

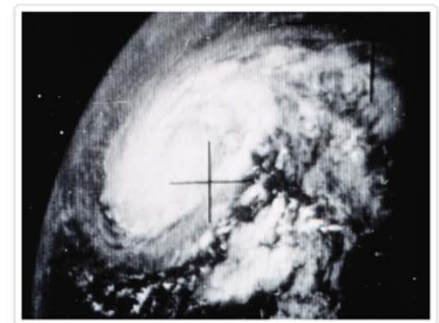


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A Conversation on our Changing Climate and Its Impacts on River and Coastal Flooding

David R. Vallee
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Religious Experience:

Record floods in my hometown of West Warwick – March 2010



Record flooding on the Pawtuxet River, West Warwick, RI – 10 am March 31st, 2010. Photo: D. Vallee/NWS



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Our conversation will cover:

- An overview of our changing climate
 - Rainfall/Temperature trends & the impacts on river flooding
 - Sea Level Rise and ramifications on coastal flood potential
- The challenges before us
 - A look at a few best practices to stem the tide of flooding
- Some new tools to help us



The latest Science: A warming planet and shrinking Arctic Sea ice



This graph shows the average area covered by sea ice during September each year. Minimum sea ice extent has decreased 12% per decade since 1979. Reference: Fourth National Climate Assessment <https://nca2018.globalchange.gov/chapter/1/#fig-1-2>

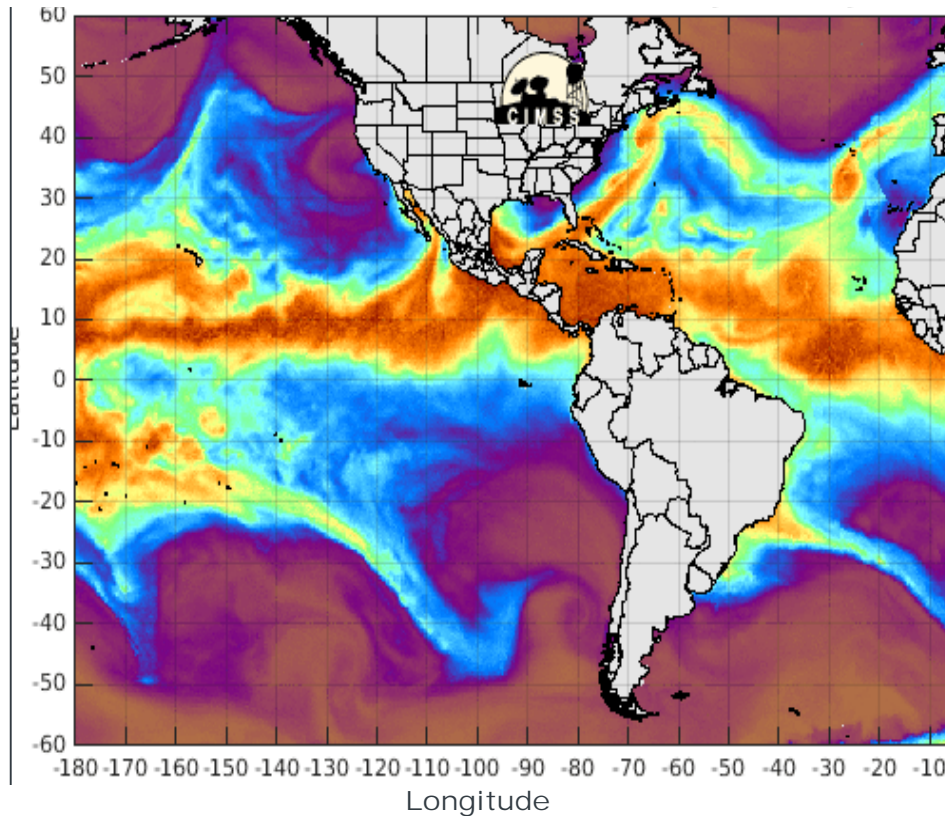


Loop of September Summer Minimum Ice Extent from 1984 through 2016. Note the steady decrease in coverage. Reference: Fourth National Climate Assessment. <https://nca2018.globalchange.gov/chapter/2/#key-message-7>



Is there a common theme to recent floods?

Composite loop of Atmospheric Water Vapor – 10/12/2018

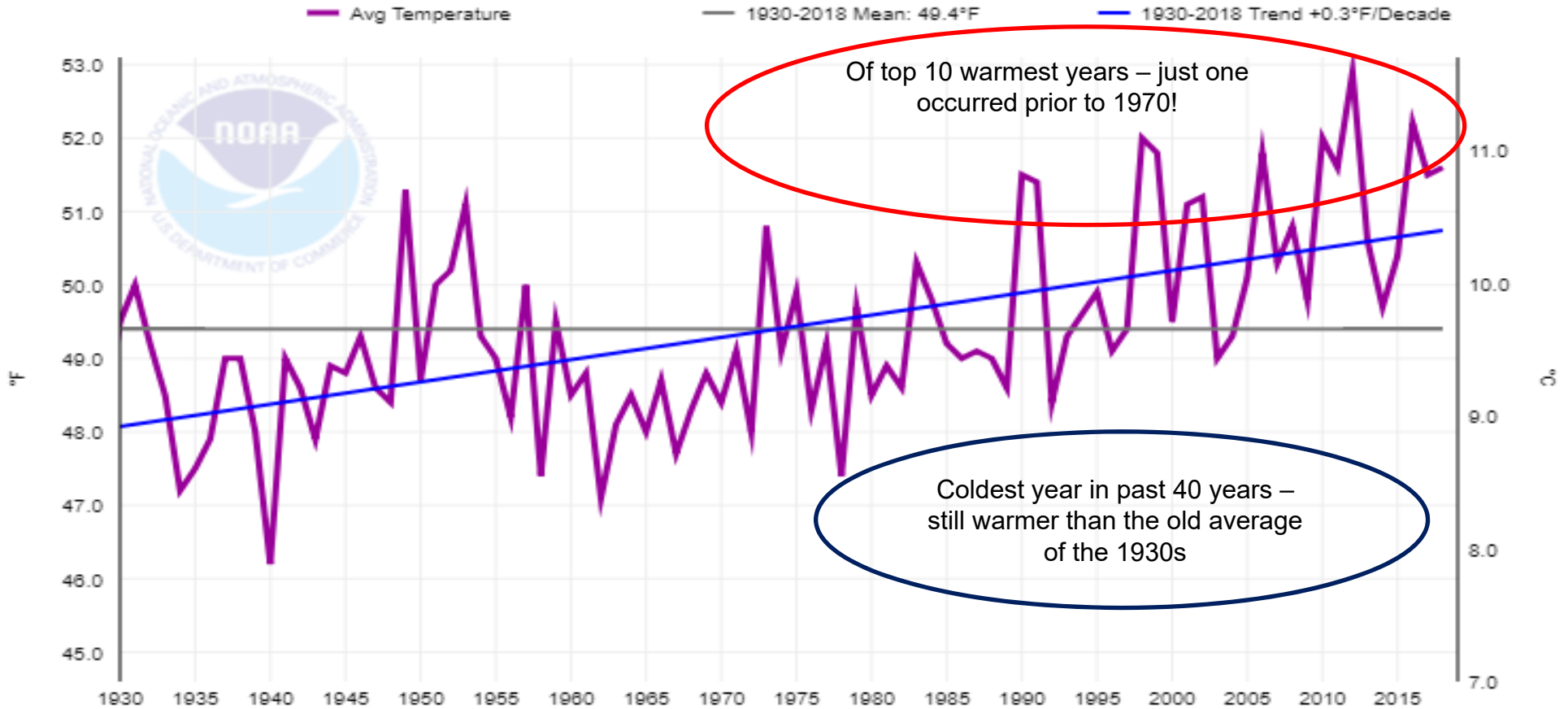


Several:

- Slow moving weather systems – a blocked up atmosphere
 - Related to loss of arctic ice cover
 - Multiple events in close succession or one big slow moving storm
- Results in saturated antecedent conditions before the “main event”
- Each fed by a “tropical connection”
 - Plumes of deep moisture
 - High moisture values are reaching our latitude more frequently



A Look at Rhode Island Annual Precipitation Trends



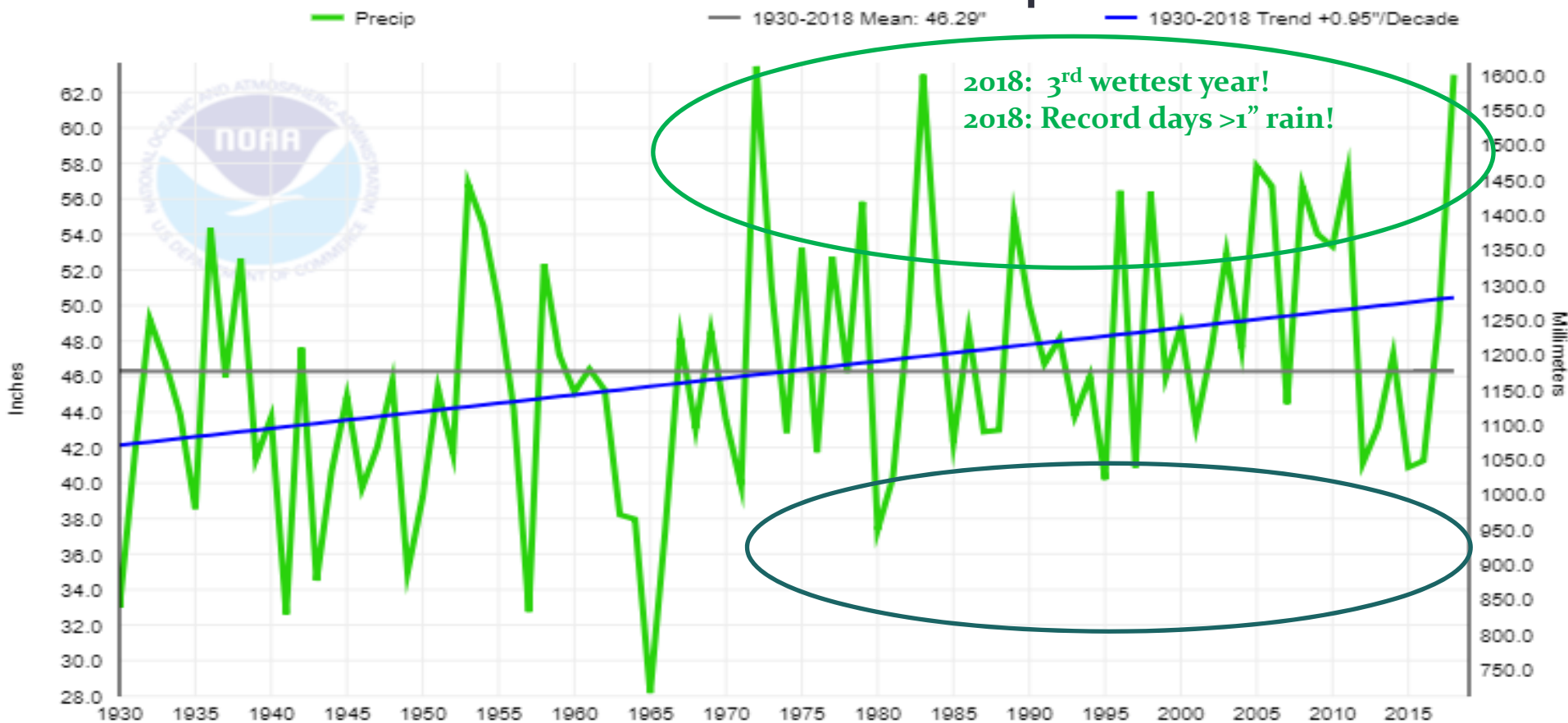
<http://www.ncdc.noaa.gov/cag>



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A Look at Rhode Island Annual Precipitation Trends

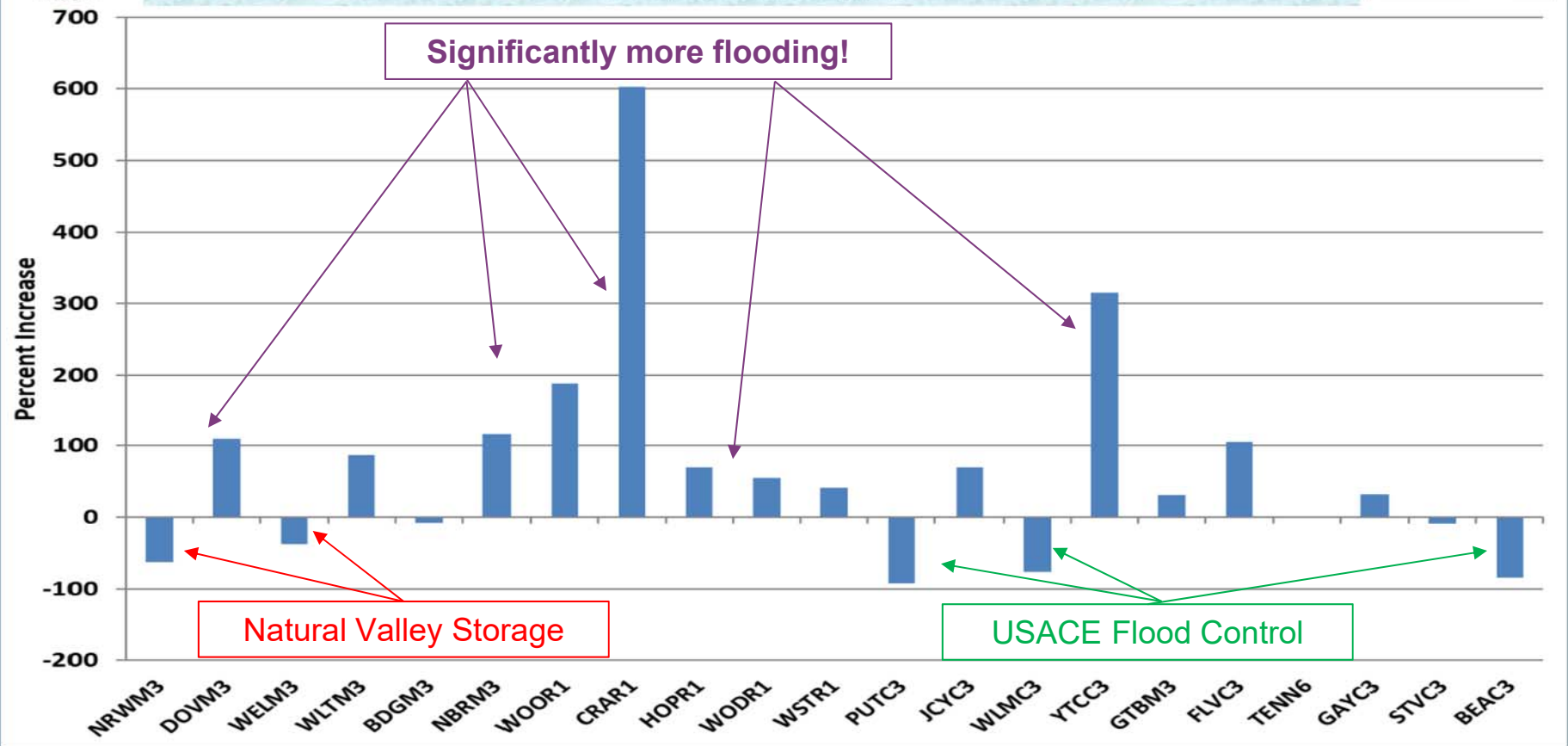


<http://www.ncdc.noaa.gov/cag>



Southern New England River Basin Percent Increase in Flooding Pre 1970 vs. 1970+

Data provided by
USGS
science for a changing world





Record Flash Flooding from 5-7 inches of rain. Westport, CT September 25th, 2018. Photo: Westport Fire Department



St-Jean-sur-Richelieu, Quebec, Canada, 5/6/11 Photo: AP//Canadian Press, R. Remoiz



Warwick Mall overtaken by the Pawtuxet River - Warwick, RI at 1030 am Wednesday 3/31/10. Photo: RI ANG



Record flooding in Dolgeville, NY on West Canada Creek, November 1st, 2019. Source: D. McGee, Office of the Governor

Moving to the coast: Sea Level Rise

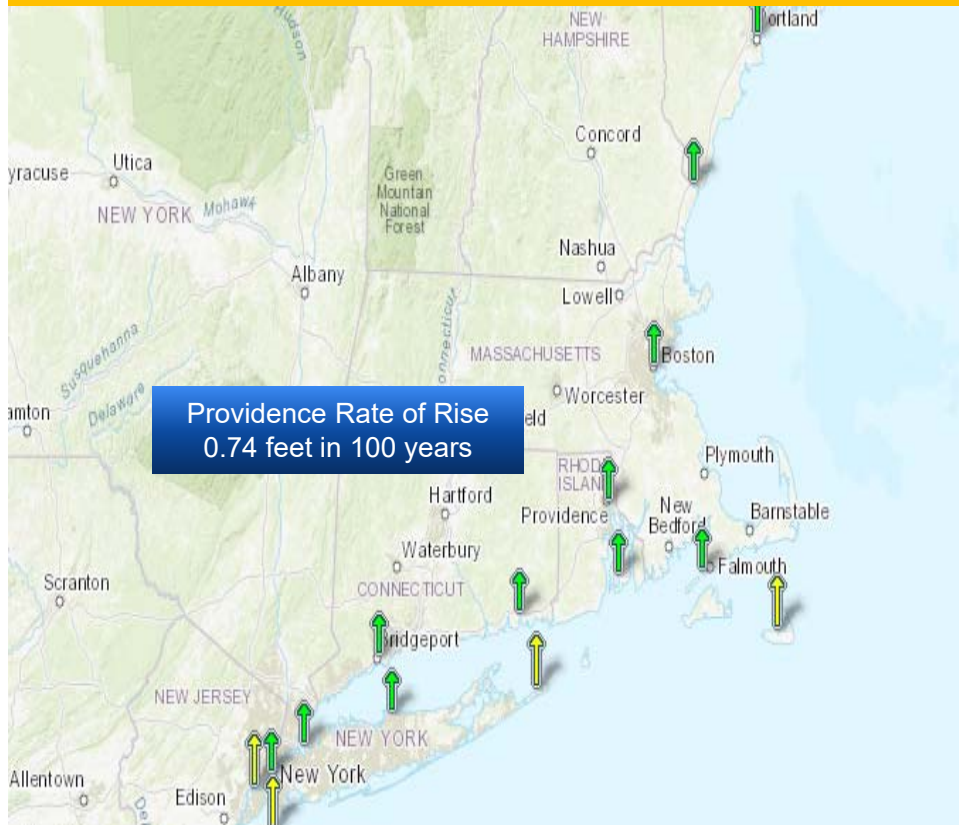
Increasing high tide flood events



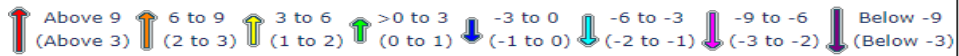
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<http://tidesandcurrents.noaa.gov/sltrends/index.shtml>

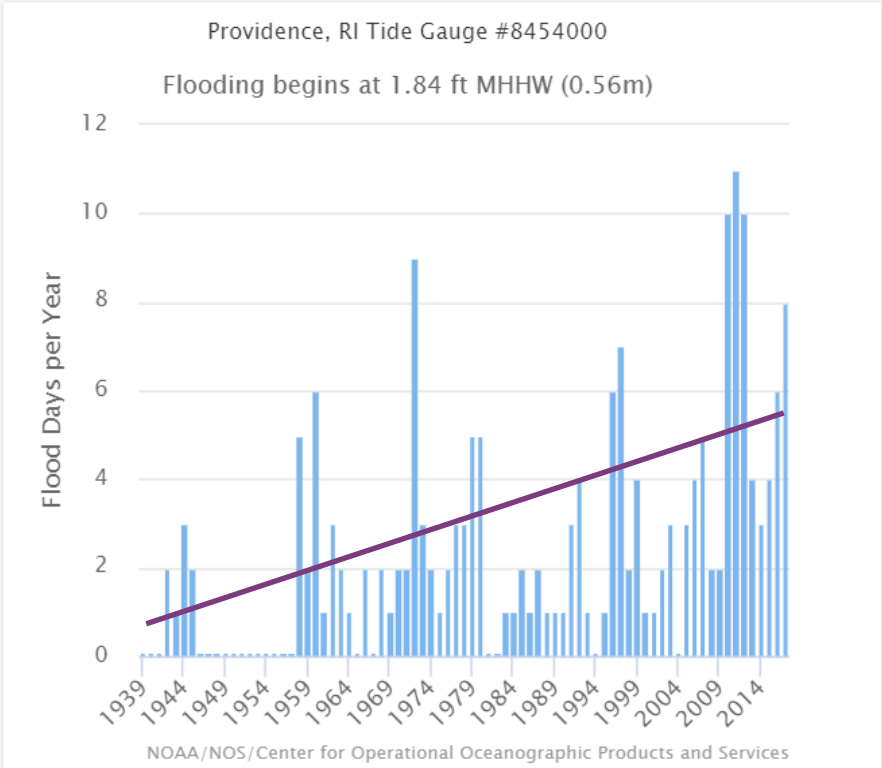


Relative Sea Level Trends
mm/yr (feet/century)



High Tide Flooding

Historical Yearly Inundation Events

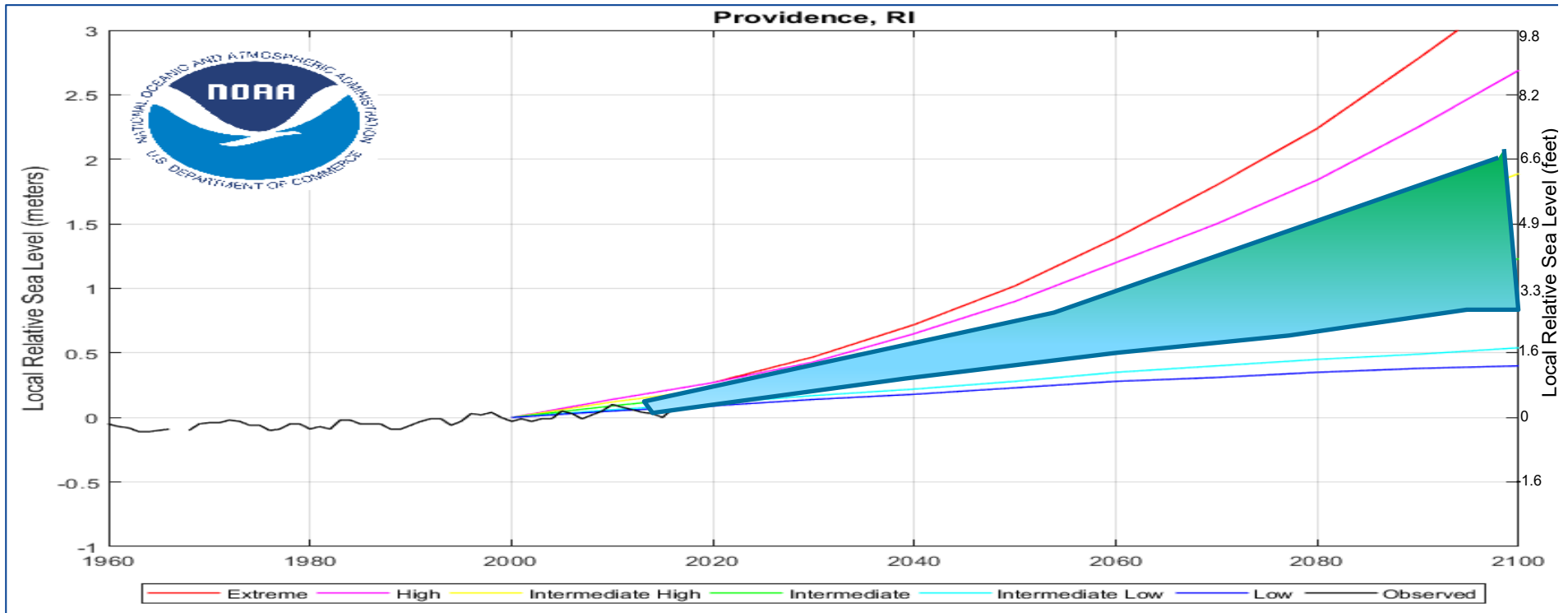


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Annual Mean Relative Sea Level since 1960

with various regional emissions scenarios



https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?plot=scenario&id=8454000



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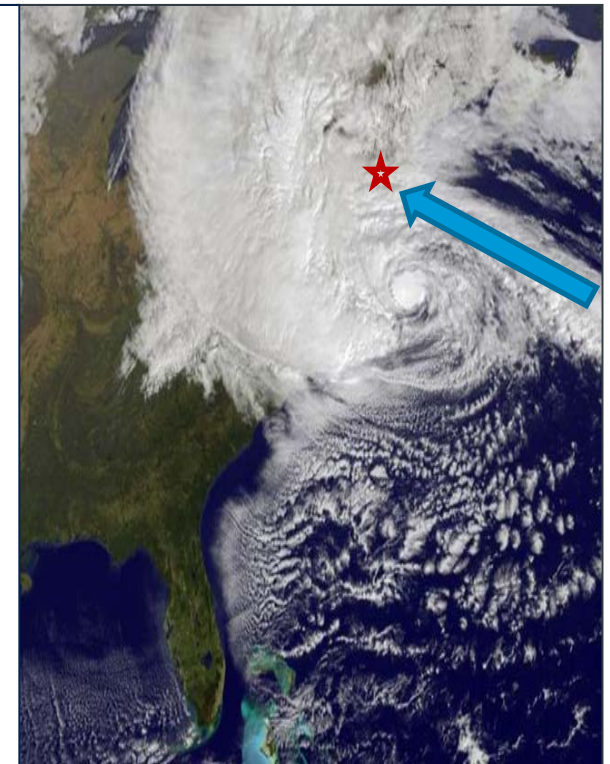
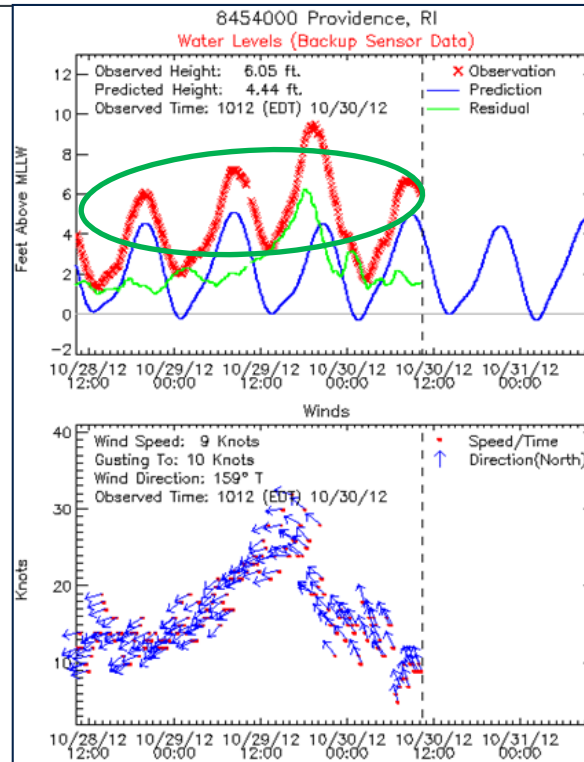
Sandy's Setup:

Long Duration Southeast Fetch

Damaging Waves, Multiple Tide Cycles & a 4-5 ft Storm Surge

Swells built on 2 days of southeast winds were driven right into the south coast of RI

- Impacted Multiple Tide Cycles – worst of which was Monday night
- 15-30 foot seas resulted in relentless pounding surf which first weakened then obliterated the 6-10 foot dunes along parts of the coast
- Storm surge of 4-5 feet atop a “middle-of-the-road” astronomical tide produce a total water level (storm tide) of 9.6 feet; One foot shy of Hurricane Bob in '91
- What she lacked in intensity she made up for in duration!



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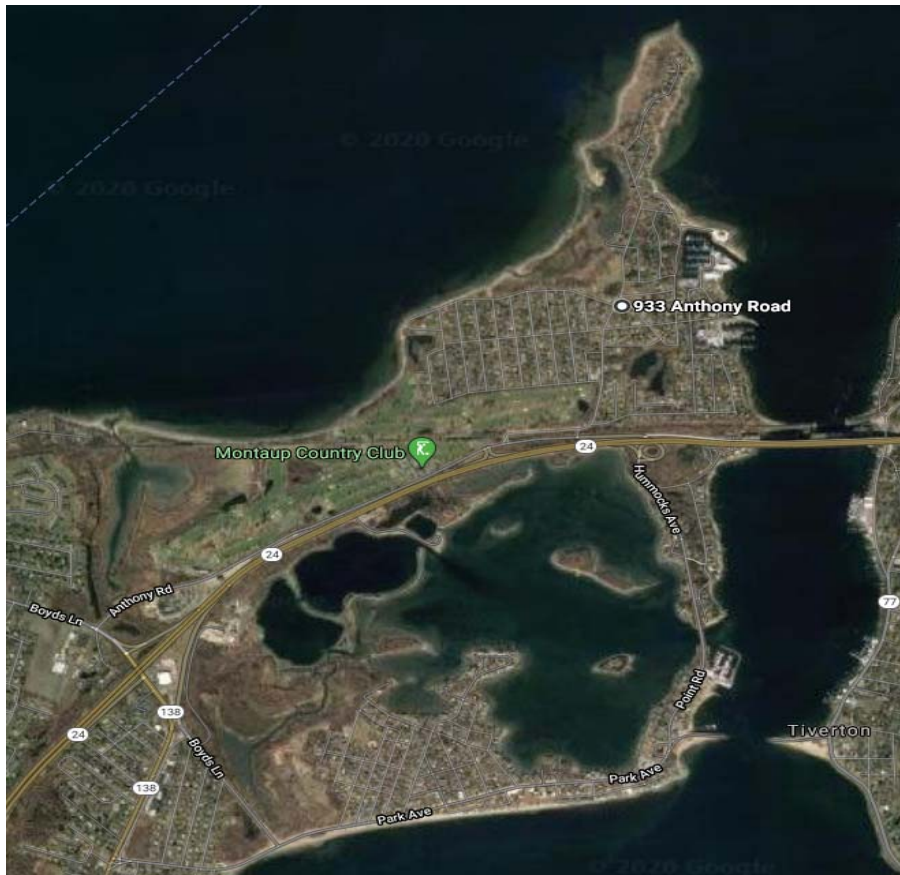
SANDY'S DESTRUCTIVE POWER



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Vulnerability in Portsmouth



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Practices that are working to mitigate losses due to heavy rains, flooding, and storm surge



Natural valley storage



Building for the new normal



Elevate & Evacuate!



Setbacks & Elevating critical systems



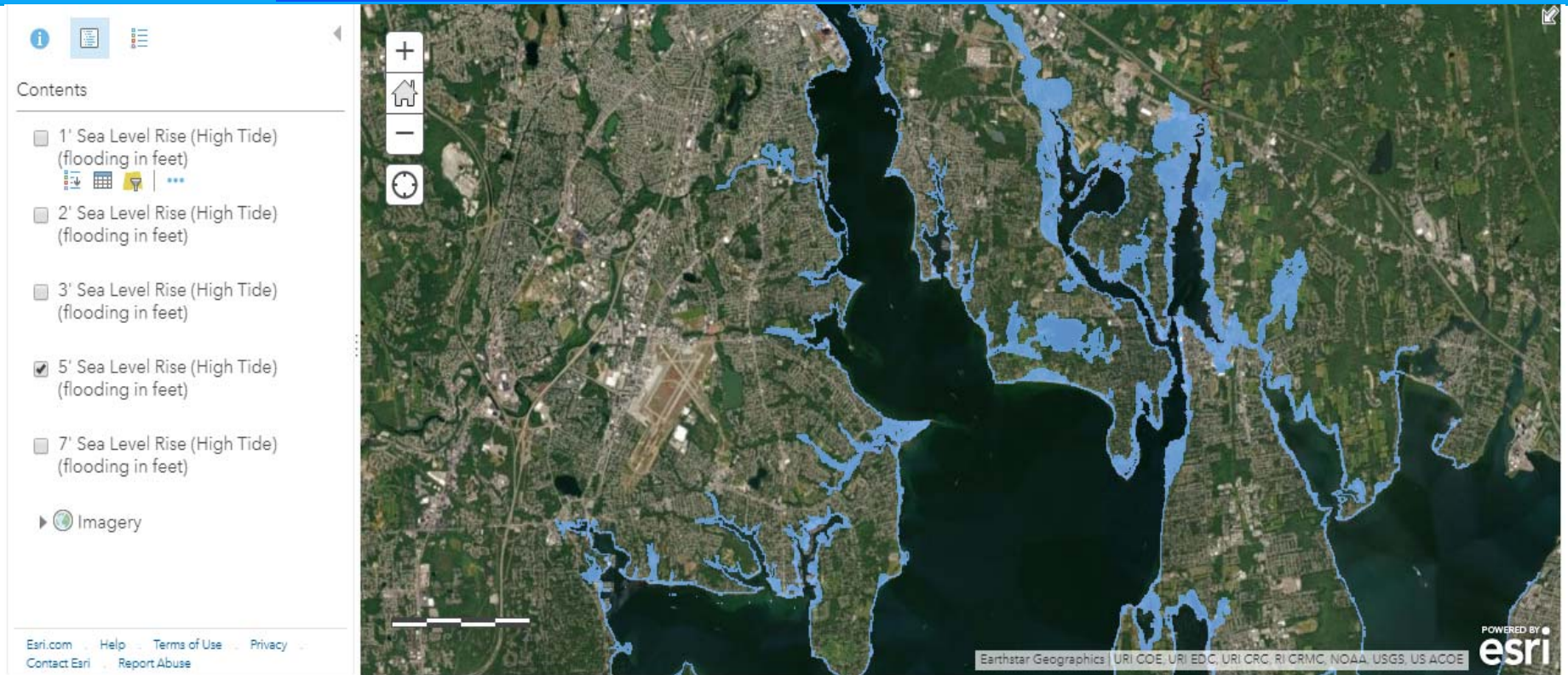
Bioswales & Porous Pavement



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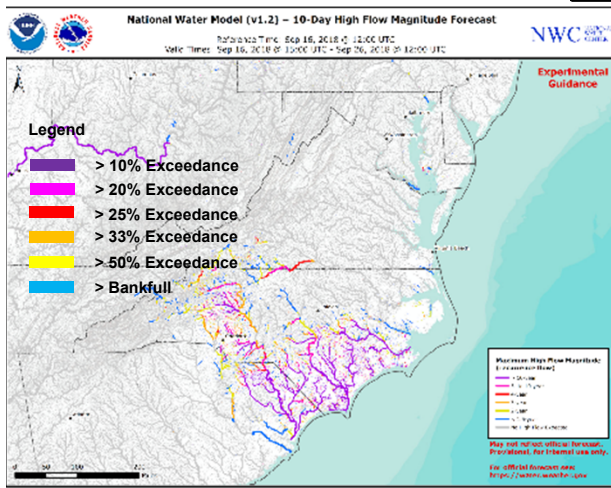
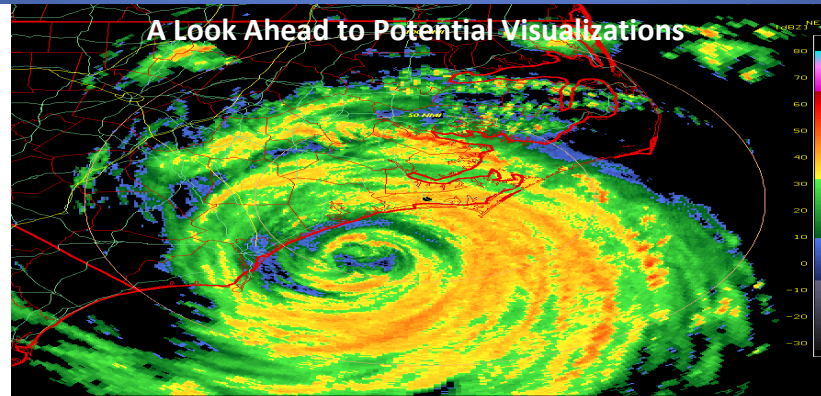
<https://uri.maps.arcgis.com/home/webmap/viewer.html?useExisting=1>
<http://www.beachsamp.org/stormtools/stormtools-map-gallery/>
<http://sealevel.climatecentral.org/>
<http://www.riema.ri.gov/resources/citizens/prepare/evacuation.php>



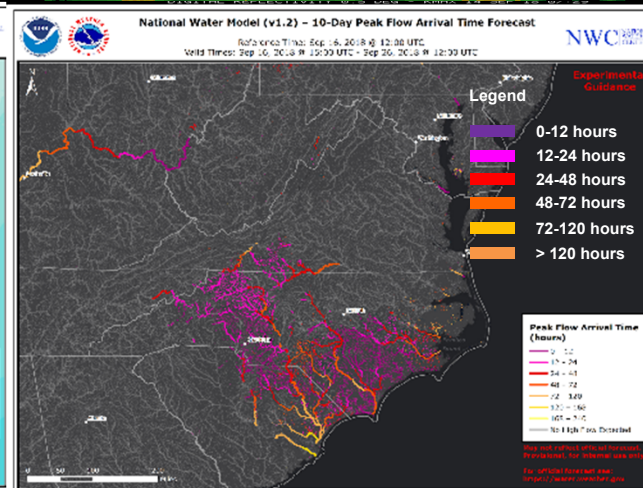
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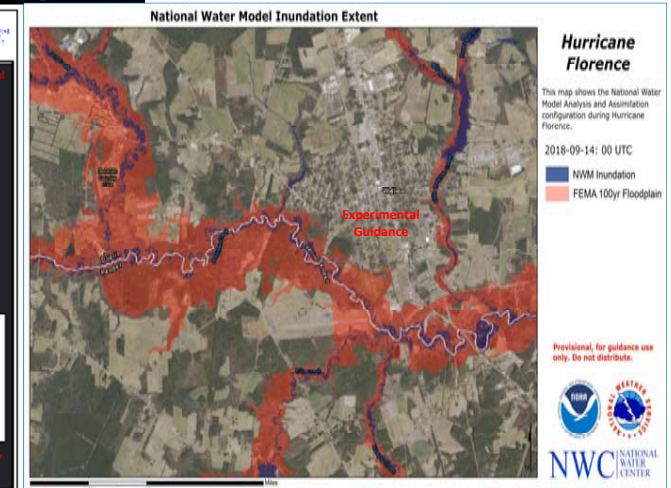
Developing Real-time Flood Inundation Mapping



10-Day High Flow Magnitude



10-Day High Flow Arrival Time



Flood Inundation - Area Extent - Florence

Where is the event? When will it occur? How likely is it?

For More Information, Click on the links below:

<http://www.beachsamp.org/stormtools/stormtools-map-gallery/>

<http://sealevel.climatecentral.org/>

<http://www.riema.ri.gov//resources/citizens/prepare/evacuation.php>



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