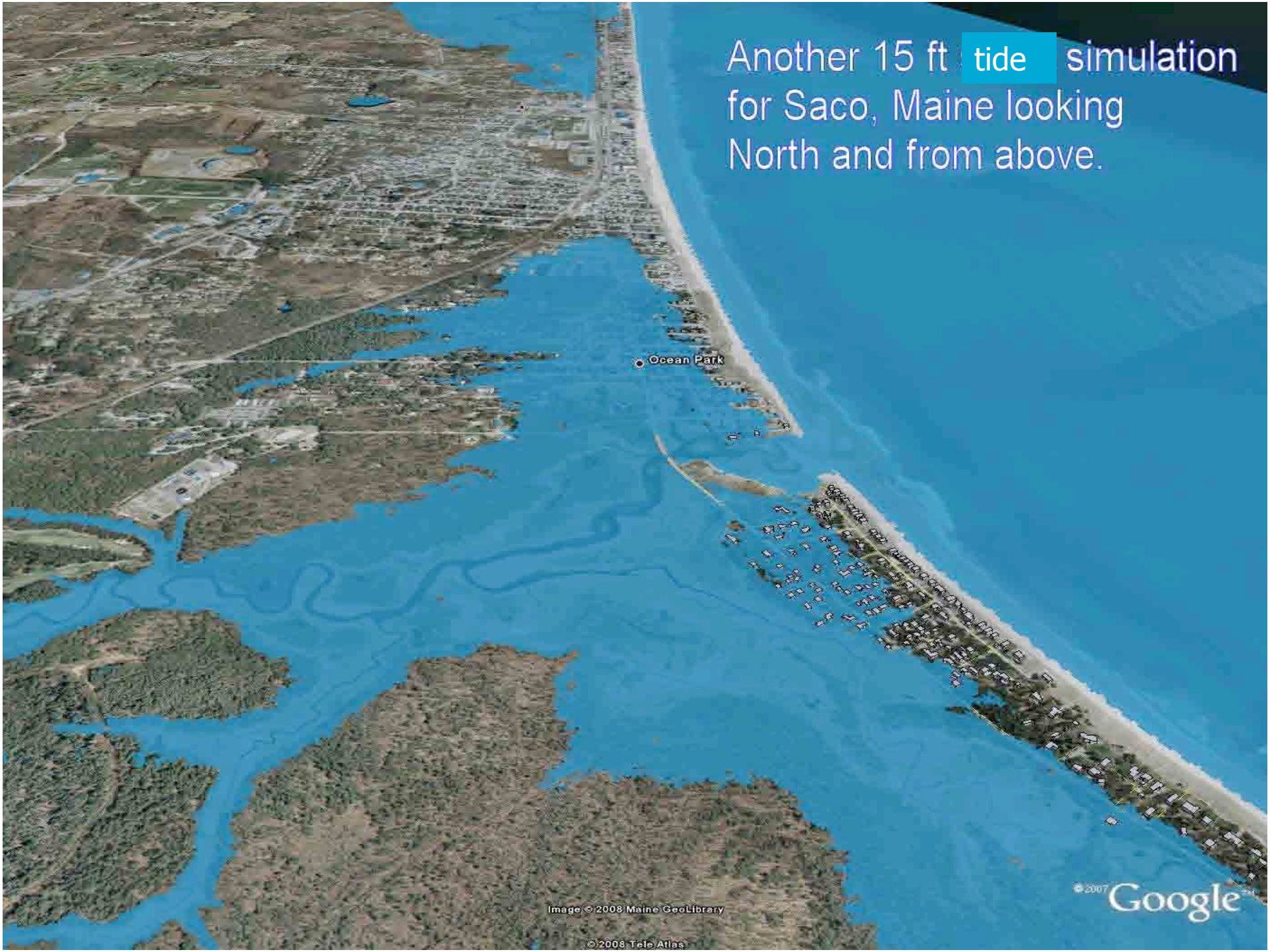
- Opportunity to focus on locations that are threatened
- Reference maps for various water levels soon to be available for pilot communities


This image, created in ArcMap shows Scituate, MA. The blue areas represent different depths from a simulated 15ft storm tide
14.3
16.6
18

Another view of a simulated tide of 18ft for Scituate, MA displayed in Google Earth. The red areas are surge warning zones and the points are historical still high-water marks for the 1991 storm.

Scituate
Scituate Station
North
Egy
18
19.1
This image shows a theoretical 18ft tide to Scituate, Ma displayed in Google Earth format.
It also shows historical still high-water mark areas for the 1991 storm.
©2007 Google™
Image MassGIS, Commonwealth of Massachusetts EOEA
© 2008 Tele Atlas

This image also shows a theoretical flood of 15ft near Saco, Maine with 3-D structures.
This view is more aerial and can be panned in any direction in Google Earth.
Image © 2008 Maine GeoLibrary
© 2008 Tele Atlas
©2007 Google™


Another 15 ft tide simulation
for Saco, Maine looking
North and from above.
Ocean Park
Image © 2008 Maine GeoLibrary
© 2008 Tele Atlas
© 2007 Google

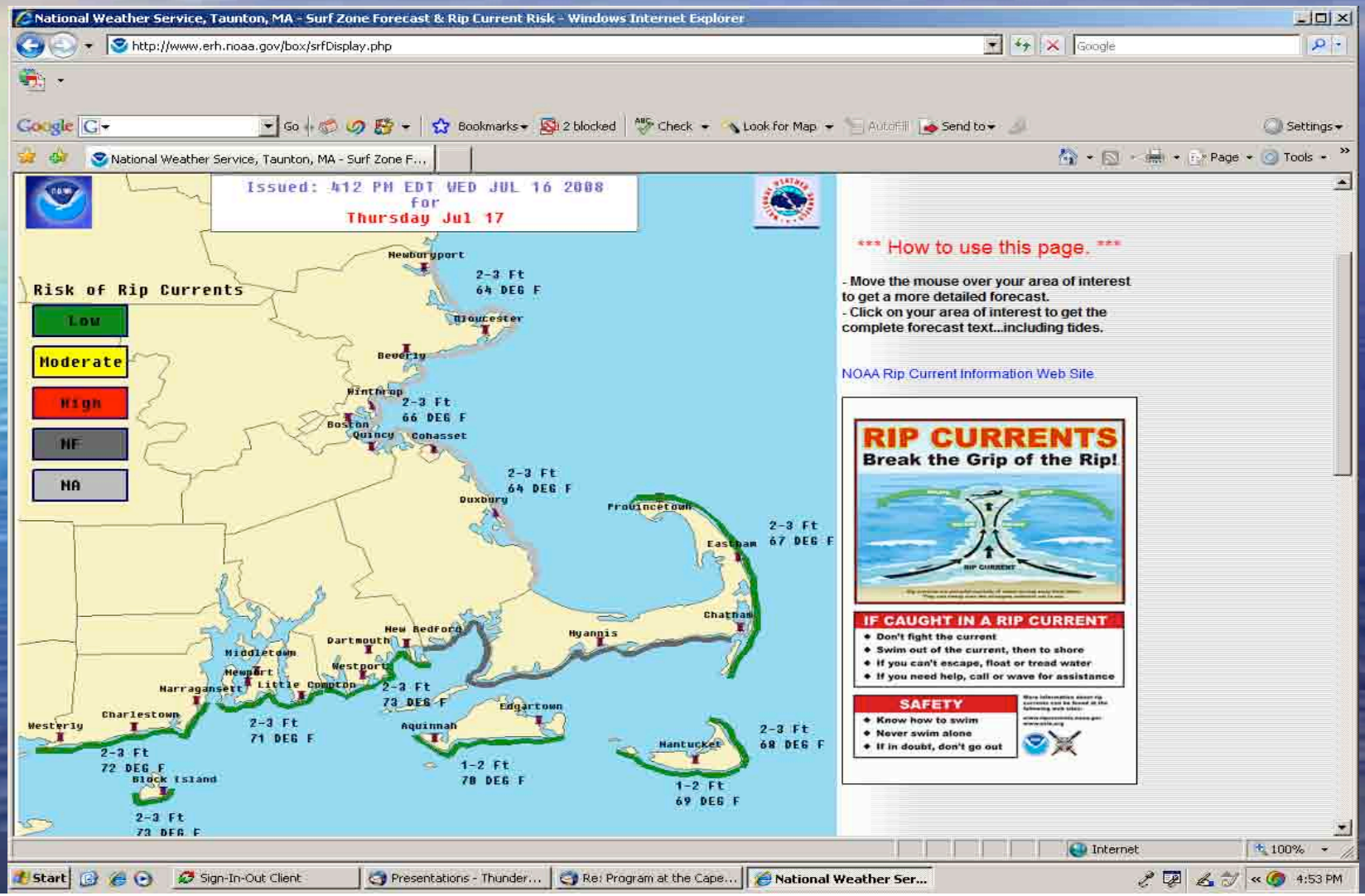
FUTURE
Short Term

- **Investigate wave run-up in collaboration with Coastal Services Center (CSC)**
- **Evaluate UMASS FVCOM Model**
- **Develop Model Output Statistics guidance**
  - Predict impact based on screened predictors (wind, waves, storm tide…)
  - In cooperation with Wheaton College
- **Event assessment**
  - Tide gage installation in Scituate
  - Rapid Response Team in Scituate
  - Expansion of Skywarn amateur radio net to provide detailed coastal flood impact feedback from other communities
- **Visualization mapping to other locations**
- **Refine visualization maps to depict velocity zones for various wave heights**
- **Help pilot communities become *StormReady***

MEDIUM TERM

Produce Interface Map

Like Surf Zone Forecast Map

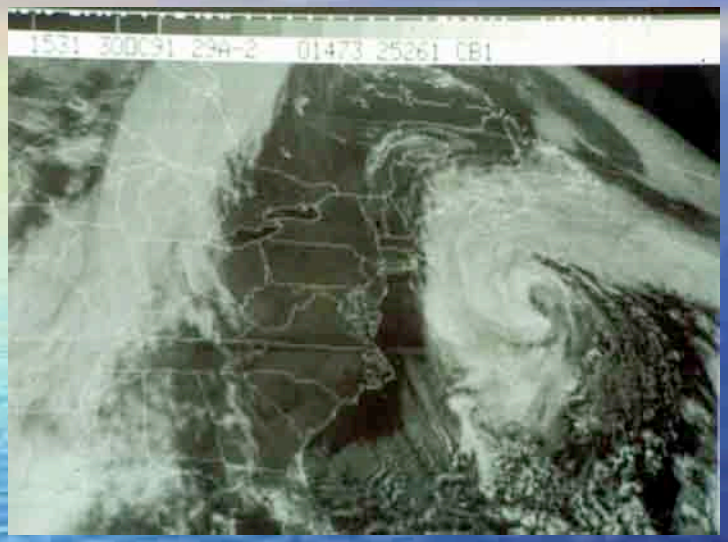


FUTURE
Longer Term

- Produce real-time forecast visualization maps based on forecast surge and waves
  - Factor in uncertainty
- Look at erosion
  - Can potential erosion be predicted?
- Consider impact of sea level rise scenarios
- Look at Benthic impacts

PARTNERS

- **NOAA's North Atlantic Regional Team**
- National Ocean Service (NOS)
  - Coastal Services Center (Doug Marcy & Matt Pendleton)
  - Stellwagen Bank Sanctuary Office
  - Betsy Nicholson
- Jeremiah Pyle (Student Intern)
- MA Coastal Zone Management
- Communities of Scituate and Saco
- USGS
- NERACOOS/GOMOOS
- Southern New England Amateur Radio Skywarn Coordinators

- National Weather Service (Gray and Taunton)

QUESTIONS?