

Flood Vulnerability on Maine Islands: An Advanced Circulation (ADCIRC) Model of Penobscot Bay

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Augusta Civic Center

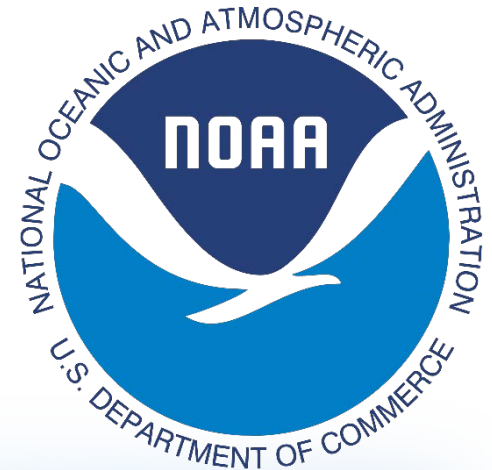
Augusta, ME

RANSOM
Consulting
Engineers
and Scientists



Acknowledgements

- Town of Islesboro, Maine
- Town of Vinalhaven, Maine
- Maine Coastal Program
- The Island Institute
- National Oceanic & Atmospheric Administration







Overview

Impetus – How vulnerable are these locations to coastal flooding?

Processes

- Storm Surge and Waves
- Sea Level Rise
- Wave Runup

Approach

- Existing Information
- Refined Modeling
- Statistical Synthesis





Grindle Point

- Home of the Ferry Terminal

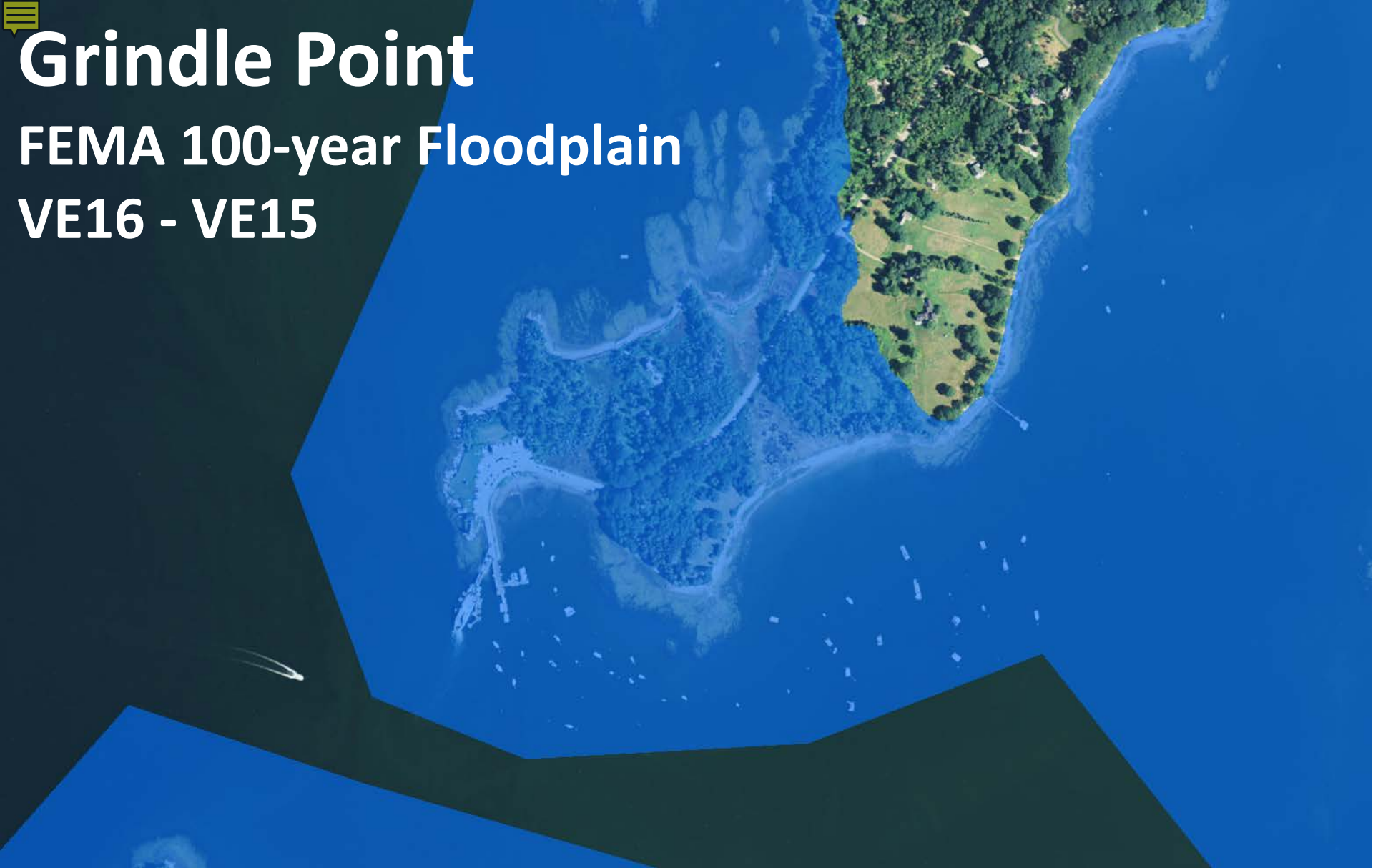




Grindle Point

FEMA 100-year Floodplain

VE16 - VE15



The Narrows

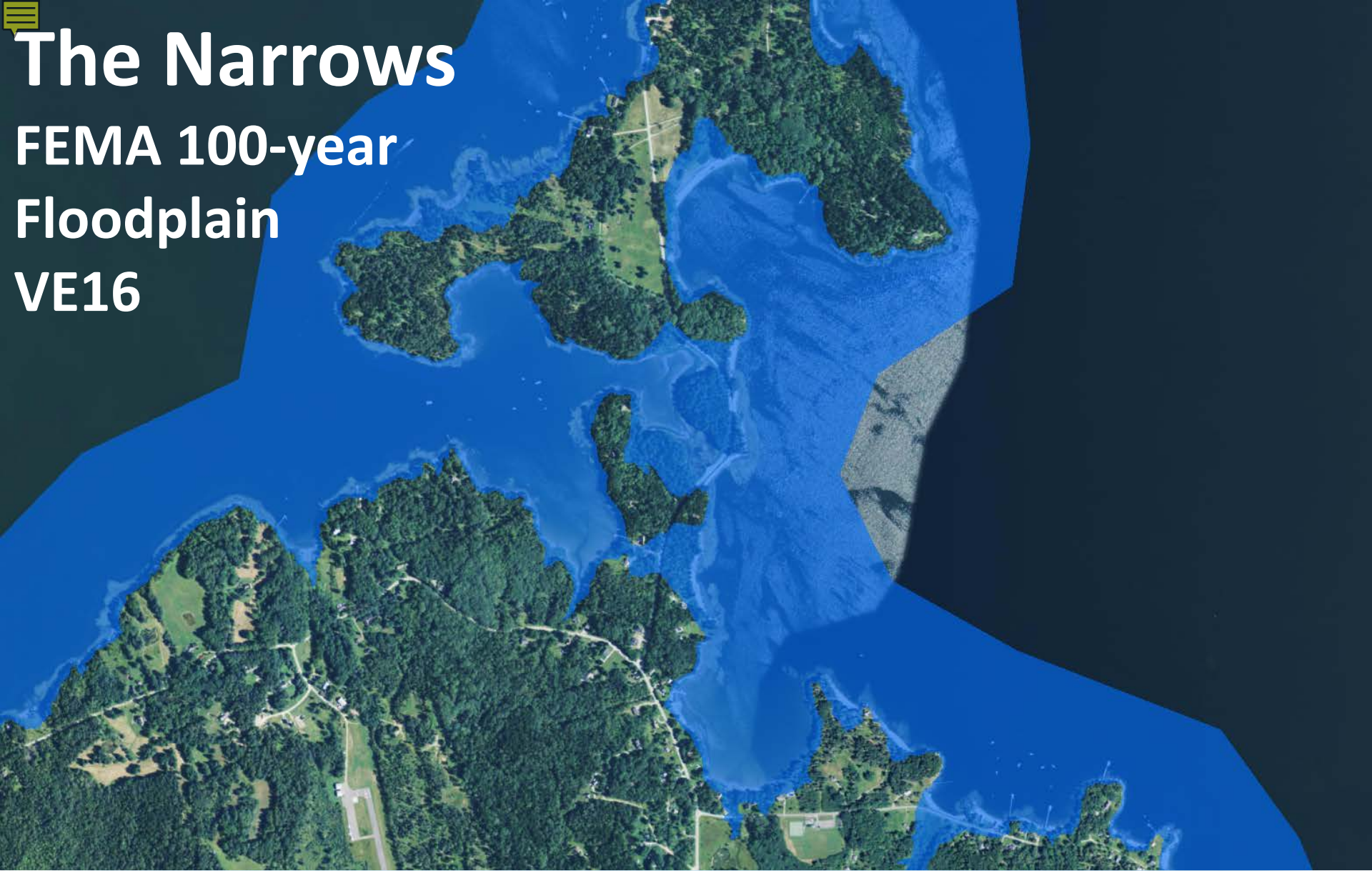
South of The Narrows:

- The school (*the emergency shelter*)
- The ferry
- The health center
- The fire station



The Narrows

FEMA 100-year
Floodplain
VE16





The Narrows, Blizzard of February 1978

Downstreet, Vinalhaven





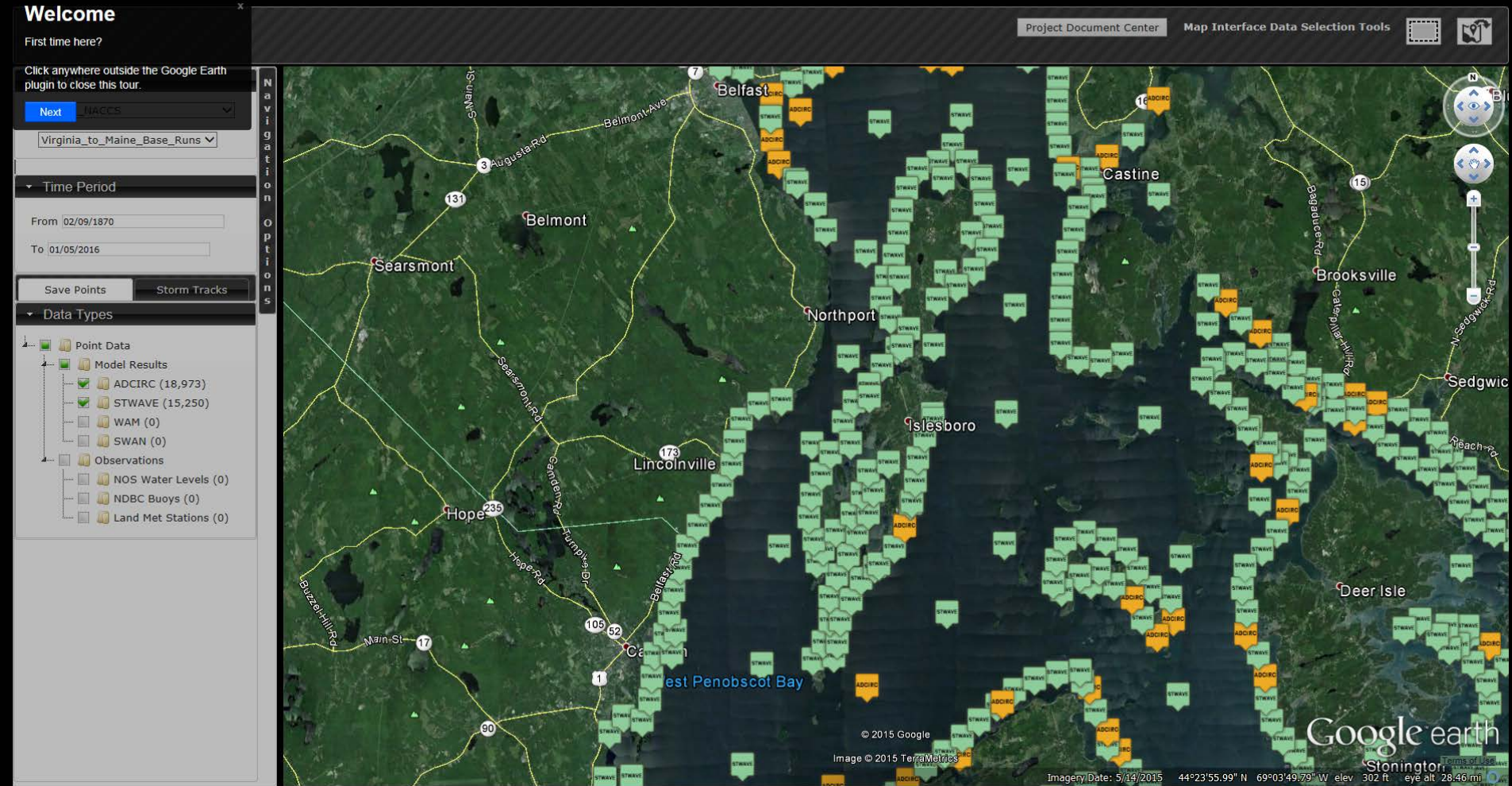
Downstreet FEMA 100-year Floodplain

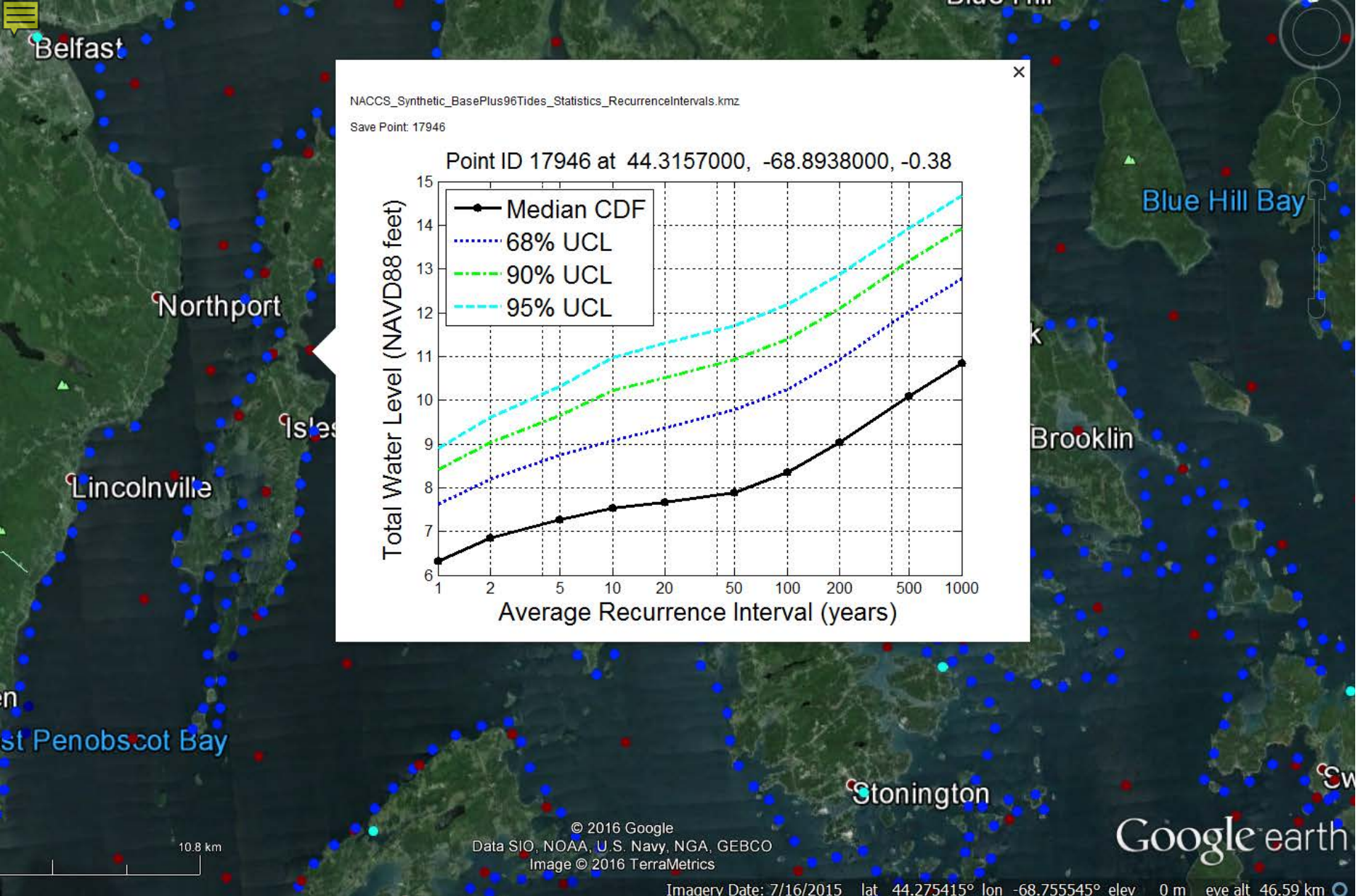
When in the future will the islands need solutions to frequent and/or damaging floods?

10 years from now? 50 years from now? 5 years from now?

Existing Information– USACE NACCS Study

Coastal Hazards System



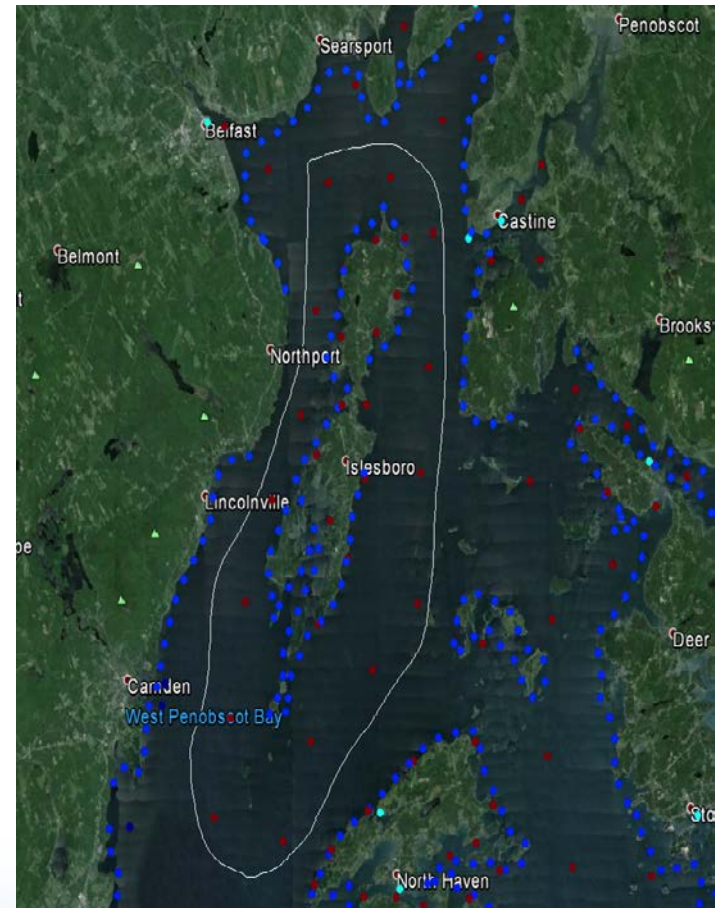


NACCS – Getting “raw” model data

- 1050 Tropical Storms
- 100 Extra-tropical Storms
- 2 SLR realizations, w/ & w/o tides

= Lots of simulations and files

Don't need it all for local study





NACCS – Getting “raw” model data

For Tropical Storms (72 requested)

- 1) Select set of NACCS “save points” for local region
- 2) Examine recurrence interval data from CHS
- 3) Examine “Peaks” data from CHS for those locations
- 4) Determine sub-set of storm with peaks that contribute to extreme statistics for local area

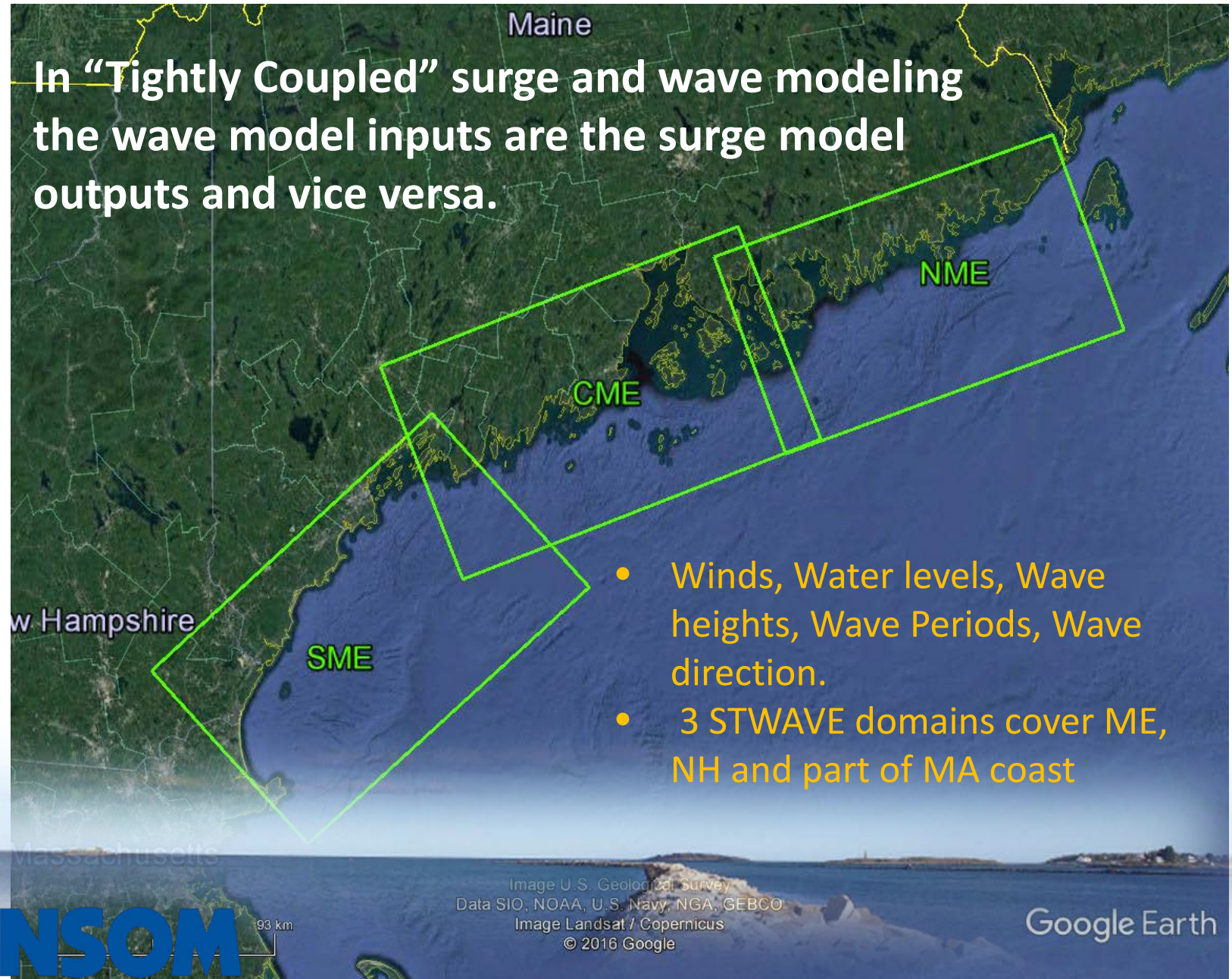
For Extra-tropical storms (80 requested)

- 1) Appendix A from TR-15-5
- 2) Select all storms from Region 1 & 2, and storms from Region 3 with highest rank or number of locations better than 7.



NACCS – STWAVE Files

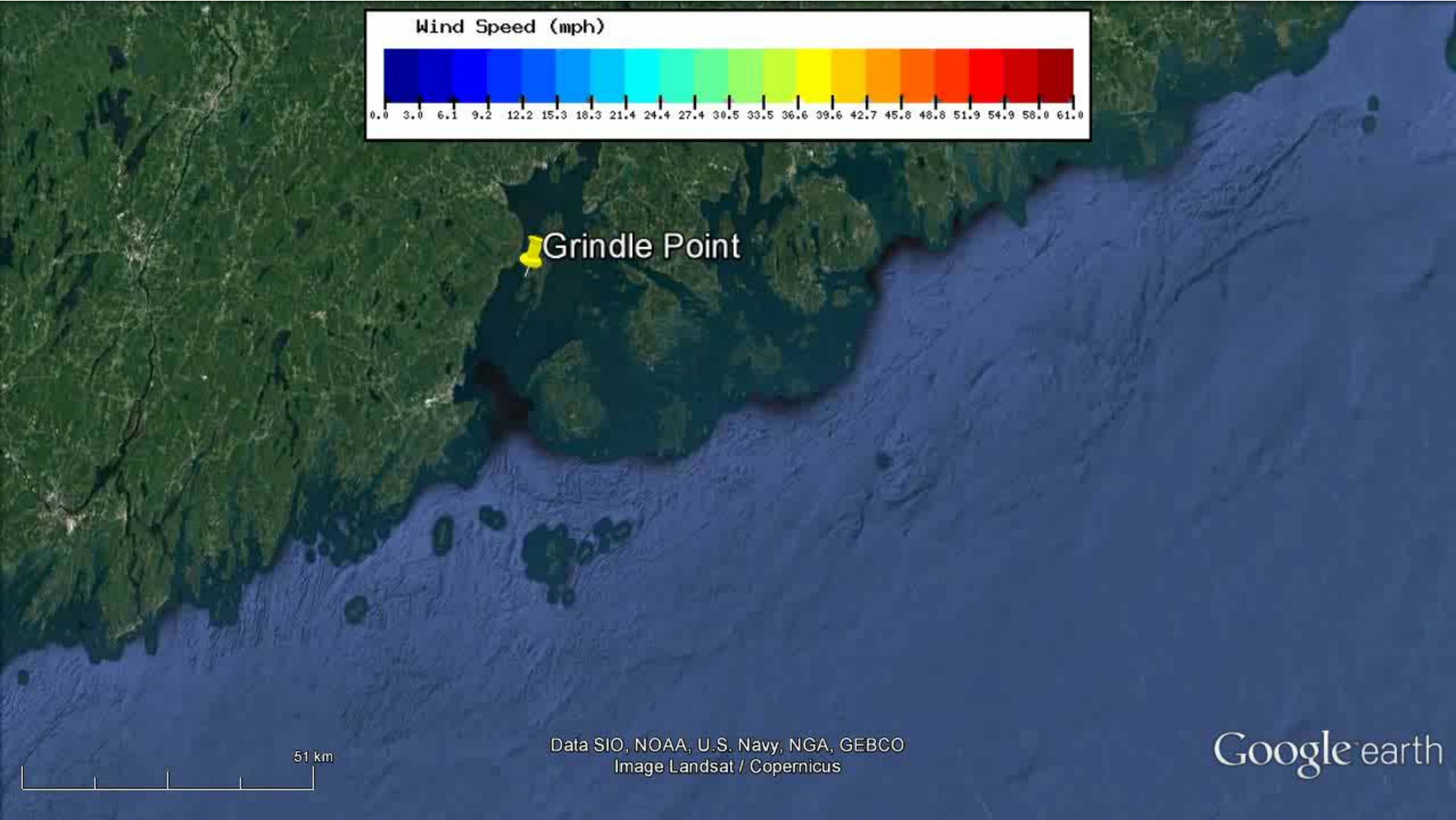
In “Tightly Coupled” surge and wave modeling the wave model inputs are the surge model outputs and vice versa.





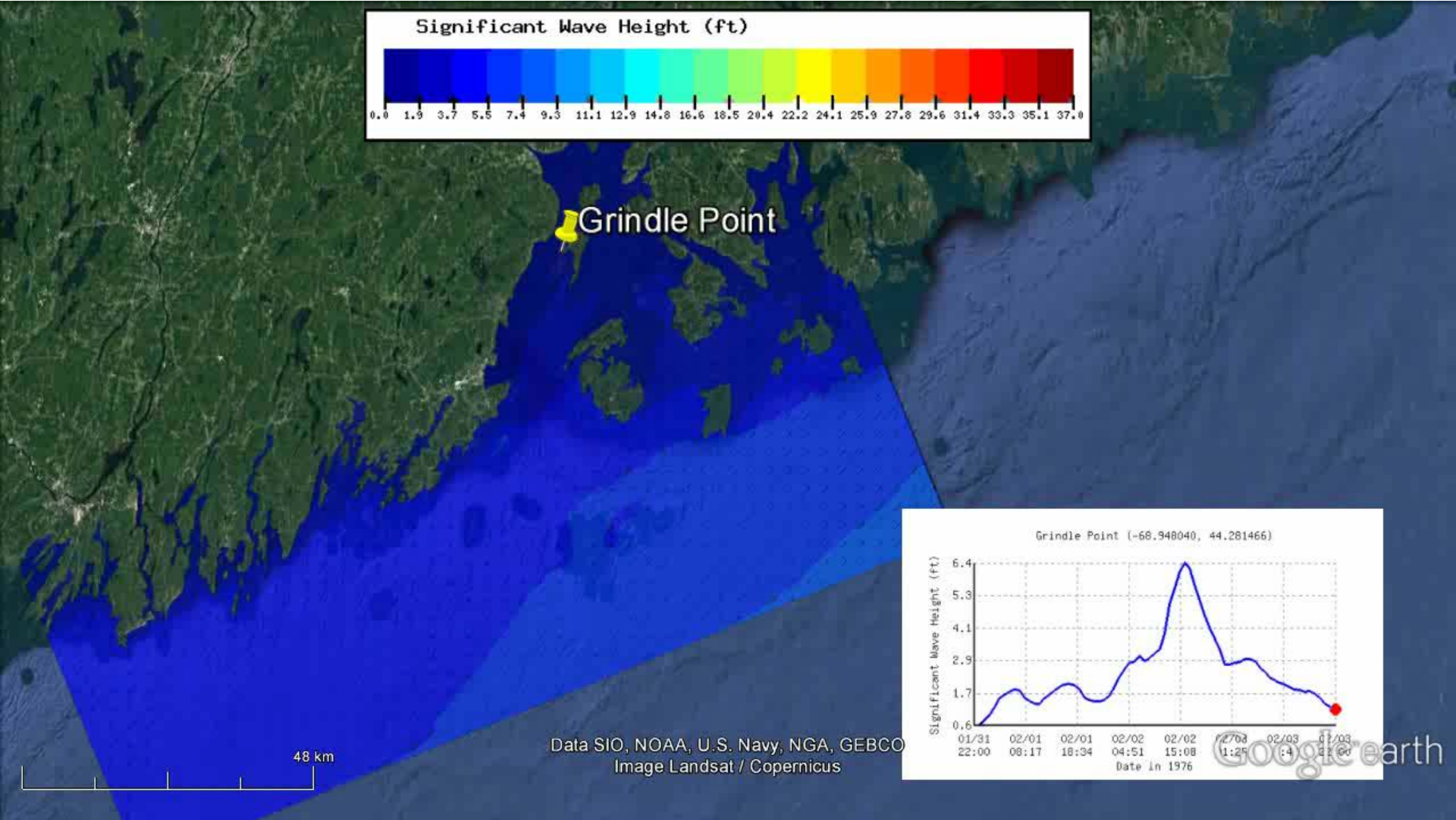
NACCS Central Maine – Wind

1976 Groundhog day storm



NACCS Central Maine - Waves

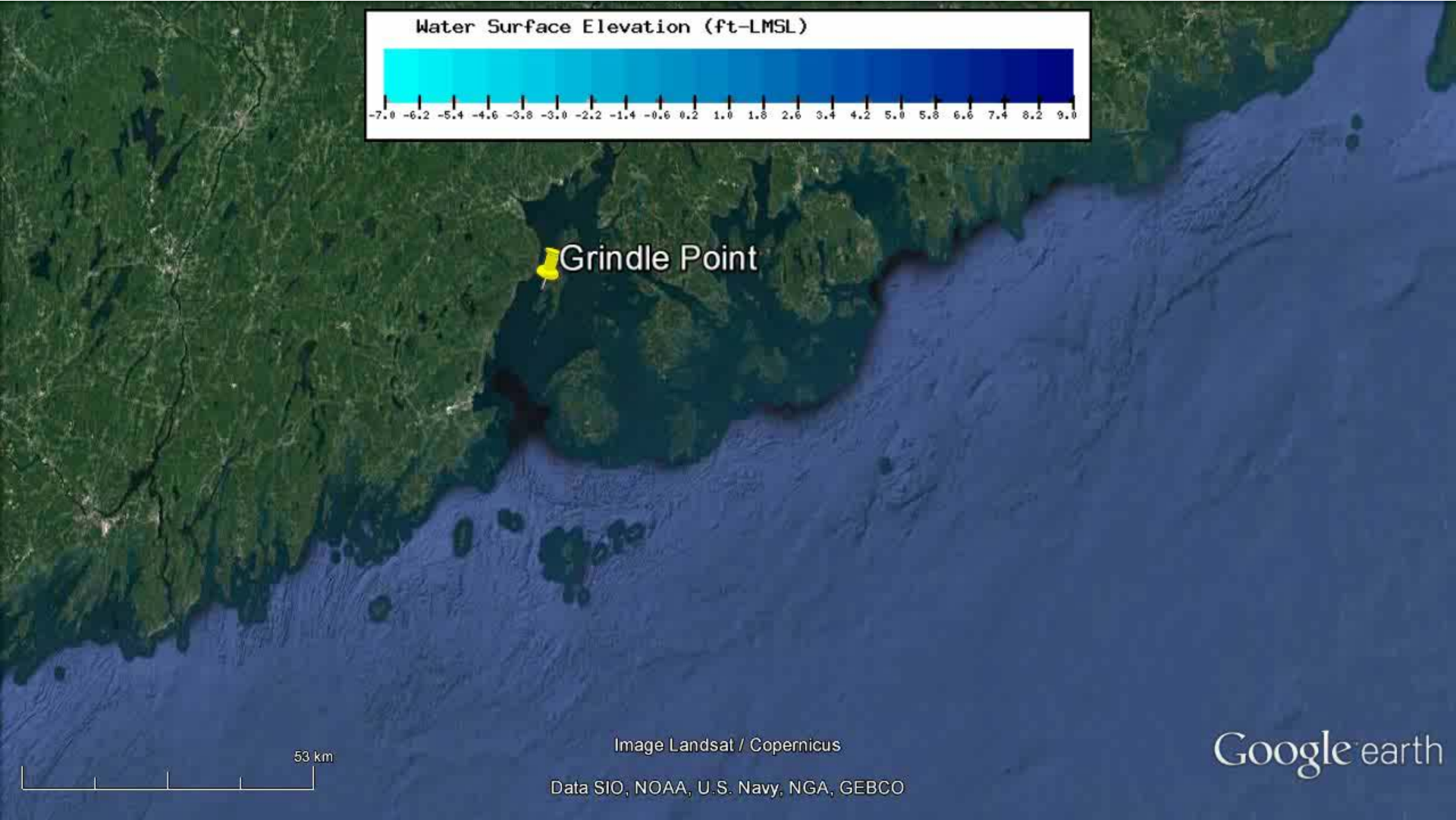
1976 Groundhog day storm





NACCS Central Maine – Water Level

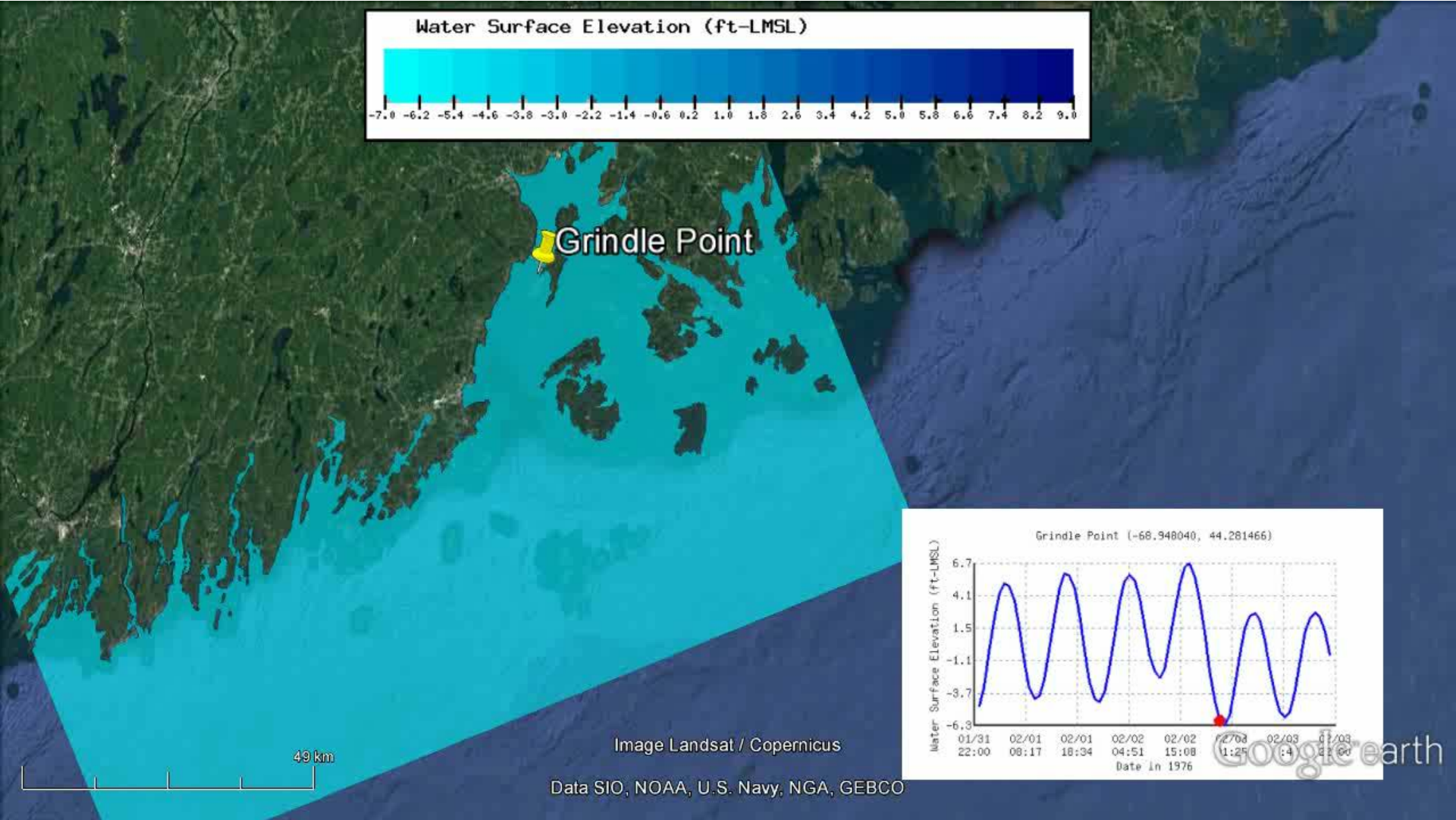
1976 Groundhog day storm





NACCS Central Maine – Water Level close-up

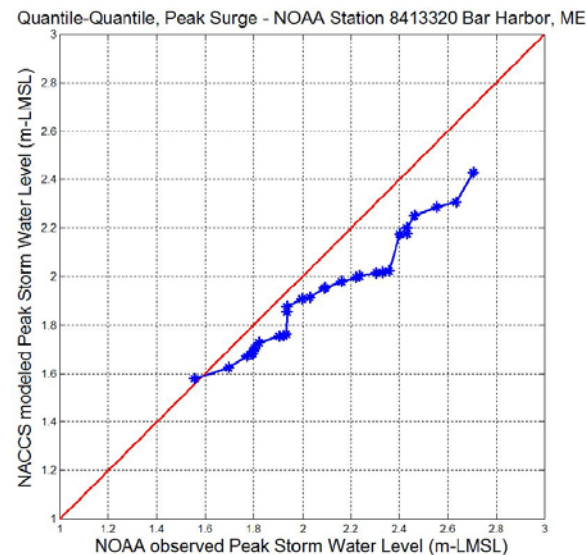
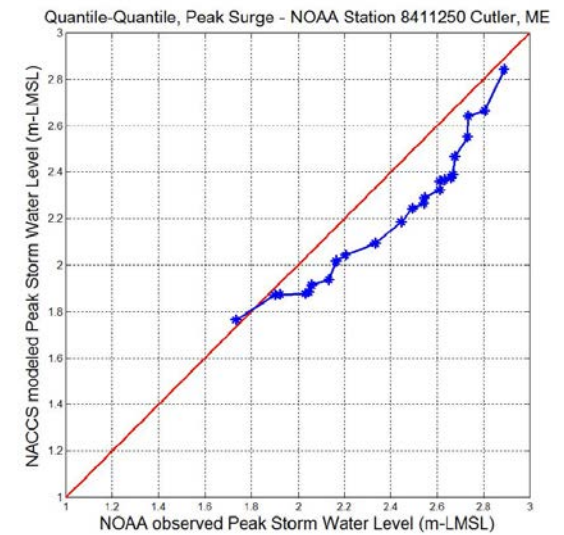
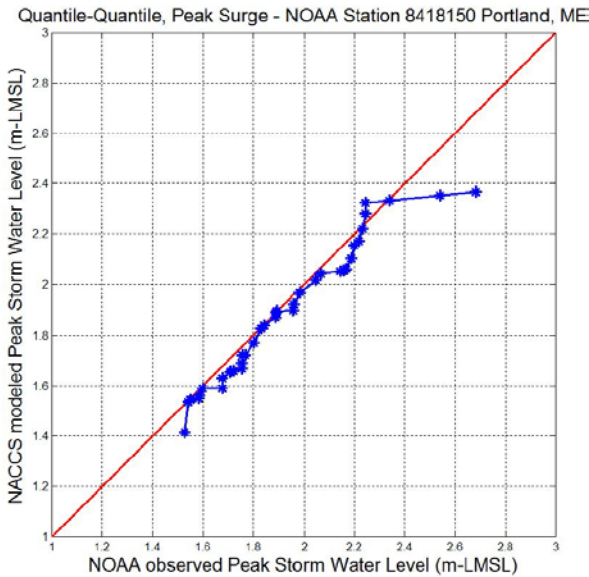
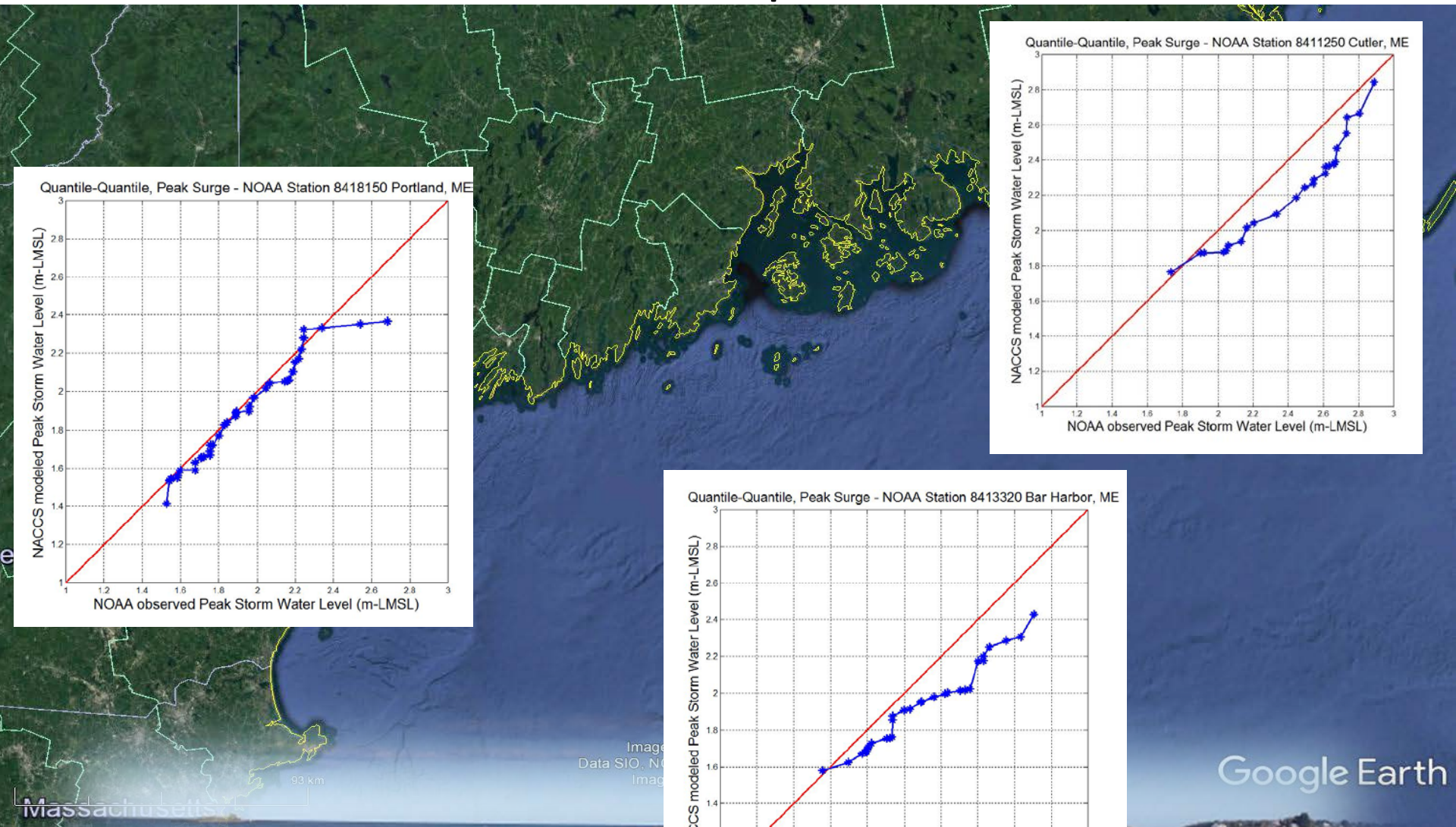
1976 Groundhog day storm





NACCS Model – Local Validation

Historic Extra-tropical storms

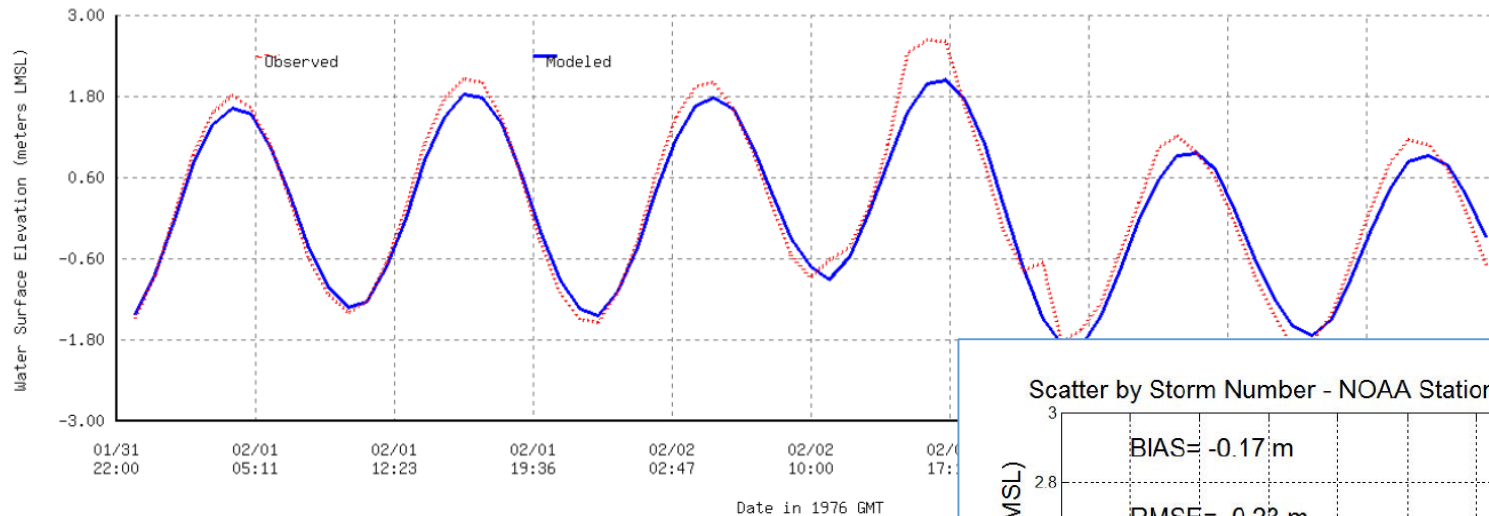




NACCS Model – Local Validation

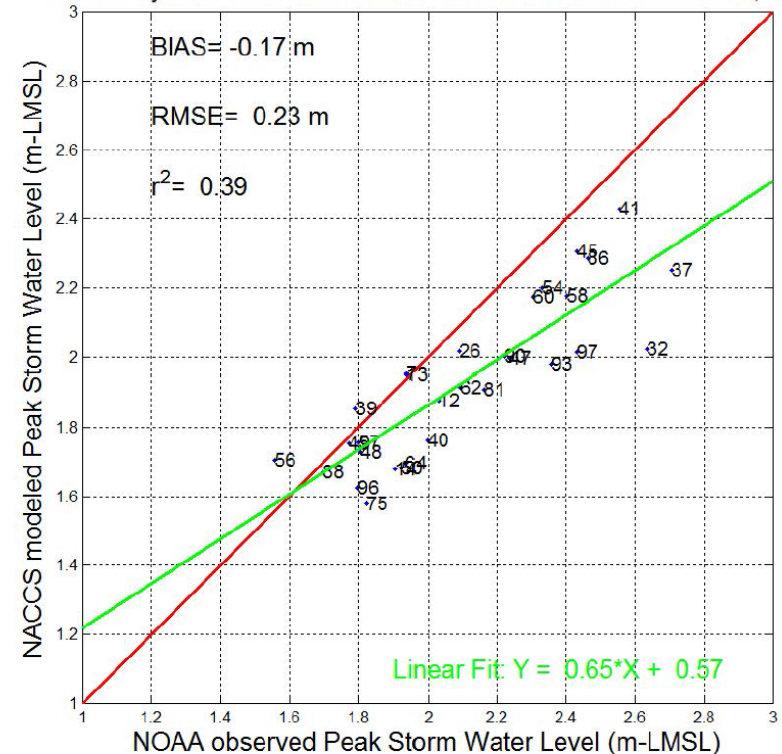
1976 Groundhog Day Storm

storm 32 Station 8413320 - Bar Harbor msl2navd=-0.0860



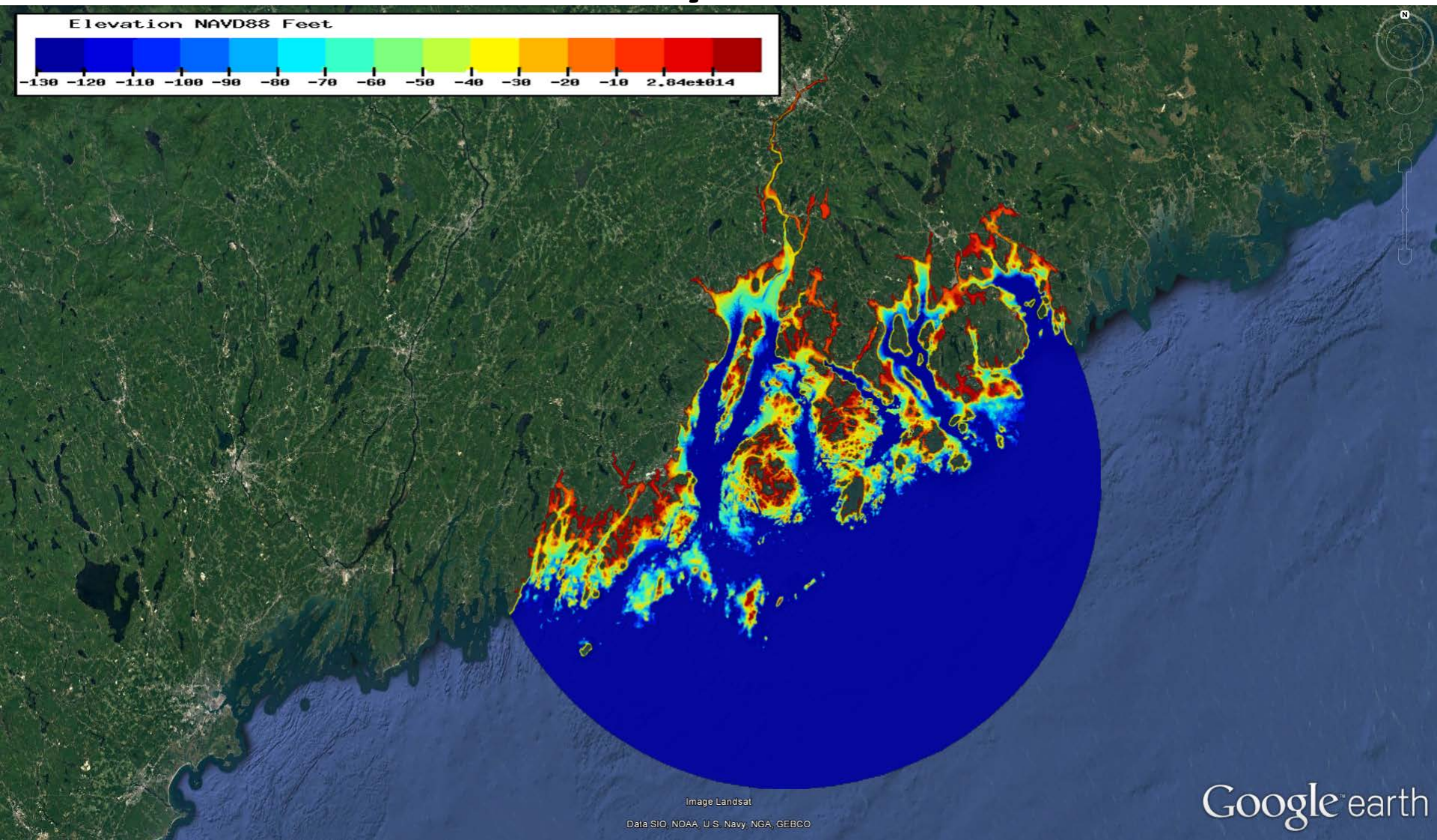
**Historic Extra-tropical
storms at Bar Harbor →**

Scatter by Storm Number - NOAA Station 8413320 Bar Harbor, ME



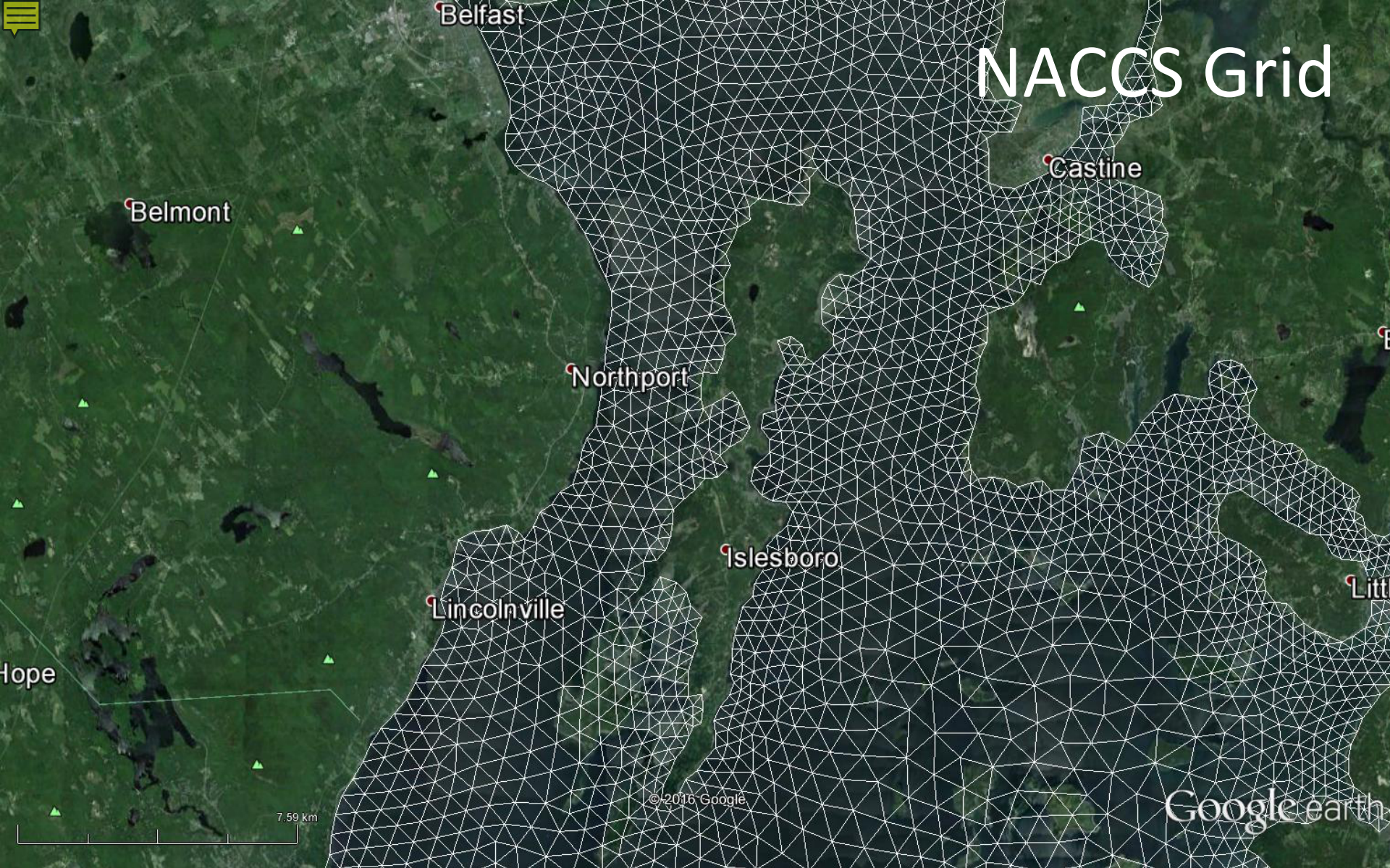


Penobscot Bay ADCIRC Model

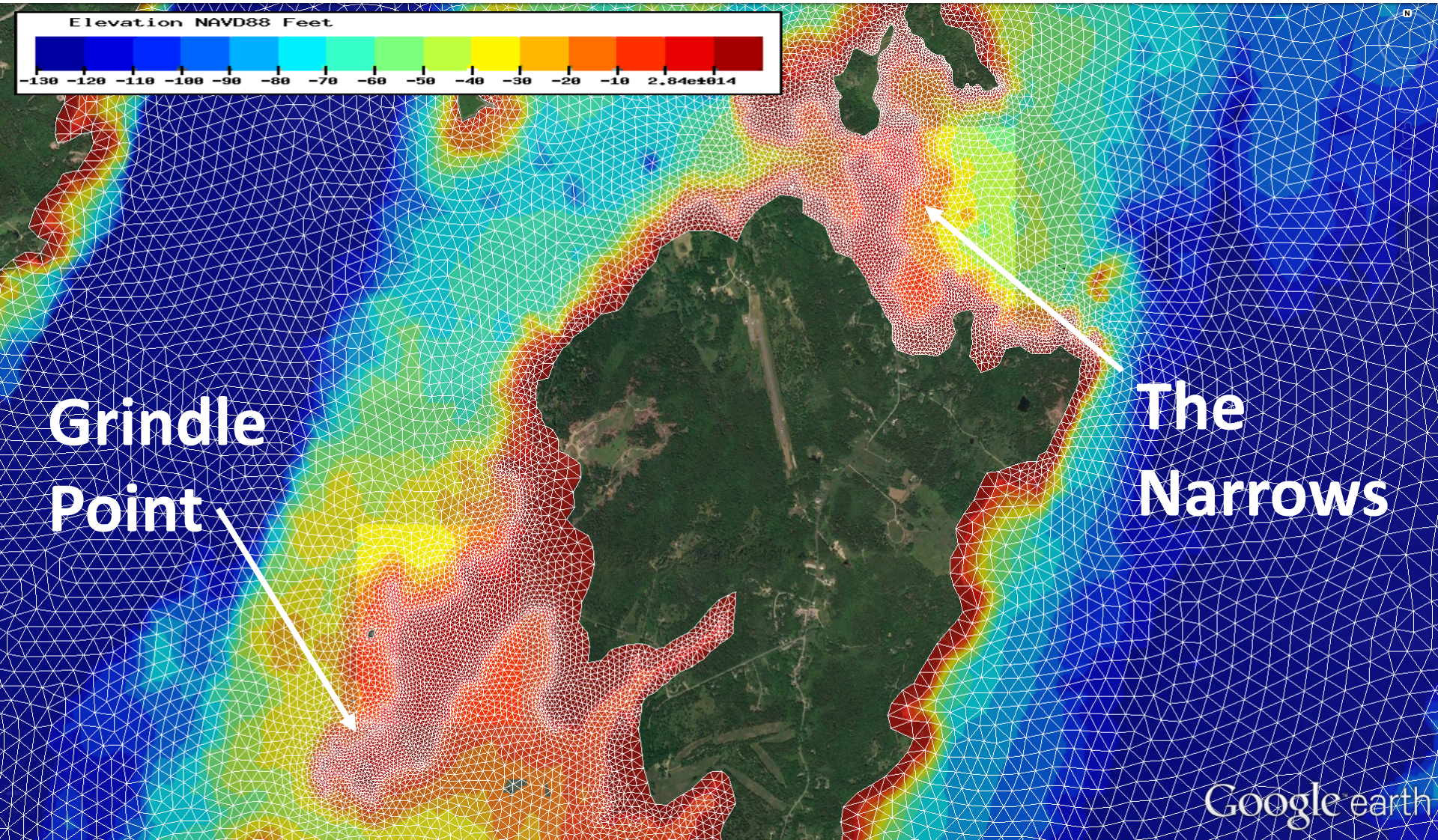


RANSOM

This block contains the RANSOM logo on the left and a photograph of a rocky coastline on the right. The logo is in blue capital letters. The photograph shows a rocky point jutting into the ocean under a clear sky.

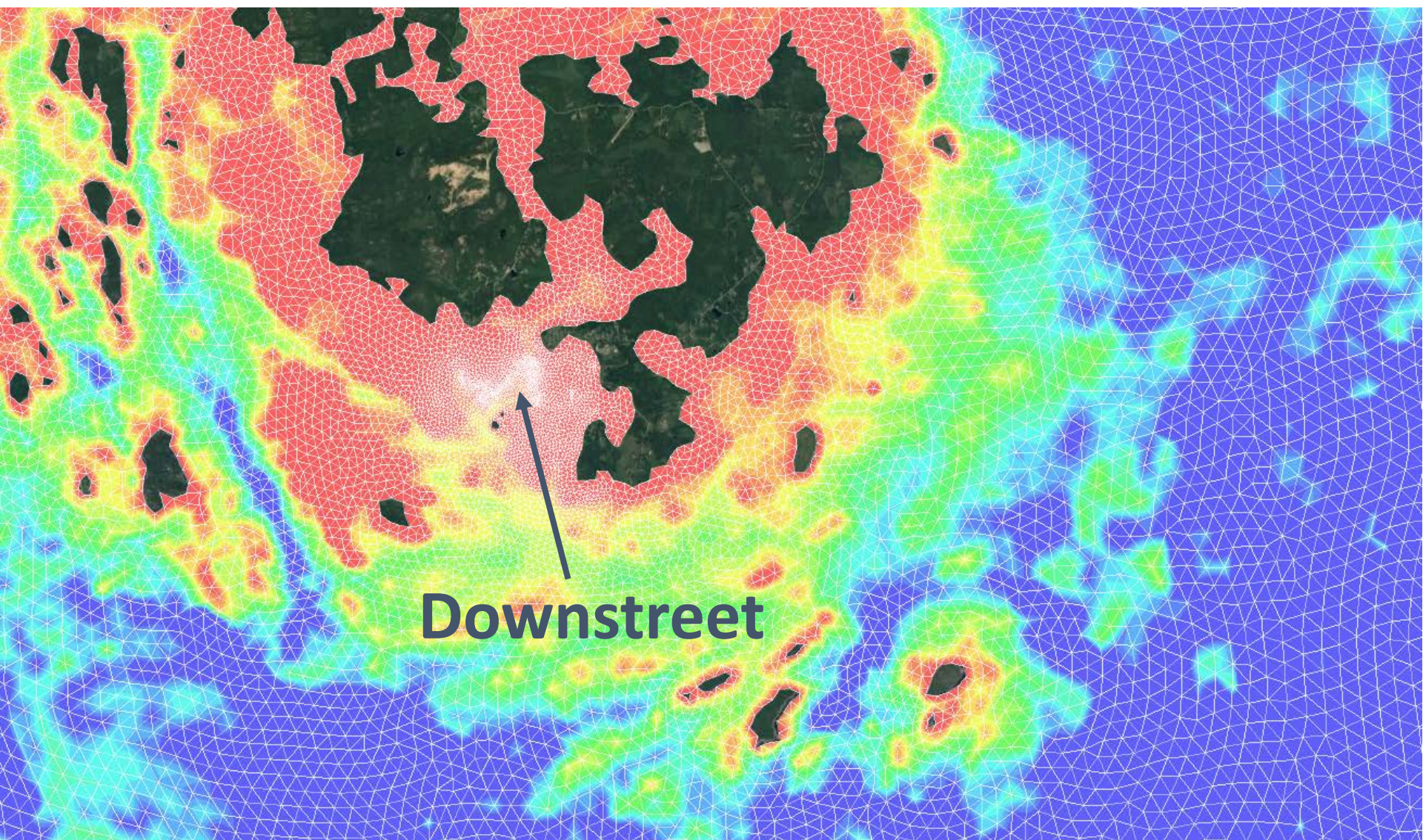


ADCIRC Grid and Bottom Elevation





ADCIRC Grid and Bottom Elevation



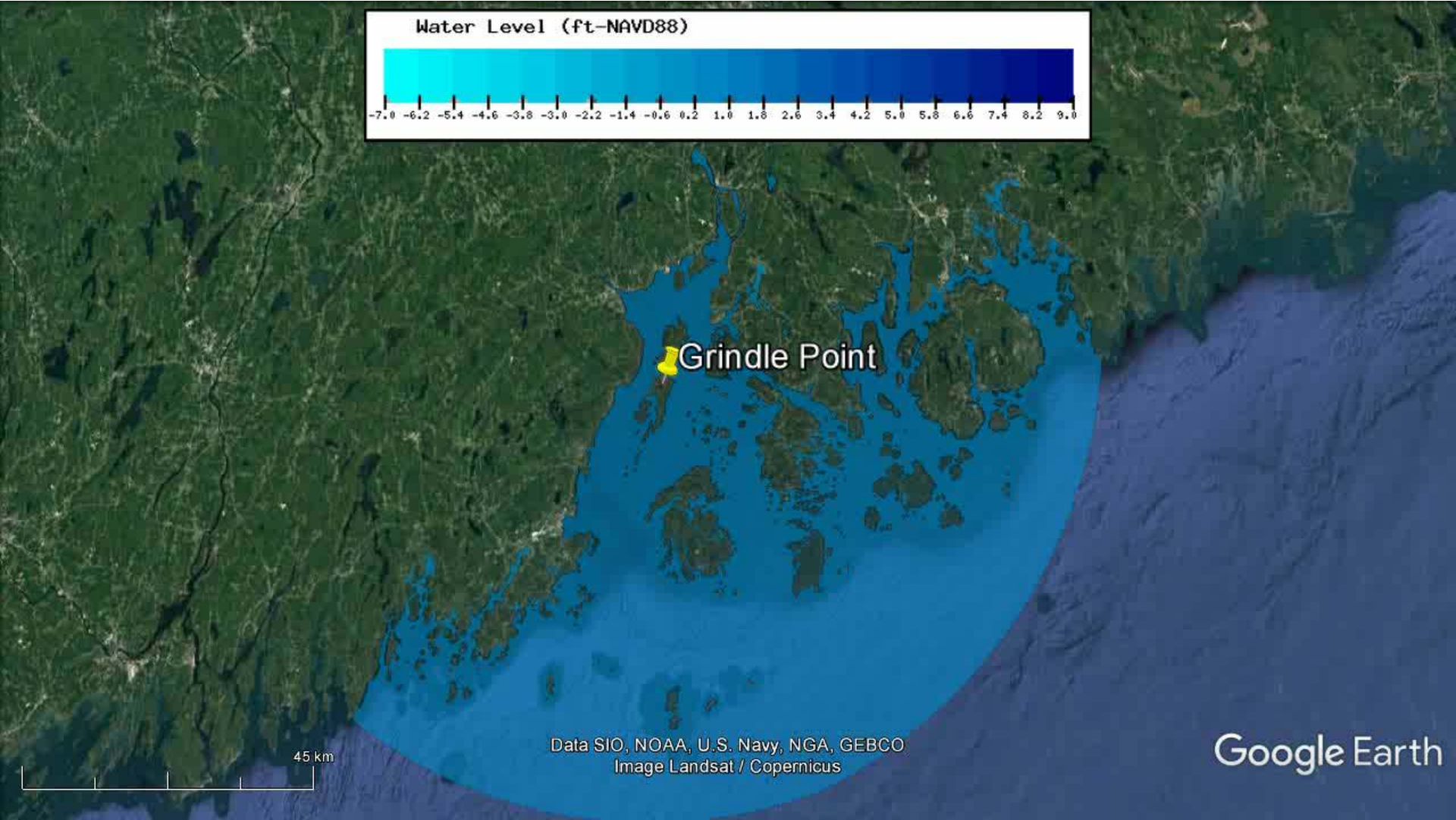
Downstreet





Penobscot Bay ADCIRC+SWAN model – Water Level

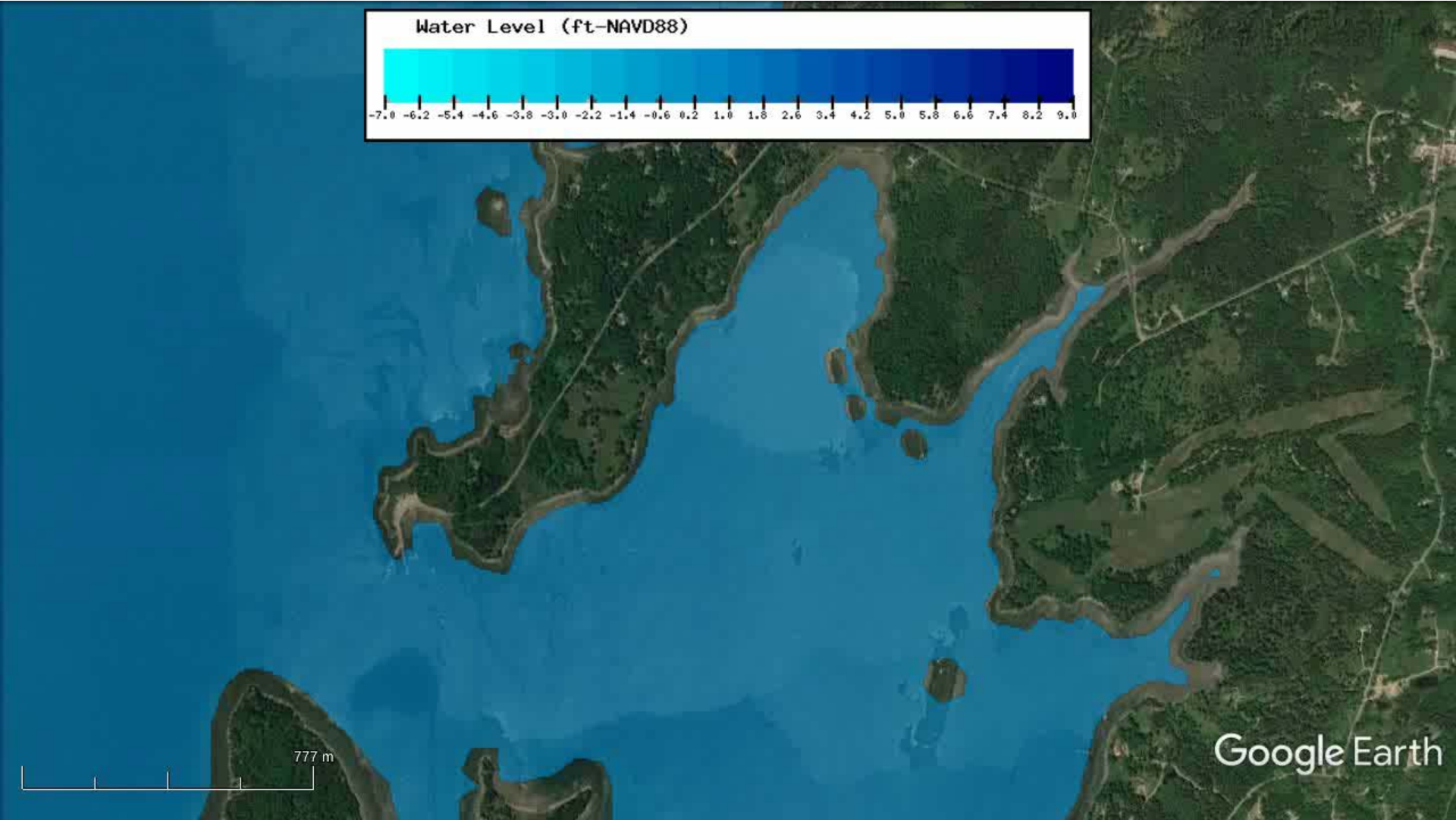
1976 Groundhog day storm





Penobscot Bay ADCIRC+SWAN model – Water Level

1976 Groundhog day storm



Penobscot Bay ADCIRC+SWAN model – Water Level

1976 Groundhog day storm

NOAA 8413320 Bar Harbor msl2navd=-0.0860

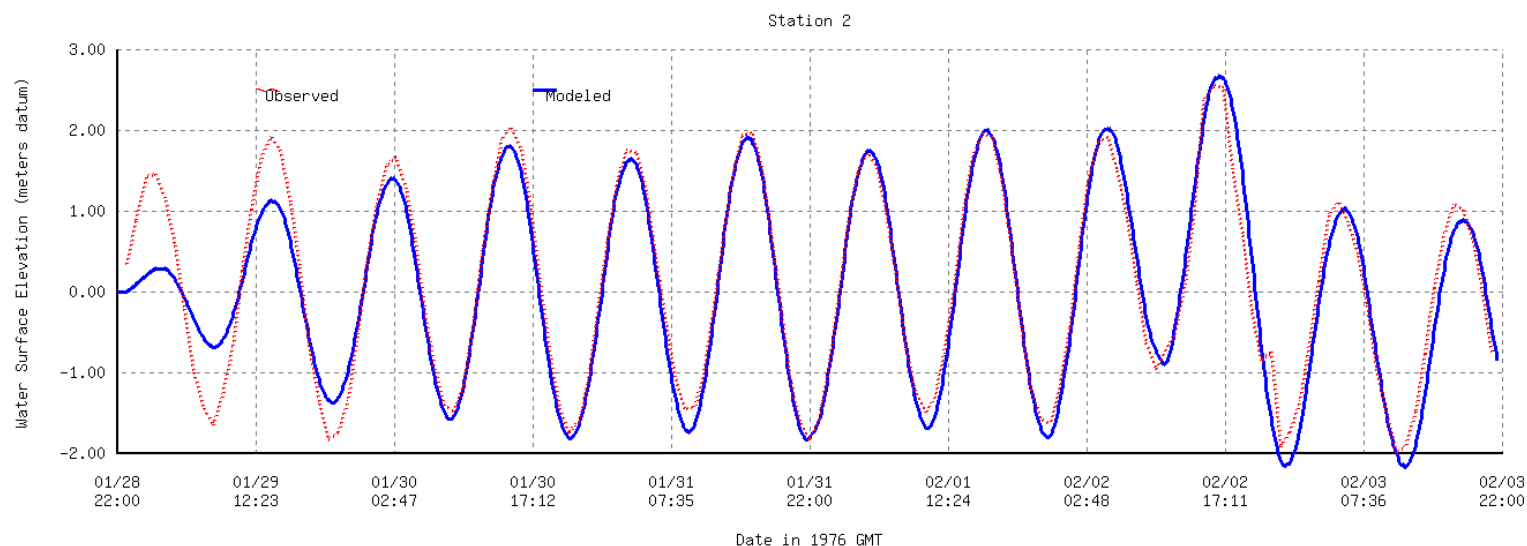


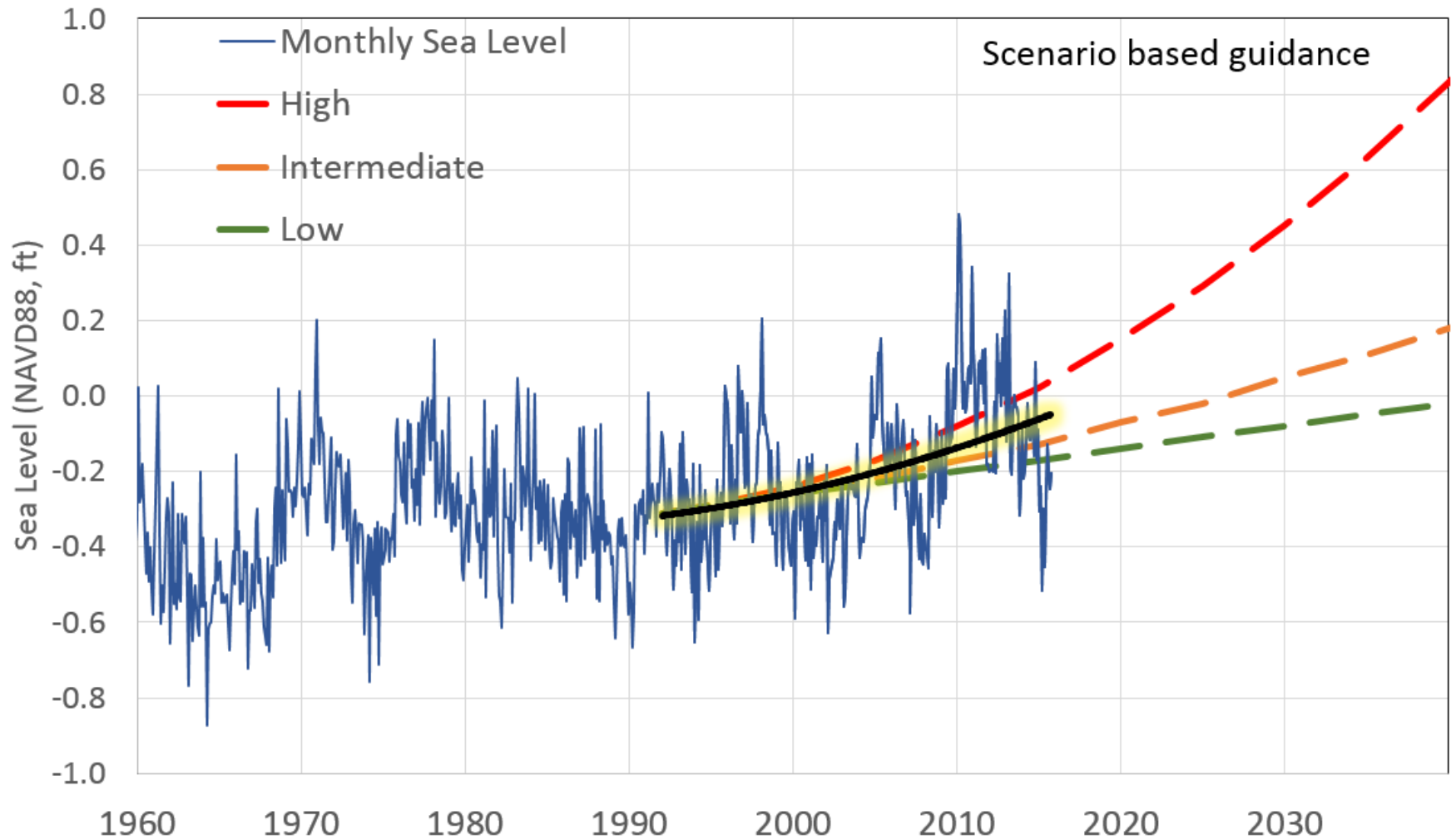
Image U.S. Geological Survey
Image Landsat / Copernicus
© 2016 Google
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Imagery Date: 12/13/2015 lat 43.086762° lon -67.840268° elev -196 m eye alt 567.27 km

Google Earth



Processes – Sea Level Rise



Processes — Sea Level Rise Probabilistic Guidance: e.g.

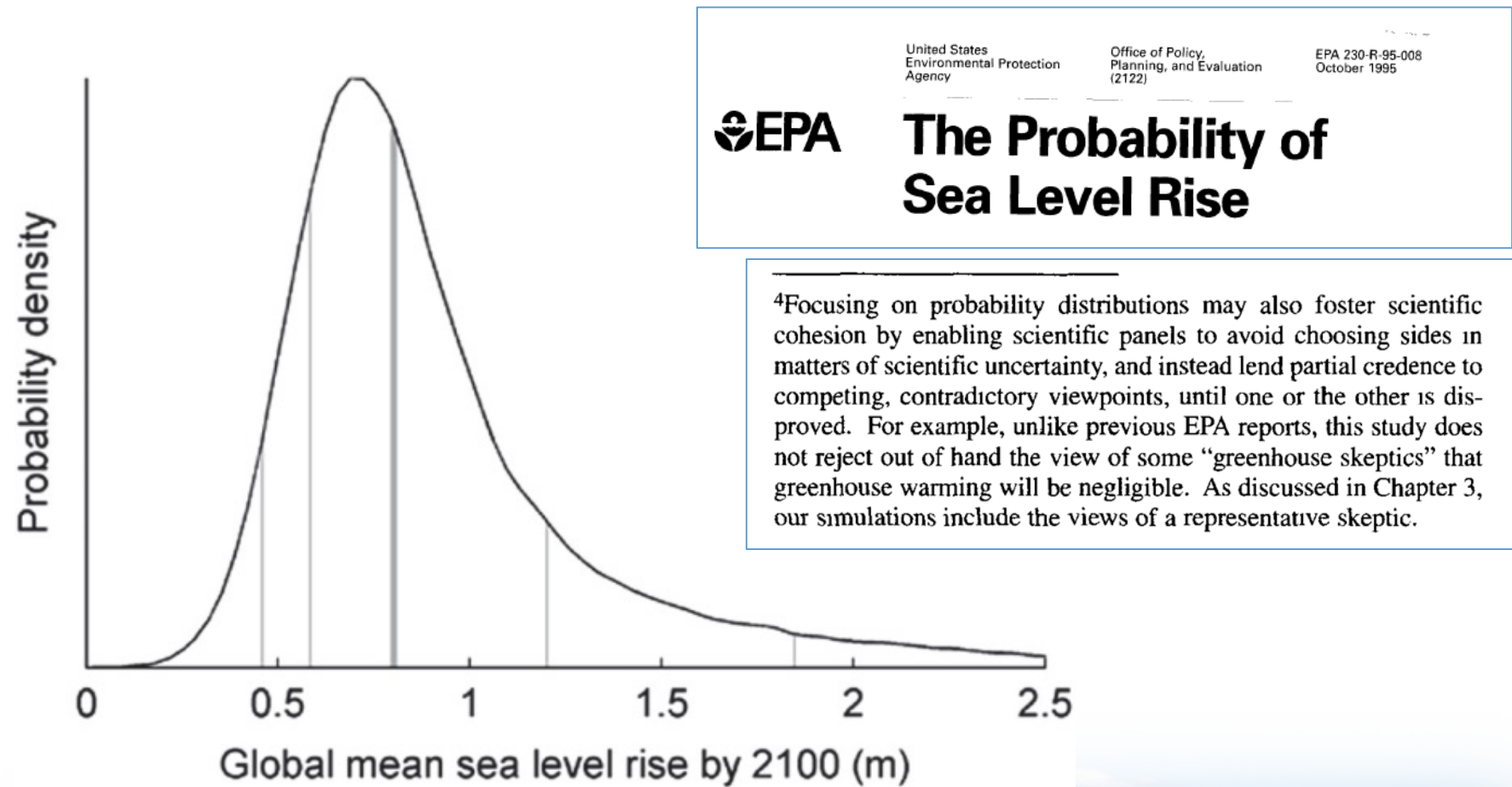
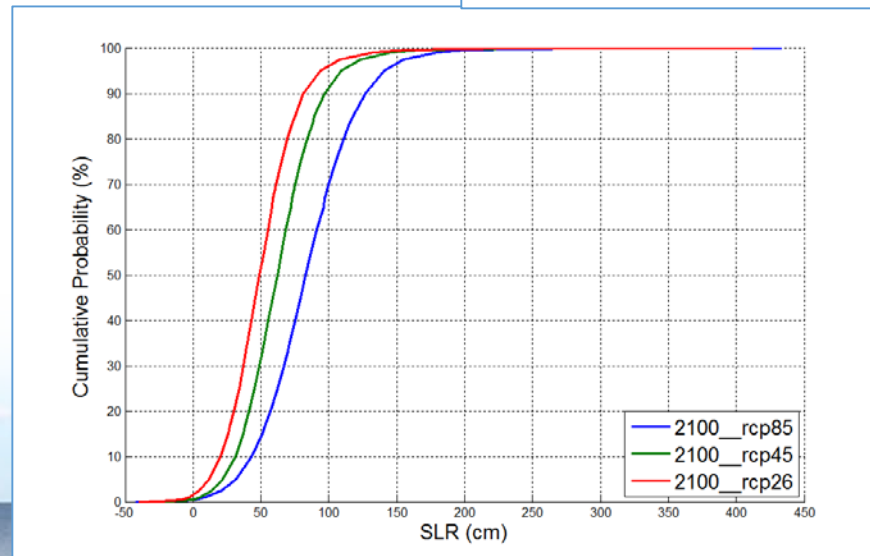
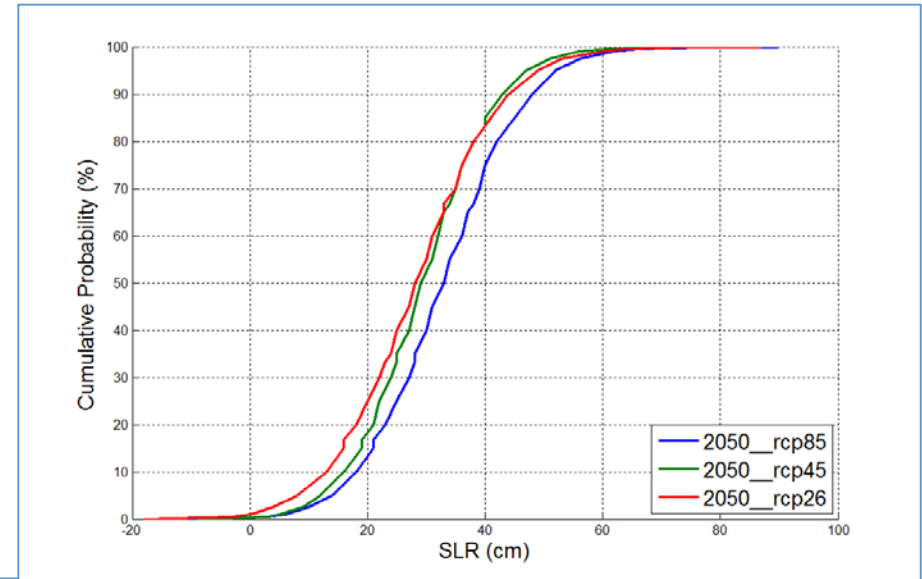
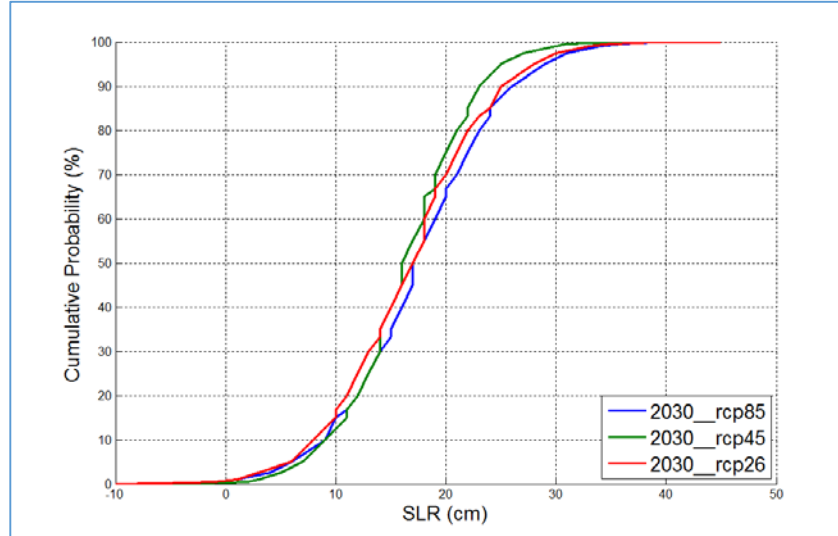


Figure from Grinsted, Aslak, S. Jevrejeva, R. E. M. Riva, and D. Dahl Jensen. *Sea level rise projections for northern Europe under RCP8.5*. Climate Research. Vol 64: 15-23. June 17, 2015.



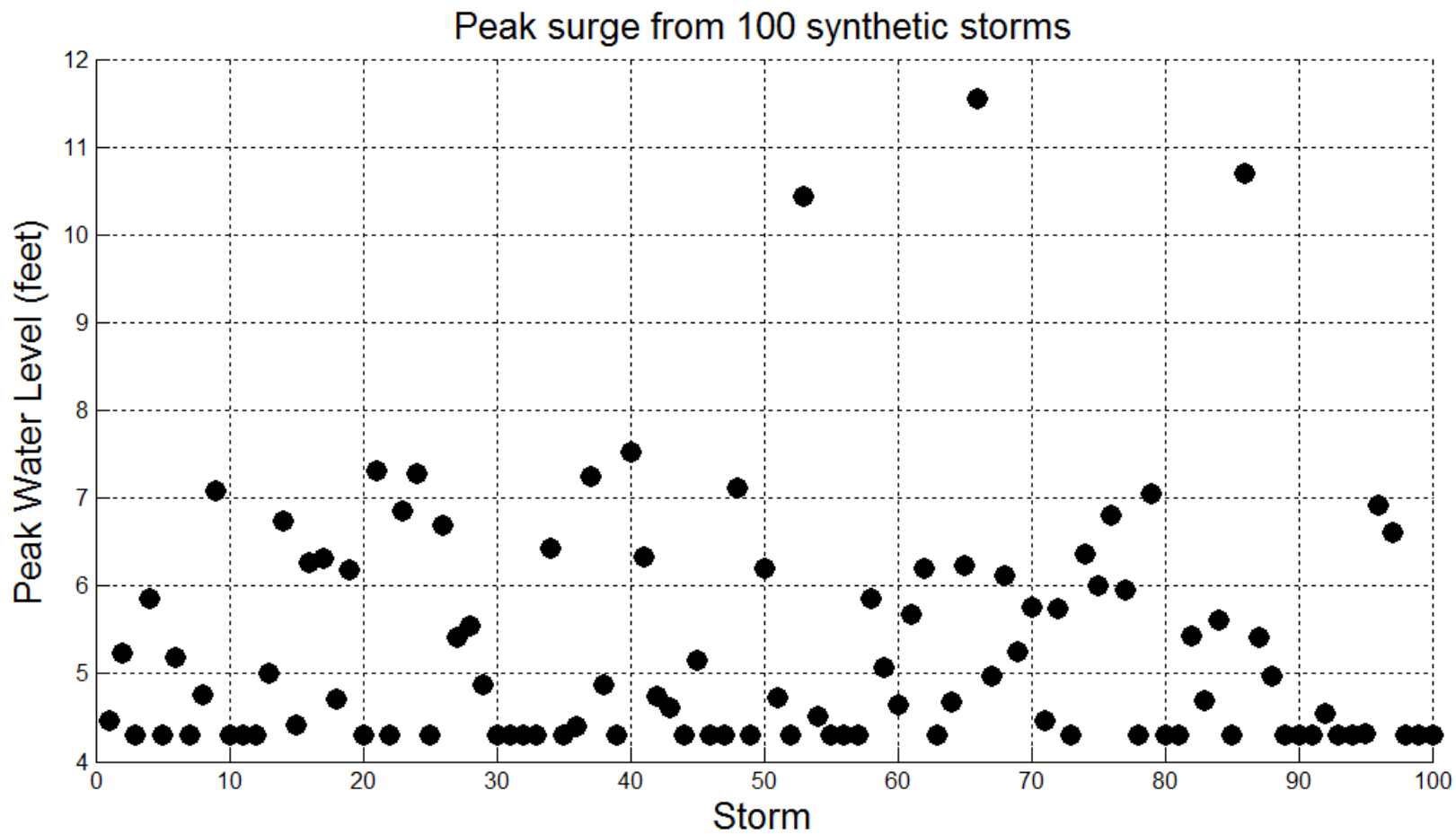


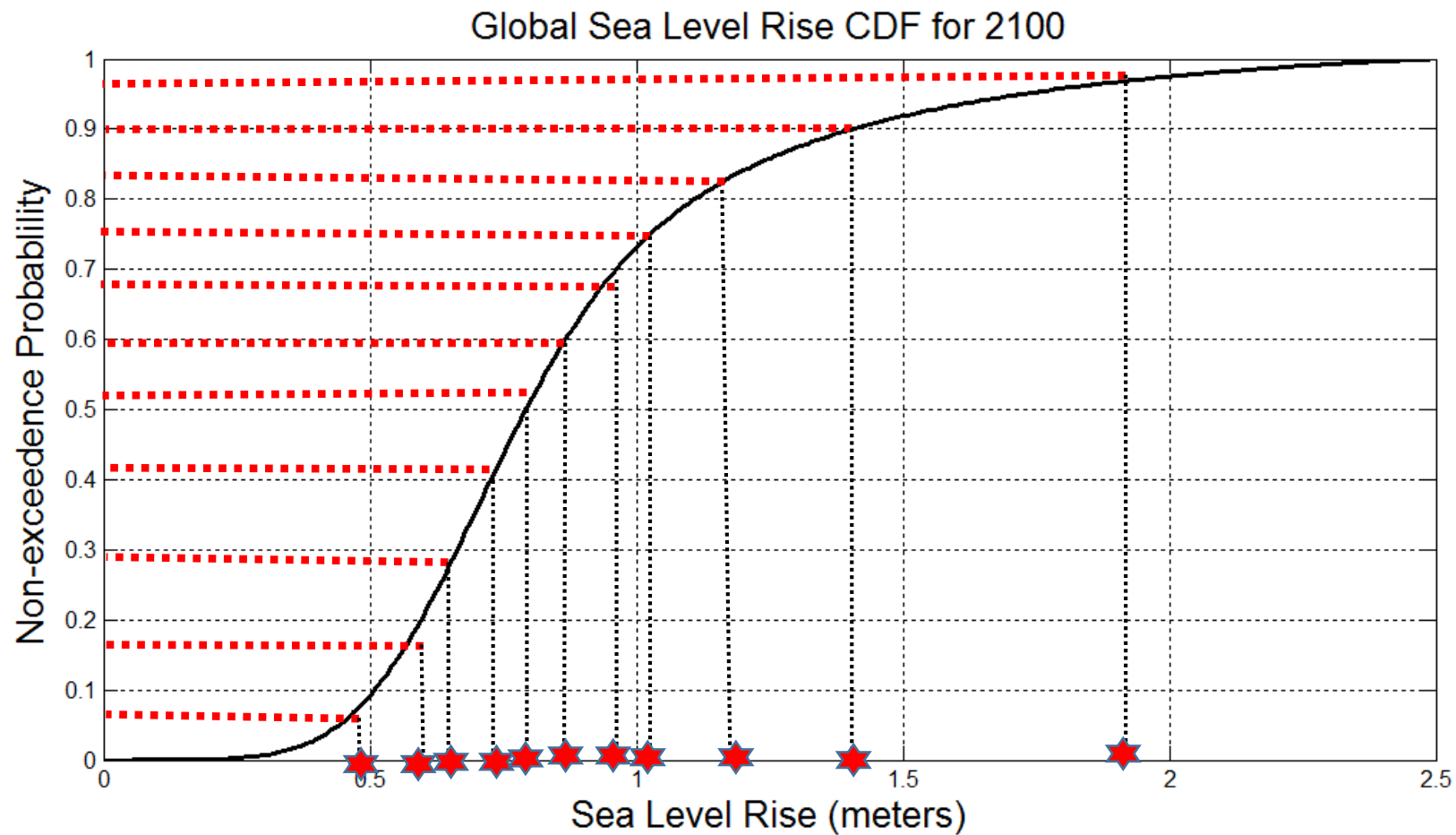
Localized, State-of-the-Science, Probabilistic Guidance:

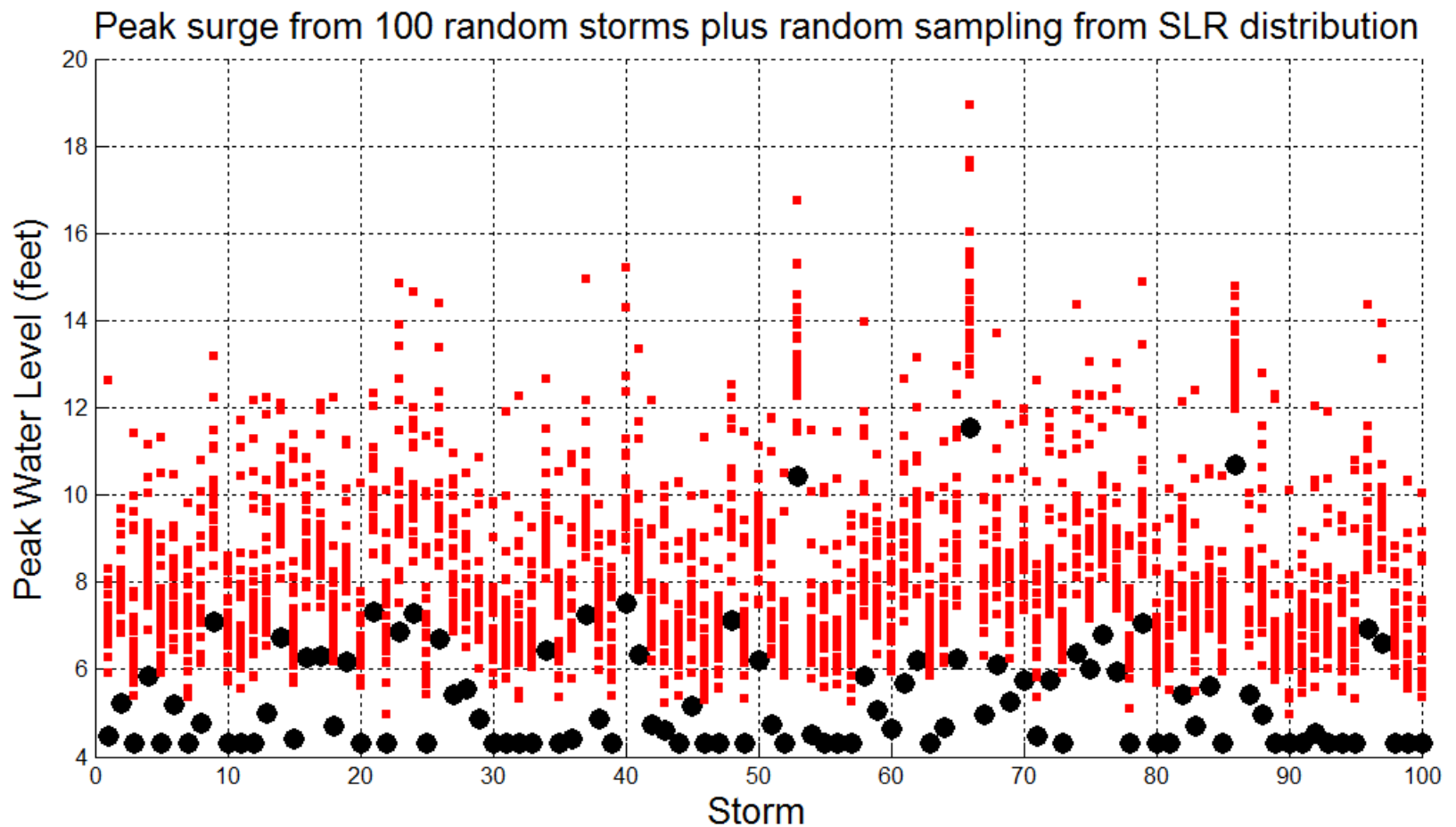


Data From:

Kopp, R. E., R. M. Horton, C. M. Little, J. X. Mitrovica, M. Oppenheimer, D. J. Rasmussen, B. H. Strauss, and C. Tebaldi (2014), Probabilistic 21st and 22nd century sea-level projections at a global network of tide-gauge sites, *Earth's Future*, 2, 383–406, doi:10.1002/2014EF000239.



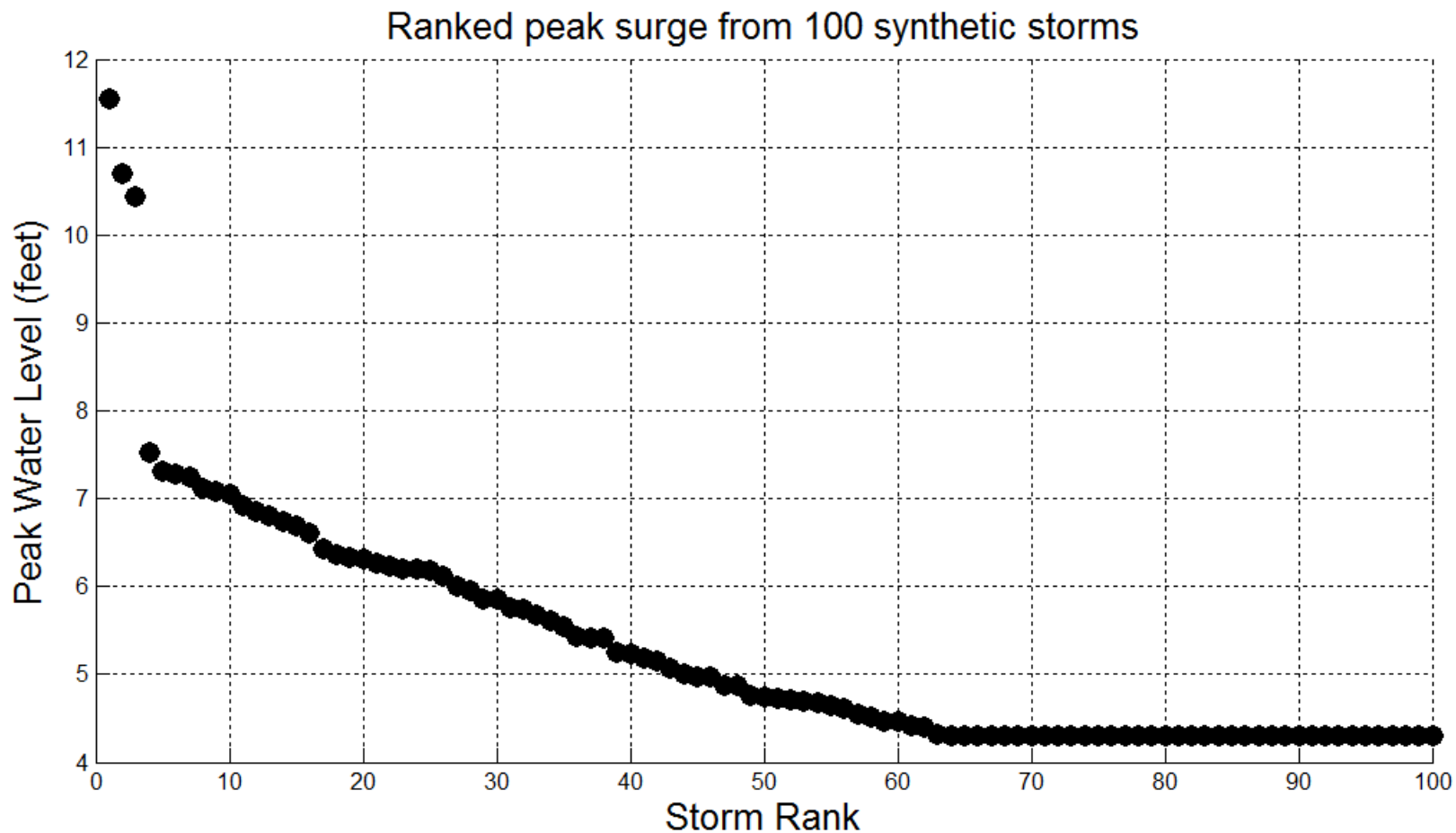




Note: here we may also incorporate distributions for other types of uncertainty (aleatory uncertainty in surge predictions, error estimates for non-linear residuals, etc.)

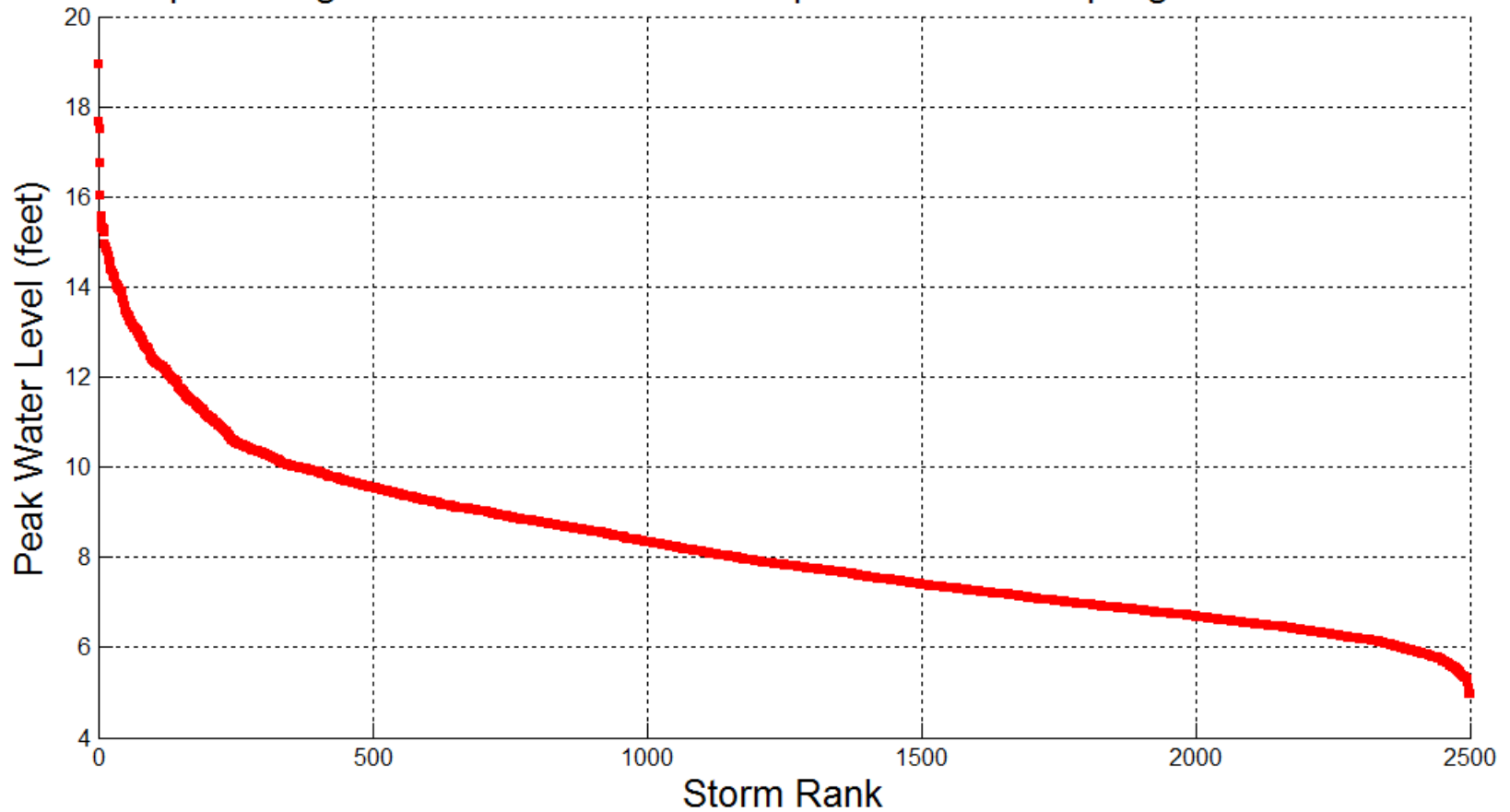
Additional re-sampling is done for a series of years with non-stationary probability distributions for SLR.



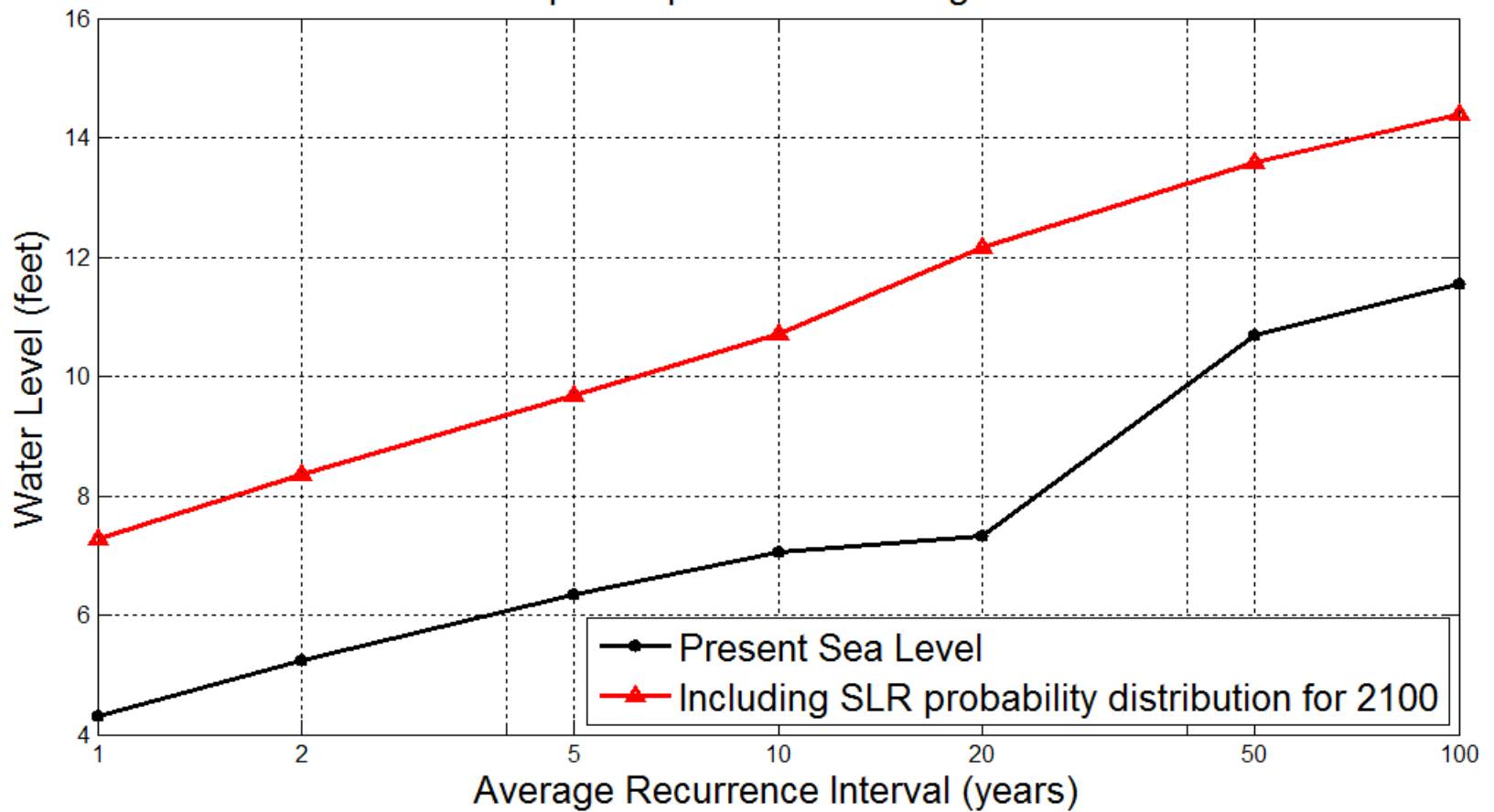




Ranked peak surge from 100 random storms plus random sampling from SLR distribution



Example Empirical Storm Surge CDFs





Thank You!

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Town of **Islesboro**
Maine

