Overhaul of MDL's Extra-Tropical Storm Surge (ETSS) Post-Processing and Web Dissemination

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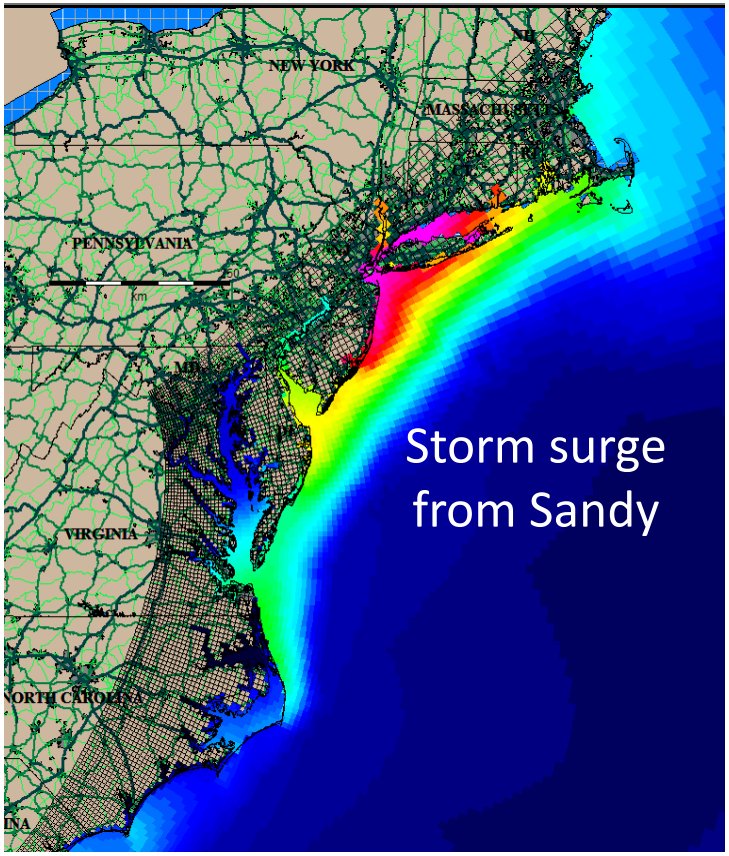
What is ETSS?

- **M**eteorological **D**evelopment **L**ab's (**MDL**'s) **E**xtra**T**ropical **S**torm **S**urge (**ETSS**) model predicts coastal surge
- Input: **G**lobal **F**orecast **S**ystem (**GFS**) 0.5 degree winds and pressure
  - Runs 4x daily
  - For large extra-tropical storms (not hurricanes)
- Surge, obs, and tides combined for bias-adjusted total water level

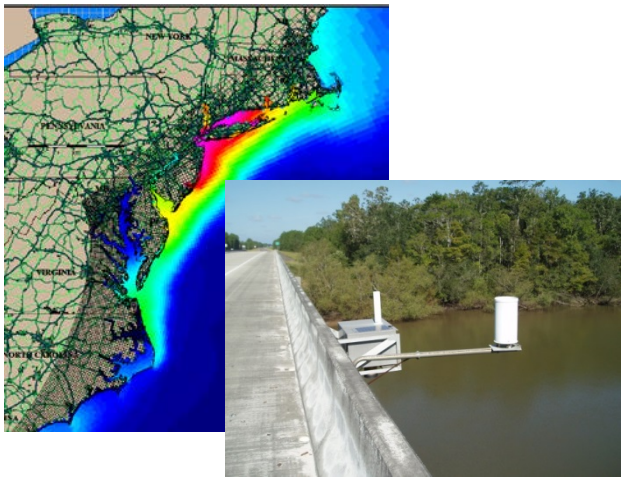


A Potential User

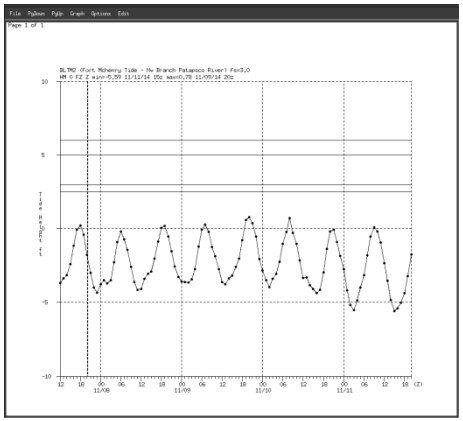
- **R**iver **F**orecast **C**enters (**RFC**s) use **A**dvanced **H**ydrological **P**rediction **S**ervice (**AHPS**) to make forecasts

- AHPS reads data encoded in a special **S**tandard **H**ydrometeorological **E**xchange **F**ormat (**SHEF**)

Data Source



Output on AHPS



What is SHEF?

- Designed for data sharing and readability
  - Identifies location, data type, time and interval of measurements, units
- Example:

```
****0000021076****CBOFS KWBC 061842
TIDNT
:SHEF ENCODED 30 MINUTE WATER LEVEL FORECAST GUIDANCE
:WATER LEVEL VALUES REFERENCED TO MLLW IN FEET (HMIFZ)
:TIME ZONE IS UTC
:WATER LEVEL FORECAST GUIDANCE IS FOR TOTAL WATER LEVELS
:PROVIDED BY DOC/NOAA/NOS/CO-OPS
:corms@noaa.gov 301-713-2540
.E SWPV2 20120906 Z DH1200/HMIFZ/DIN30/  0.427 /  0.887 /  1.122 /  1.435 /  1.646 /  1.865
.E1   2.065/  2.219 /  2.446 /  2.589 /  2.676 /  2.767 /  2.665 /  2.500 /  2.322 /  2.156 /  1.939 /  1.764
.E2   1.602/  1.407 /  1.251 /  1.057 /  0.925 /  0.789 /  0.781 /  0.880 /  1.045 /  1.230 /  1.414 /  1.616
.E3   1.820/  2.007 /  2.182 /  2.363 /  2.453 /  2.538 /  2.498 /  2.405 /  2.288 /  2.128 /  1.994 /  1.820
.E4   1.631/  1.385 /  1.184 /  1.027 /  0.931 /  0.897 /  0.943 /  1.046 /  1.175 /  1.347 /  1.563 /  1.812
.E5   2.087/  2.375 /  2.632 /  2.855 /  3.002 /  3.111 /  3.150 /  3.104 /  3.001 /  2.853 /  2.699 /  2.524
.E6   2.322/  2.086 /  1.812 /  1.537 /  1.313 /  1.164 /  1.073 /  1.065 /  1.116 /  1.191 /  1.267 /  1.352
.E7   1.464/  1.598 /  1.754 /  1.916 /  2.050 /  2.139 /  2.167 /  2.138 /  2.071 /  1.972 /  1.848 /  1.715
.E8   1.573/  1.419 /  1.239 /  1.042 /  0.866 /  0.724 /  0.648
```

Problem and Solution

- No SHEF-encoded bias-corrected total water level predictions at river mouths.
- Operationalize MDL's ETSS post-processing output
  - Provide in SHEF-encoded, AHPS-readable output
  - Disseminate to RFCs

Robust Computing

- Moved post-processing from local experimental machine to operational state on **W**eather and **C**limate **O**perational **S**upercomputing **S**ystem (**WCOSS**)
- **Benefits:**
  - Faster and more reliable computing
  - Backup machine if production fails
  - Direct access to input data and NWS dissemination system (i.e. **A**dvanced **W**eather **I**nteractive **P**rocessing **S**ystem; **AWIPS**)

Input Data

Observations

COOPS tide gauge → Encode and Transfer → Store on WCOSS

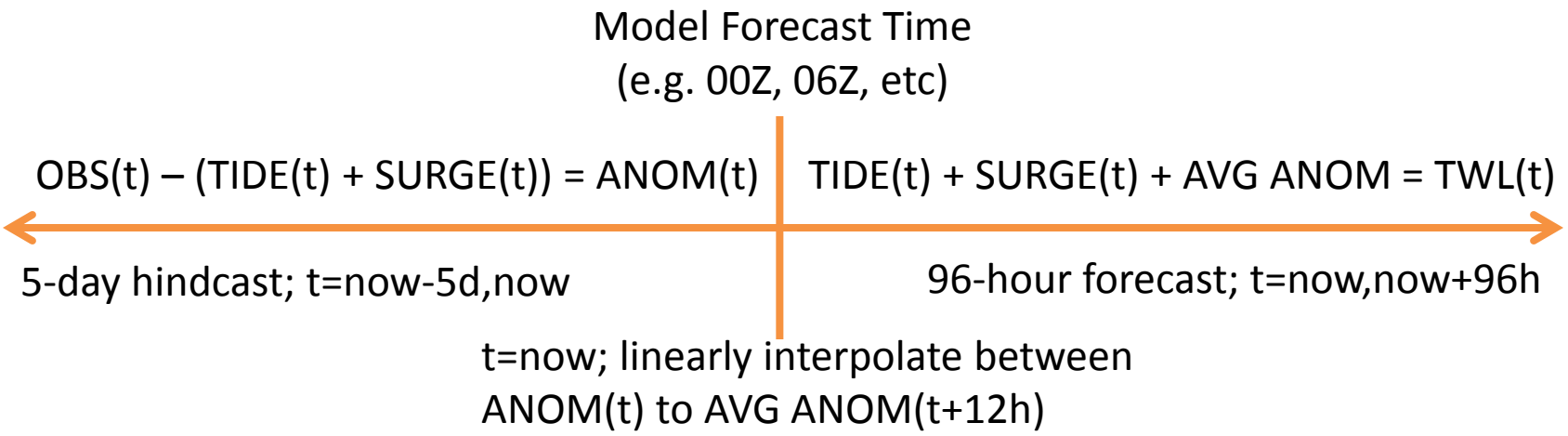
Surge

ETSS model → Output on WCOSS

Tide

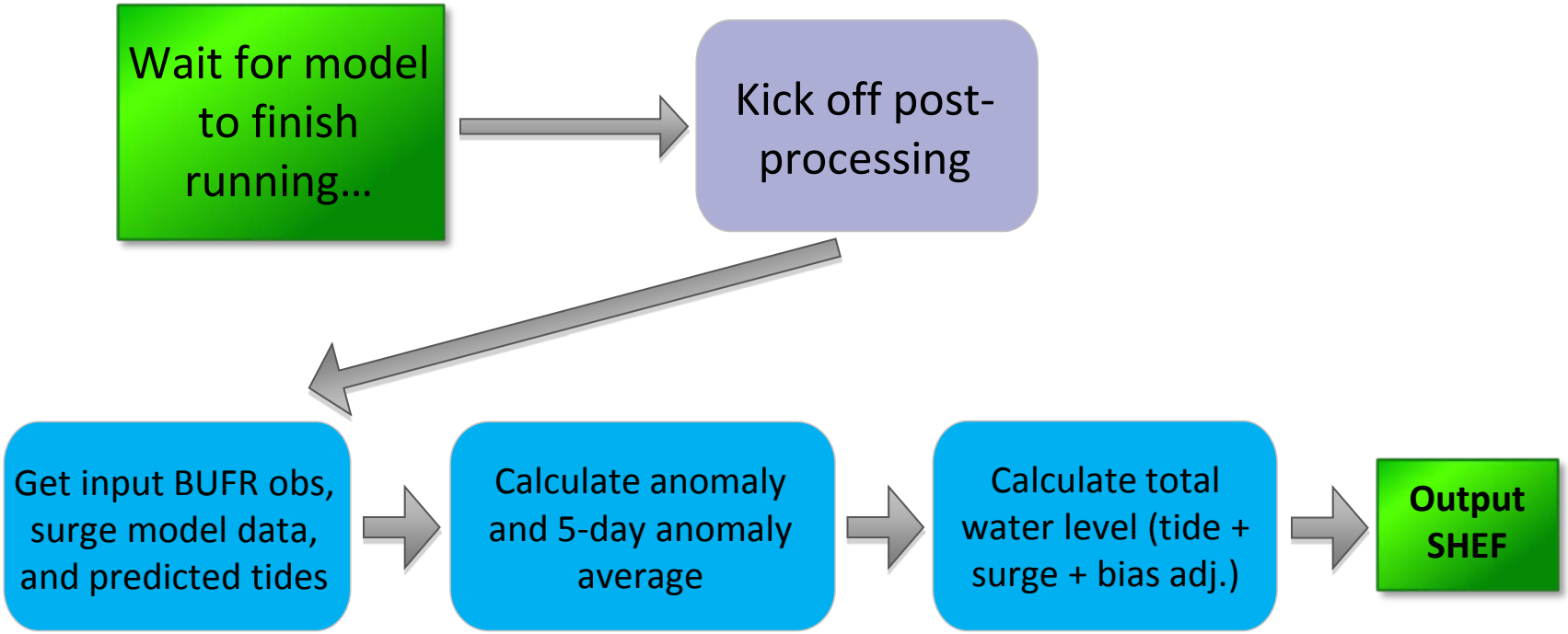
Tide constituents (from COOPS) → Calculate tides on WCOSS

Adjustment and Output



- Need to account for wave action, flooding from rain, sea level rise, model bias etc.
  - Use inputs (obs, tide, surge) to calculate anomalies in 5-day hindcast; take average
  - Adjust predicted water levels using the average

Workflow Summary



Web Dissemination

- Hydrographs display obs, surge, tide, anomaly and predicted water levels

- Experimental hydrographs previously available here: http://www.nws.noaa.gov/mdl/etsurge

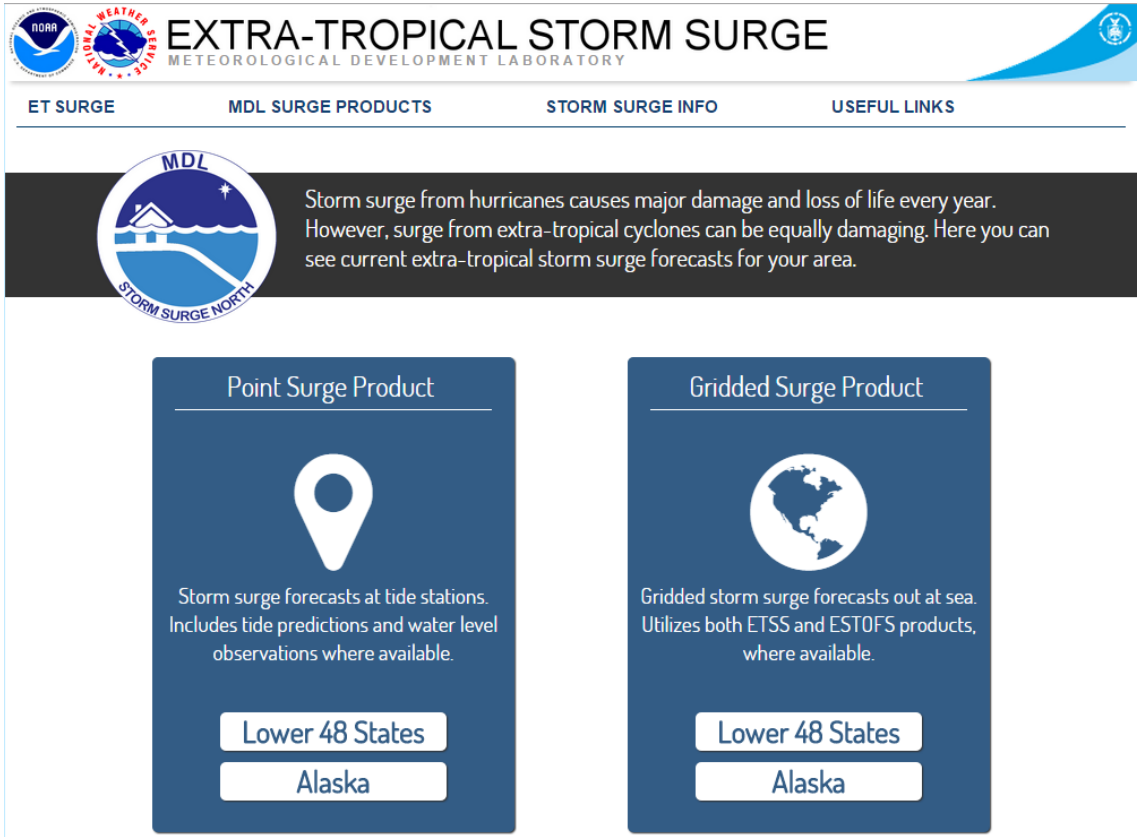
- Upgraded website to display ETSS output interactively

New Website

http://nws.weather.gov/mdlsurge/etsurge2.0/

- Main features:
  - Google maps display station status and max predicted water levels
  - Interactive hydrograph displays when:
    - User selects location from station map
  - Archive, bookmark, and station search functions
  - More stations available

Front Page


EXTRA-TROPICAL STORM SURGE
METEOROLOGICAL DEVELOPMENT LABORATORY
ET SURGE
MDL SURGE PRODUCTS
STORM SURGE INFO
USEFUL LINKS
MDL
STORM SURGE NORTH
Storm surge from hurricanes causes major damage and loss of life every year. However, surge from extra-tropical cyclones can be equally damaging. Here you can see current extra-tropical storm surge forecasts for your area.
Point Surge Product
Storm surge forecasts at tide stations. Includes tide predictions and water level observations where available.
Lower 48 States
Alaska
Gridded Surge Product
Gridded storm surge forecasts out at sea. Utilizes both ETSS and ESTOFS products, where available.
Lower 48 States
Alaska
US Dept of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Meteorological Development Laboratory
Author: ryan.schuster@noaa.gov
POC: arthur.taylor@noaa.gov
1325 East West Highway
Silver Spring, MD 20910
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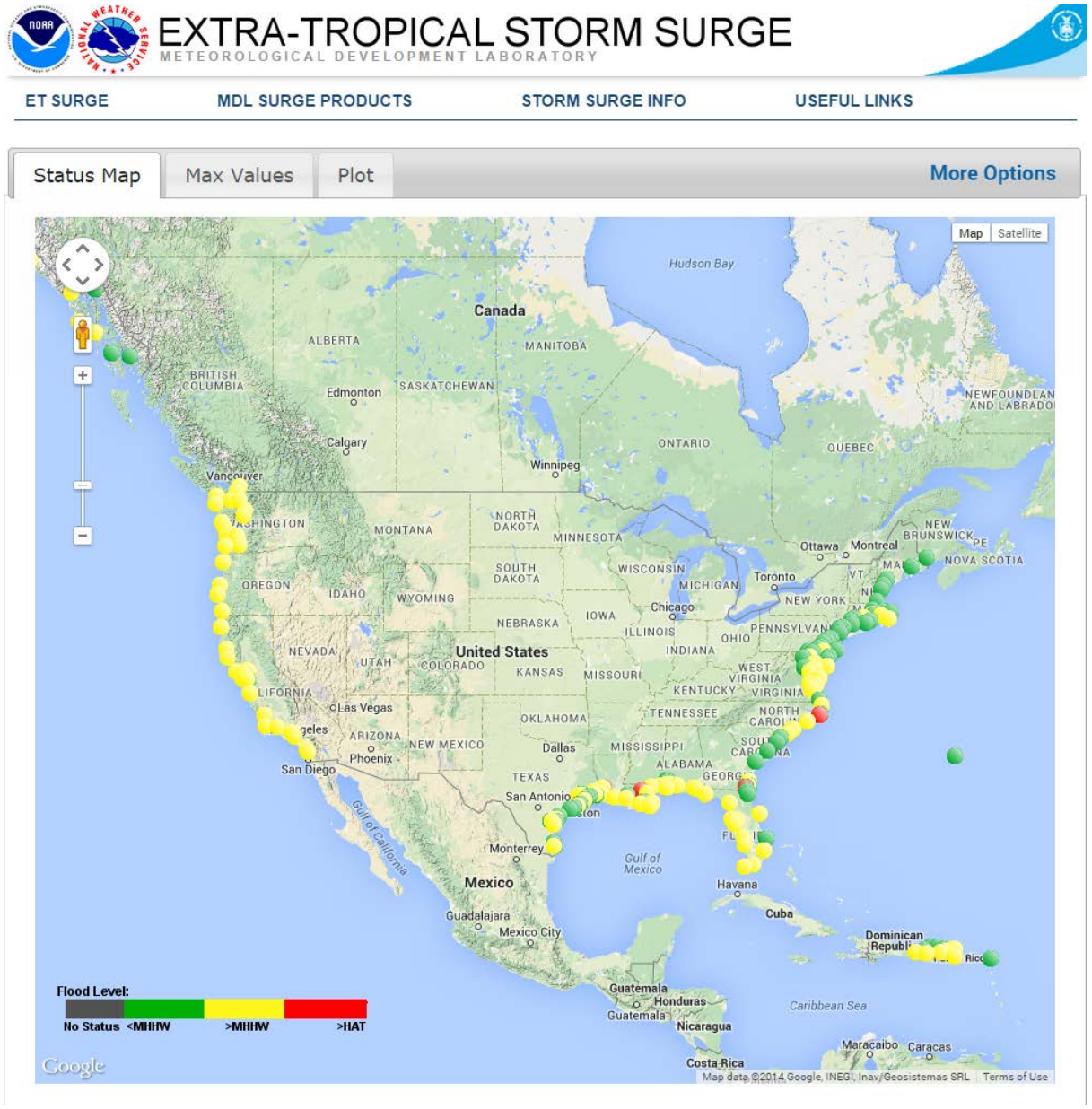
Status Map


EXTRA-TROPICAL STORM SURGE
METEOROLOGICAL DEVELOPMENT LABORATORY
ET SURGE
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STORM SURGE INFO
USEFUL LINKS
Status Map
Max Values
Plot
More Options
Map
Satellite
Hudson Bay
Canada
ALBERTA
MANITOBA
BRITISH COLUMBIA
Edmonton
SASKATCHEWAN
Calgary
ONTARIO
QUEBEC
Winnipeg
Vancouver
NORTH DAKOTA
MONTANA
MINNESOTA
Ottawa
Montreal
NEW BRUNSWICK
NOVA SCOTIA
SOUTH DAKOTA
WISCONSIN
MICHIGAN
Toronto
OREGON
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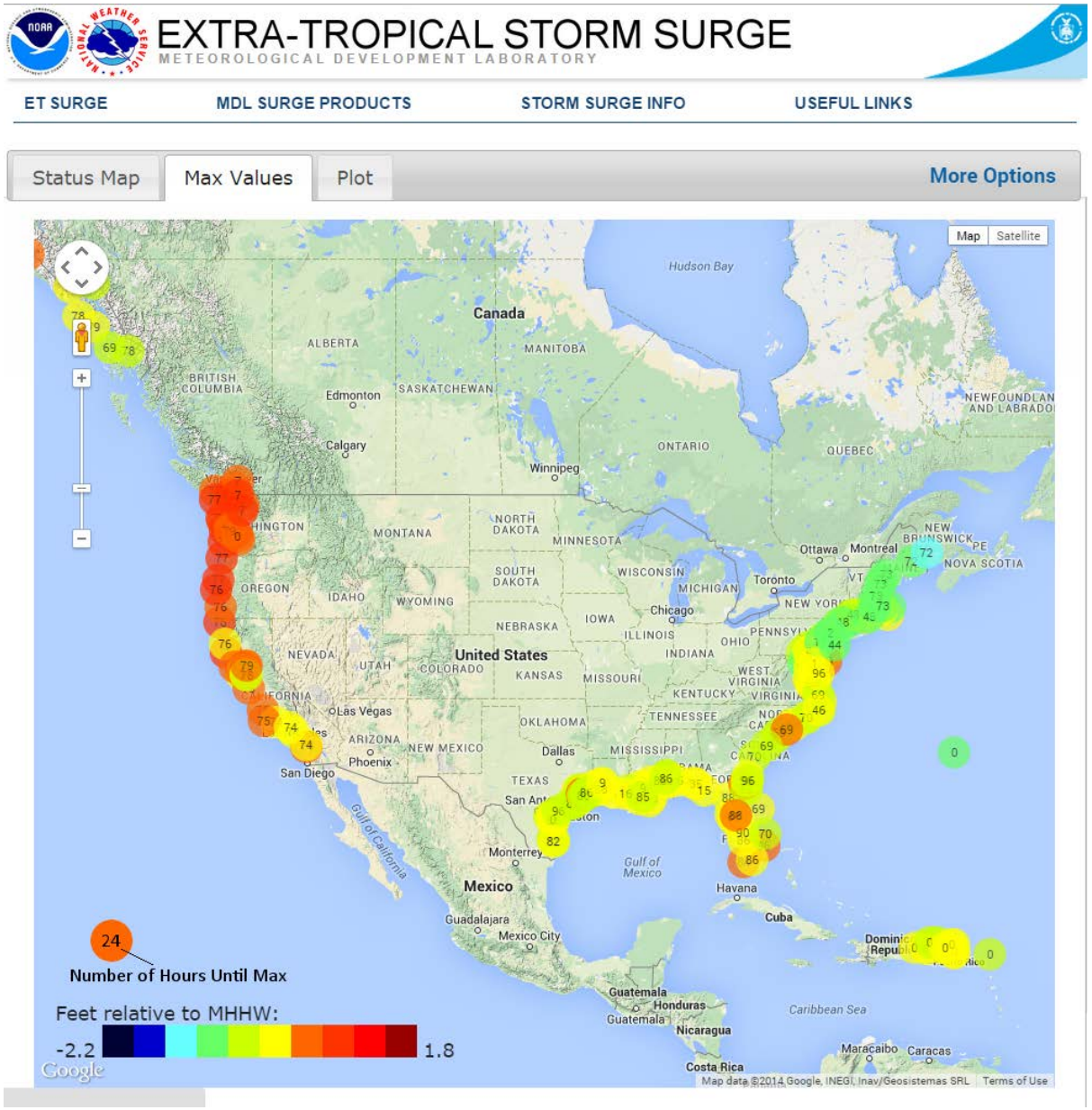
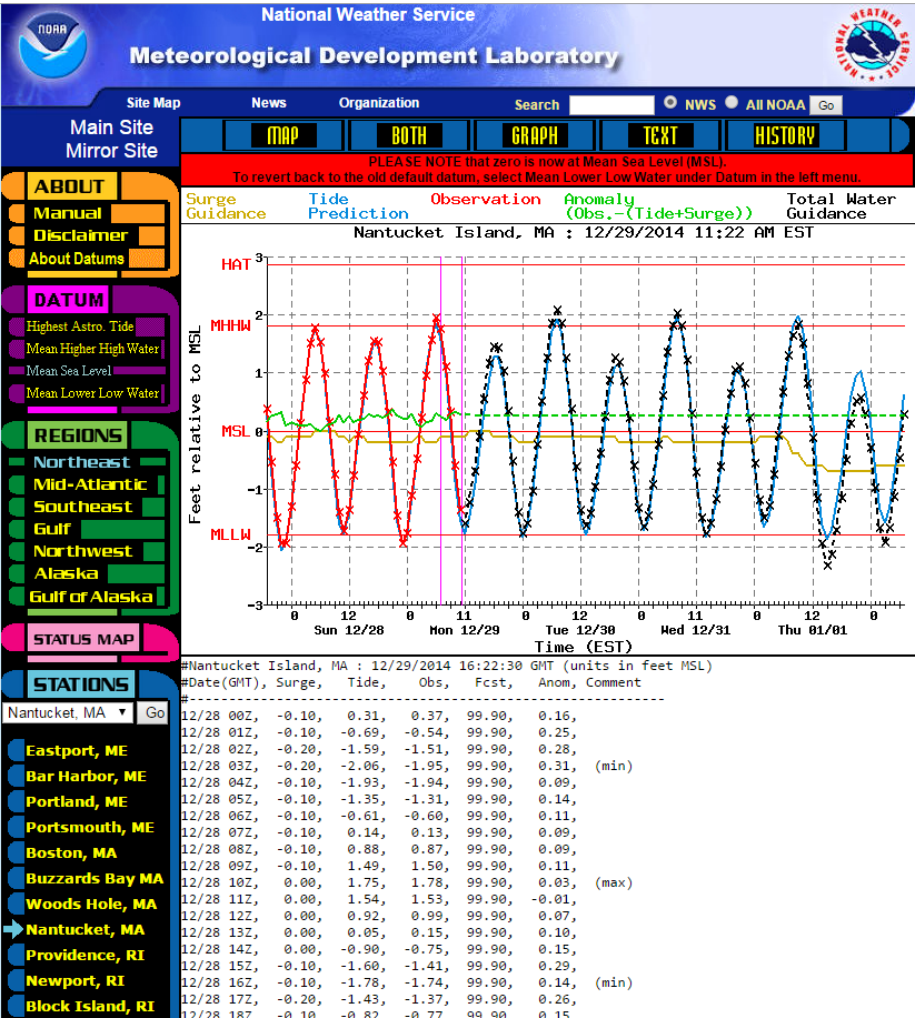
OKLAHOMA
ARIZONA
NEW MEXICO
Phoenix
Dallas
MISSISSIPPI
ALABAMA
San Diego
TEXAS
San Antonio
Gulf of California
Monterrey
Gulf of Mexico
Mexico
Havana
Cuba
Guadalajara
Mexico City
Dominican Republ
Guatemala
Honduras
Caribbean Sea
Nicaragua
Costa Rica
Maracaibo
Caracas
Flood Level:
No Status
<MHHW
>MHHW
>HAT
Google
Map data ©2014 Google, INEGI, Inav/Geosistemas SRL
Terms of Use

Max Values Map



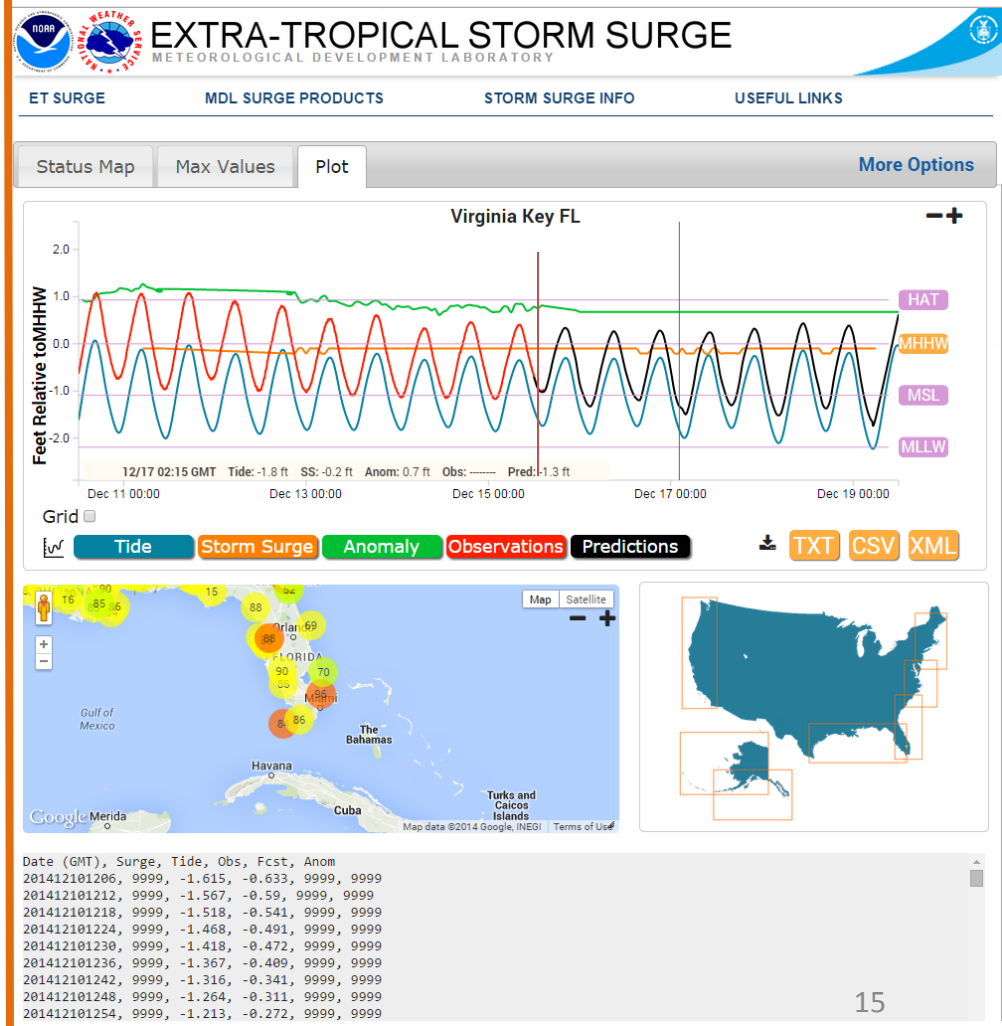
Hydrographs

Old




```
#Nantucket Island, MA : 12/29/2014 16:22:30 GMT (units in feet MSL)
#Date(GMT), Surge,   Tide,    Obs,   Fcst,   Anom, Comment
#-----------------------------------------------------------
12/28 00Z,  -0.10,   0.31,   0.37,  99.90,   0.16,
12/28 01Z,  -0.10,  -0.69,  -0.54,  99.90,   0.25,
12/28 02Z,  -0.20,  -1.59,  -1.51,  99.90,   0.28,
12/28 03Z,  -0.20,  -2.06,  -1.95,  99.90,   0.31,  (min)
12/28 04Z,  -0.10,  -1.93,  -1.94,  99.90,   0.09,
12/28 05Z,  -0.10,  -1.35,  -1.31,  99.90,   0.14,
12/28 06Z,  -0.10,  -0.61,  -0.60,  99.90,   0.11,
12/28 07Z,  -0.10,   0.14,   0.13,  99.90,   0.09,
12/28 08Z,  -0.10,   0.88,   0.87,  99.90,   0.09,
12/28 09Z,  -0.10,   1.49,   1.50,  99.90,   0.11,
12/28 10Z,   0.00,   1.75,   1.78,  99.90,   0.03,  (max)
12/28 11Z,   0.00,   1.54,   1.53,  99.90,  -0.01,
12/28 12Z,   0.00,   0.92,   0.99,  99.90,   0.07,
12/28 13Z,   0.00,   0.05,   0.15,  99.90,   0.10,
12/28 14Z,   0.00,  -0.90,  -0.75,  99.90,   0.15,
12/28 15Z,  -0.10,  -1.60,  -1.41,  99.90,   0.29,
12/28 16Z,  -0.10,  -1.78,  -1.74,  99.90,   0.14,  (min)
12/28 17Z,  -0.20,  -1.43,  -1.37,  99.90,   0.26,
12/28 18Z,  -0.10,  -0.82,  -0.77,  99.90,   0.15,
```

New




```
Date (GMT), Surge, Tide, Obs, Fcst, Anom
201412101206, 9999, -1.615, -0.633, 9999, 9999
201412101212, 9999, -1.567, -0.59, 9999, 9999
201412101218, 9999, -1.518, -0.541, 9999, 9999
201412101224, 9999, -1.468, -0.491, 9999, 9999
201412101230, 9999, -1.418, -0.472, 9999, 9999
201412101236, 9999, -1.367, -0.409, 9999, 9999
201412101242, 9999, -1.316, -0.341, 9999, 9999
201412101248, 9999, -1.264, -0.311, 9999, 9999
201412101254, 9999, -1.213, -0.272, 9999, 9999
```

Thank You

- If you'd like to talk more about water level predictions, SHEF-encoding, WCOSS capabilities, etc. email me at ryan.schuster@noaa.gov
- These slides are available online at: