

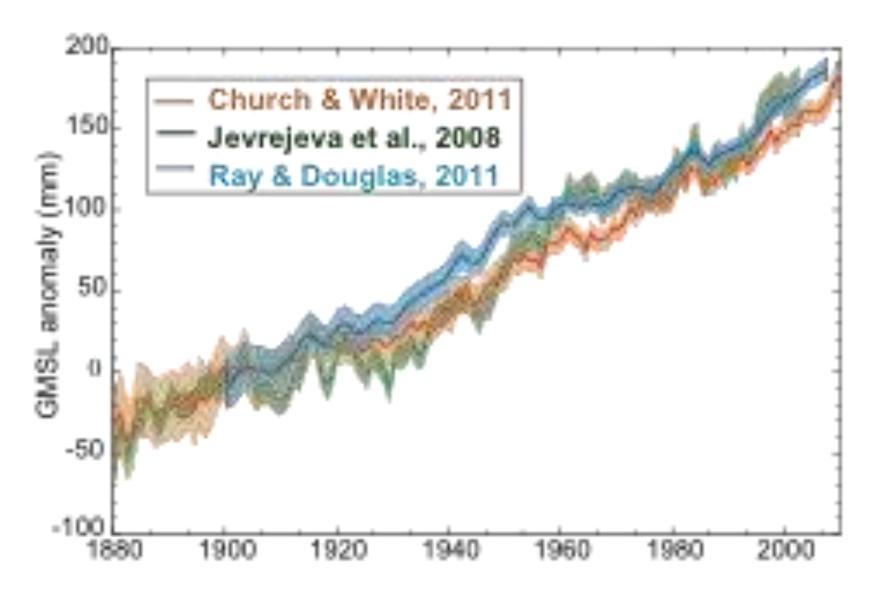
Threats from Sea-Level Rise: Present, Future, Likely and Inevitable



UF Water Institute Symposium February 11, 2014

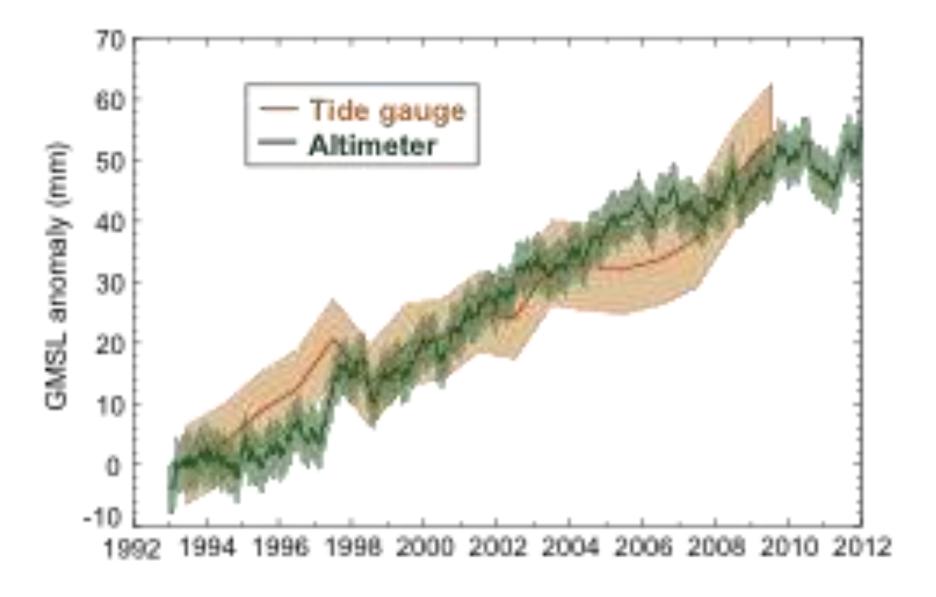
Ben Strauss
VP for Climate Impacts and
Director of the Program on Sea Level Rise
Climate Central
sealevel.climatecentral.org

Past



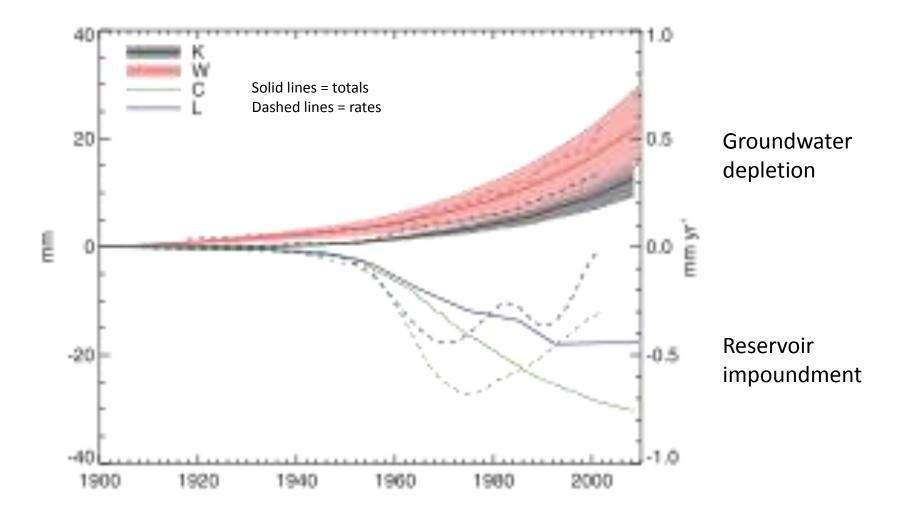
Source: IPCC WG1 AR5 ch. 3 (Rhein et al 2013)





Source: IPCC WG1 AR5 ch. 3 (Rhein et al 2013)

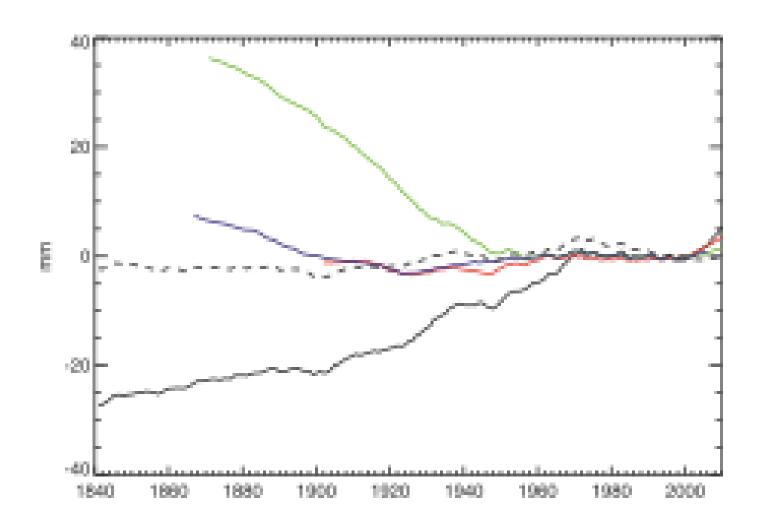




Source: after Gregory et al 2013, Journal of Climate

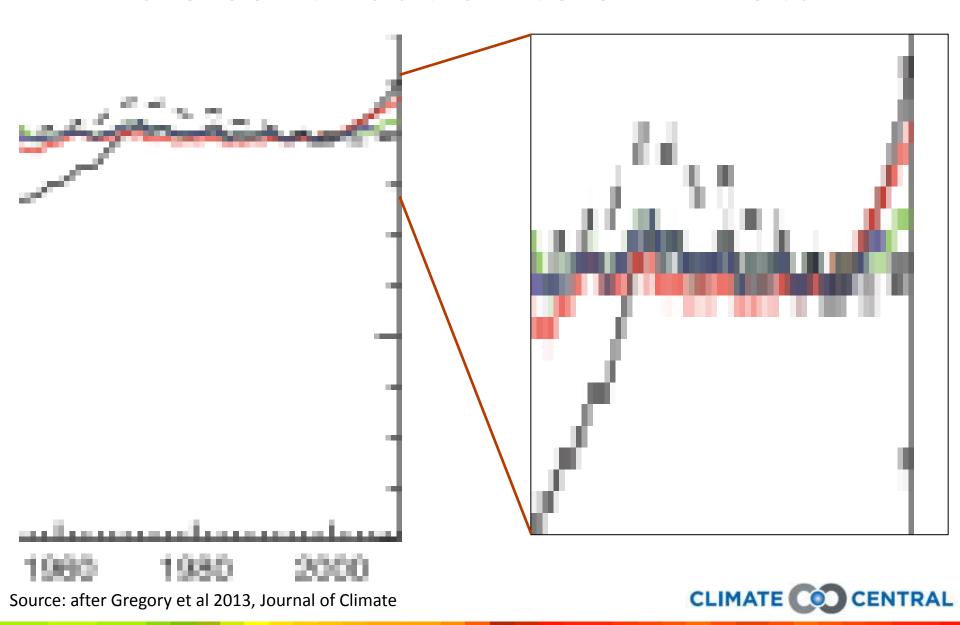


GIS contribution to SLR - Total

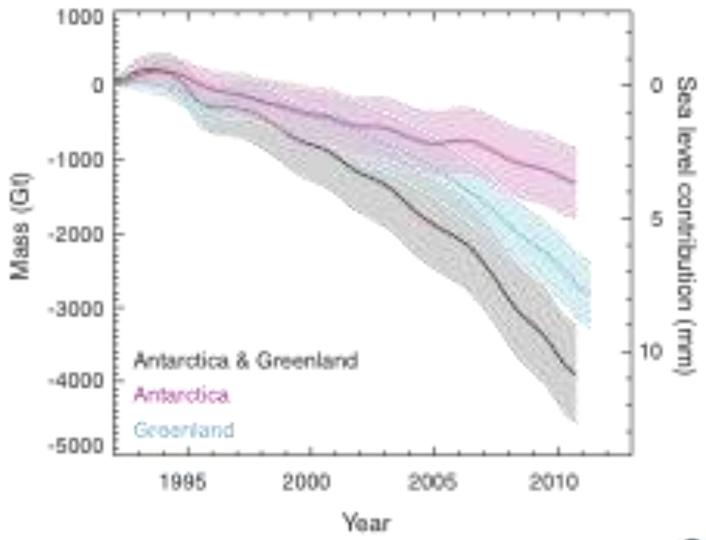




GIS contribution to SLR - Total



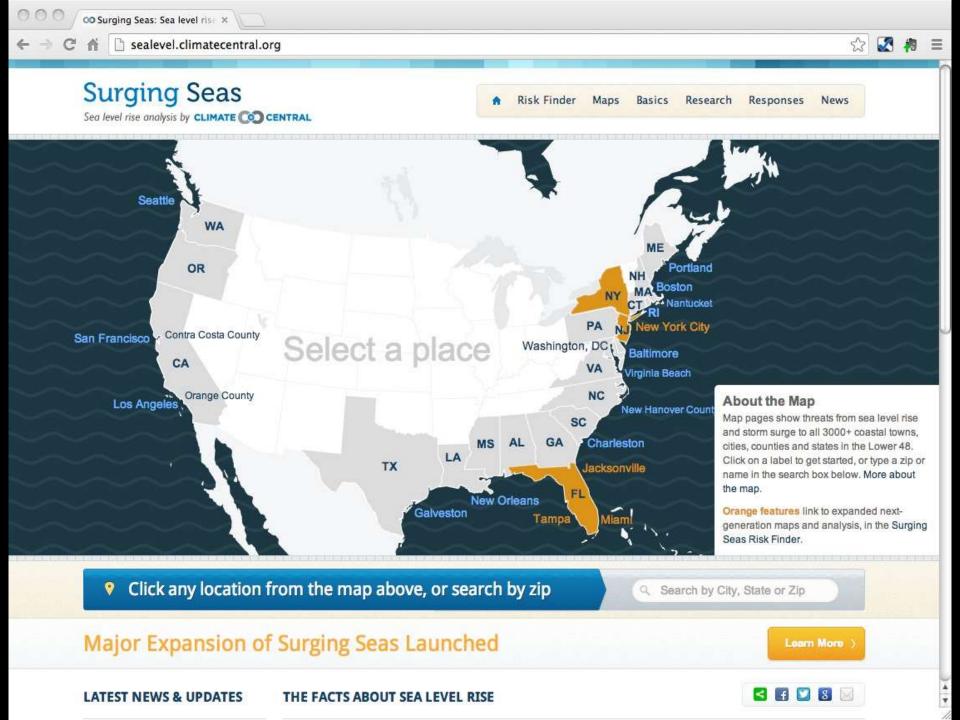
Reconciled ice sheet mass balance

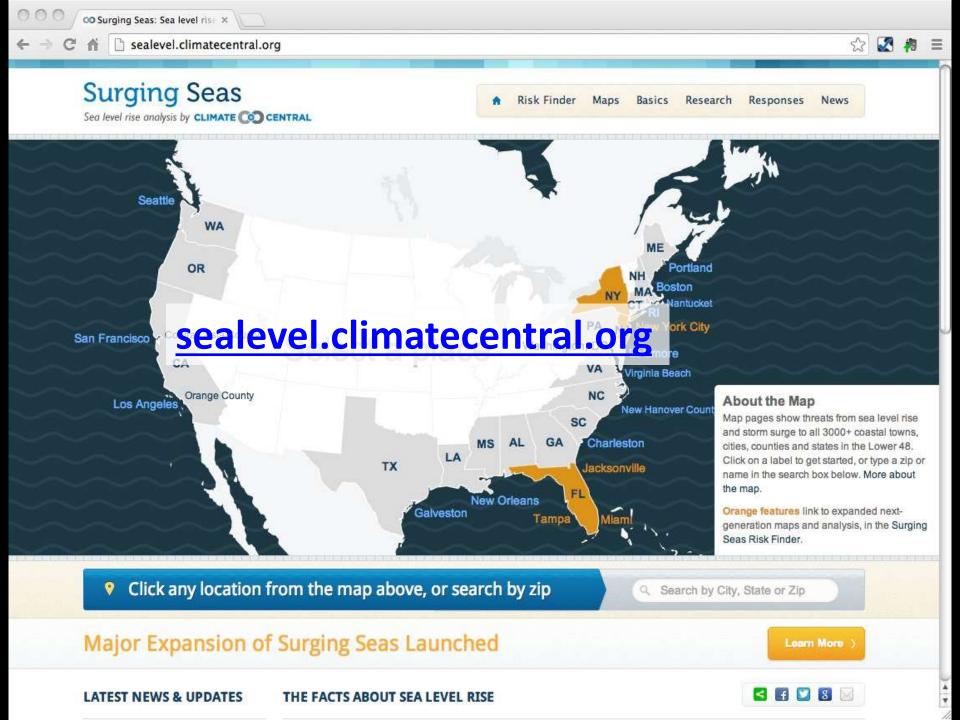


Source: Shepherd et al 2012, Science



Present







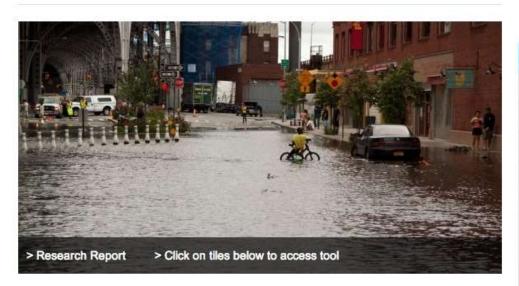


Sea level rise analysis by CLIMATE CO CENTRAL

sealevel.climatecentral.org/ssrf/new-york



Sea Level Rise & Flood Threats in New York

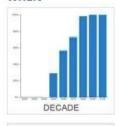


WHERE



Place name or zip

WHEN



Place name or zip

WHAT



Place name or zip

COMPARE



Category

Jump to Another State

Surging Seas Version 1: All States

RELATED RESILIENCY RESOURCES

The City of New York: PlaNYC

NYC Special Initiative for Rebuilding and Resiliency

NYS: NY Emergency Preparedness Commission

NYS 2100 Commission: Recommendations to Improve the Strength and Resilience of the Empire State's Infrastructure

NYS: New York Rising Community Reconstruction Program

NYSERDA: Response to Climate Change in New York

Scenic Hudson: Sea Level Rise Mapper

NOAA: Sea Level Rise, Coastal Flooding Impacts Viewer





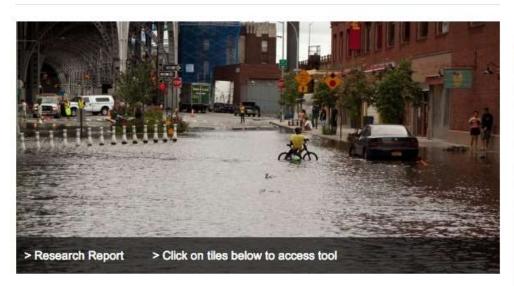




Sea level rise analysis by CLIMATE (CO) CENTRAL

Risk Finder Maps Basics Research Responses News

Sea Level Rise & Flood Threats in New York

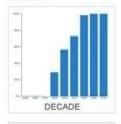


WHERE

Searchable interactive map

Place name or zip

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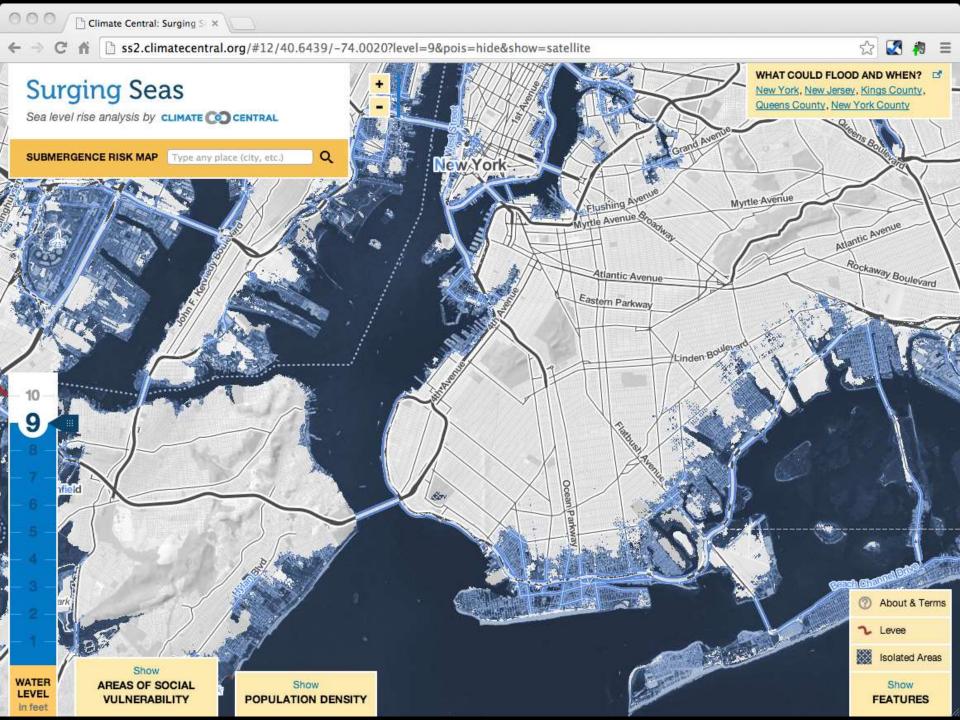
NYS 2100 Commission: Recommendations to Improve the Strength and Resilience of the Empire State's Infrastructure

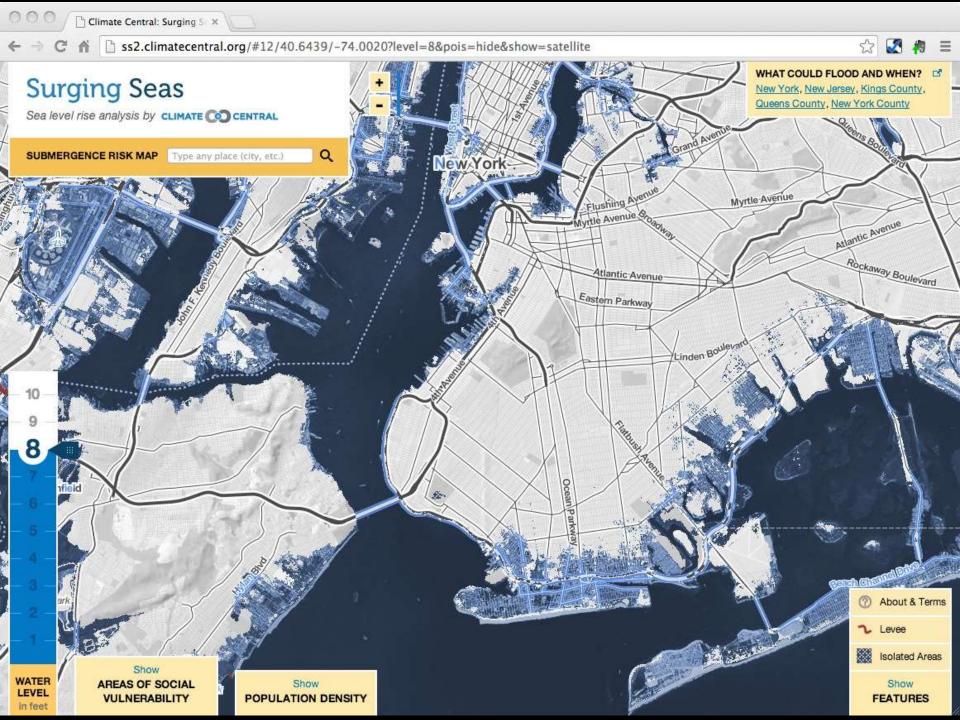
NYS: New York Rising Community Reconstruction Program

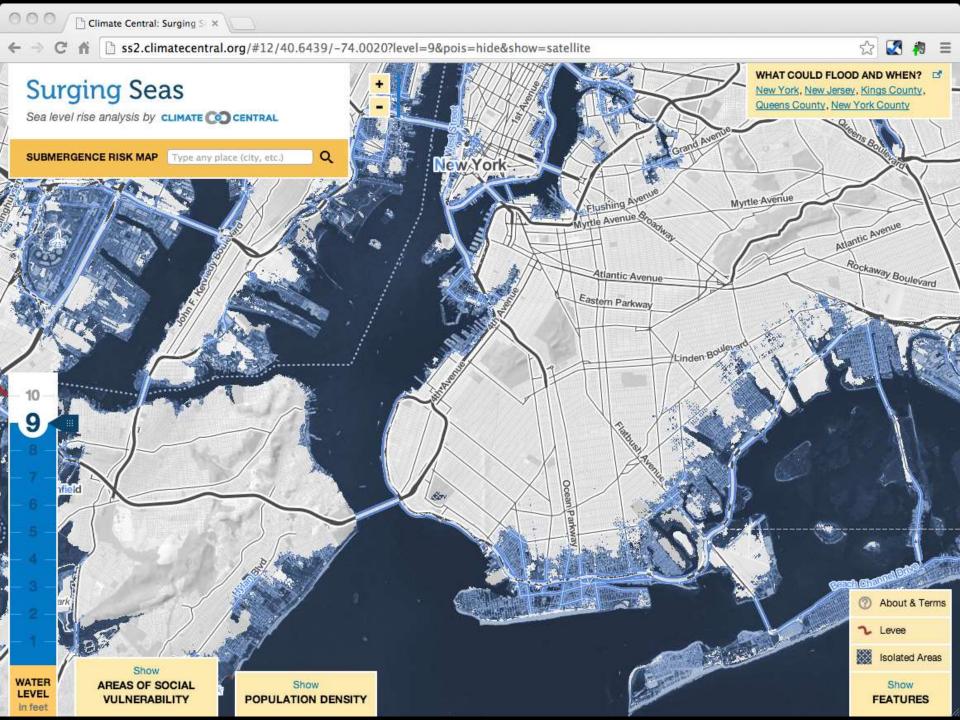
NYSERDA: Response to Climate Change in New York State

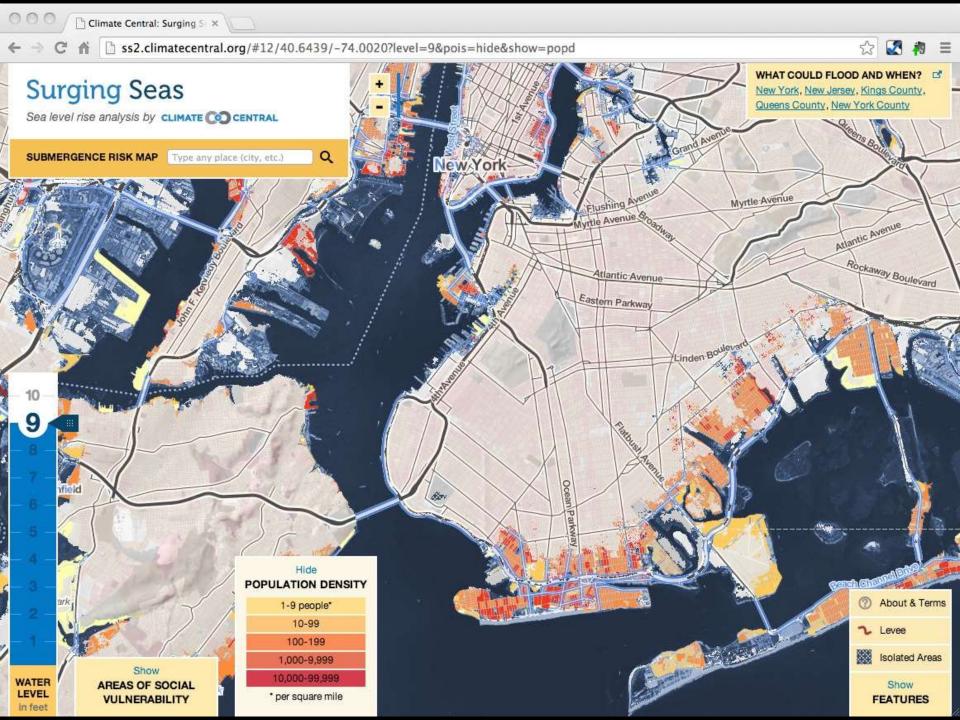
Scenic Hudson: Sea Level Rise Mapper

NOAA: Sea Level Rise, Coastal Flooding Impacts Viewer











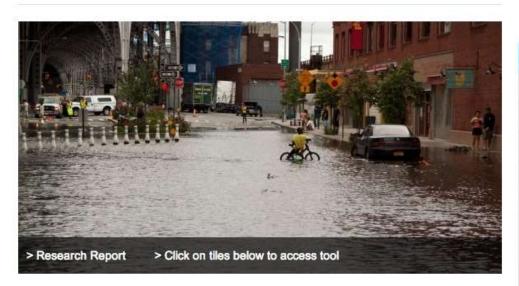




Sea level rise analysis by CLIMATE CO CENTRAL



Sea Level Rise & Flood Threats in New York

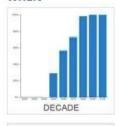


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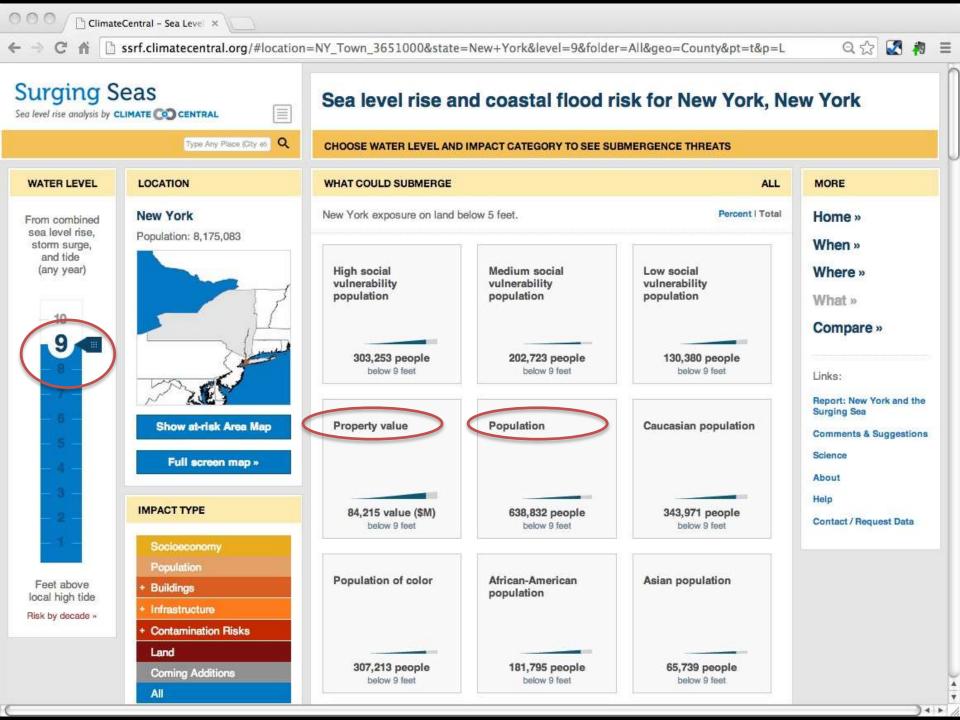
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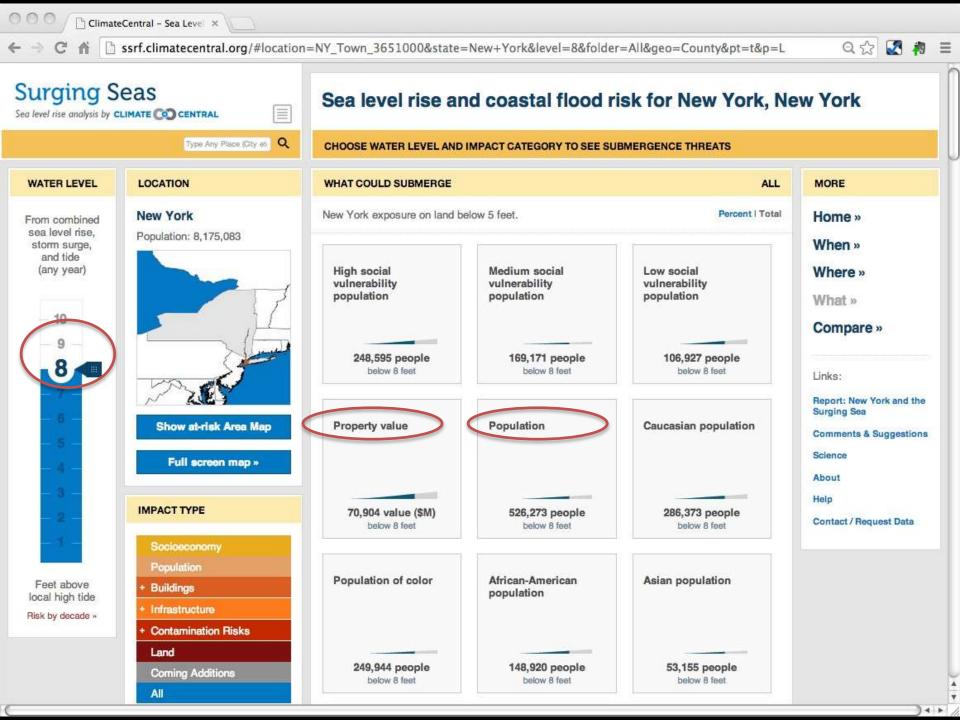
NYS: New York Rising Community Reconstruction Program

NYSERDA: Response to Climate Change in New York

Scenic Hudson: Sea Level Rise Mapper

NOAA: Sea Level Rise, Coastal Flooding Impacts Viewer





The Difference 8 Inches Make: NYC

• Land area: 13 km²

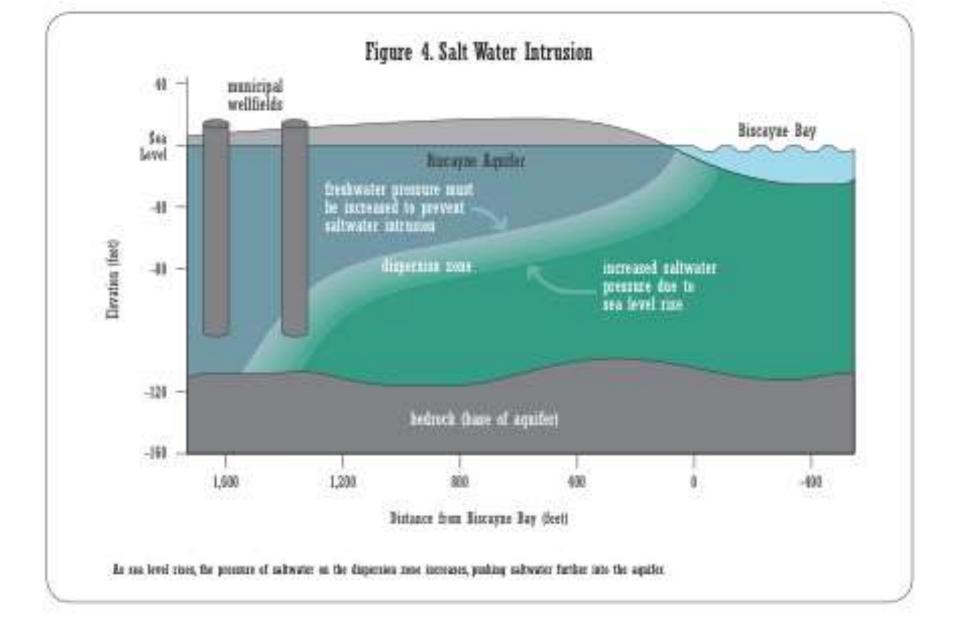
• Population: 75,000

Property value: \$8.9 Billion

Values estimated as 2/3 of the differences across 9-8 ft















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South Florida drinking water faces saltwater threat

Climate change could increase 'saltwater intrusion'

September 12, 2011 | By Andy Reid, Sun Sentinel

Summer rains can't wash away a growing underground threat to South Florida's water supply.

Saltwater seeping in from the ocean keeps spreading farther west, threatening to foul underground freshwater supplies that provide most of South Florida's drinking water.

Six of the eight wells that Hallandale Beach relies on have been closed through the years due to saltwater intrusion.

That's because 85 percent of the city is within the area where saltwater has seeped in, Castro said. As a result, the city pays to get half of its water from Broward County's western well fields and is working on a deal for new western wells of its own.

Hallandale Beach proposes building six new wells and new water lines in West Park for about \$10 million. Operating them over 40 years would cost about \$36 million, Castro said.





"Sometimes we cannot open the gates because if you open it, the water would come back" – Jayantha Obeysekera, SFWMD

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Miami Beach Luxury Real Estate From Modern to Mediterranean

ROLLOVER FOR INFO

Posted on Tuesday, 09.04.12



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ENVIRONMENT

Rising sea comes at a cost for South Florida cities Flike 17

A proposed \$206 million overhaul of Miami Beach's antiquated drainage system is just the first of many big-ticket bills South Florida faces.

MIAMI BEACH'S PLAN The city of Miami Beach has posted presentations and a video of an August meeting on its storm water management plan can be found here.

BY CURTIS MORGAN CMORGAN@MIAMIHERALD.COM

Climate change may be the subject of debate in some places but in South Florida it's become a costly reality.

In Miami Beach, where prolonged flooding in lowlying neighborhoods has become the norm after

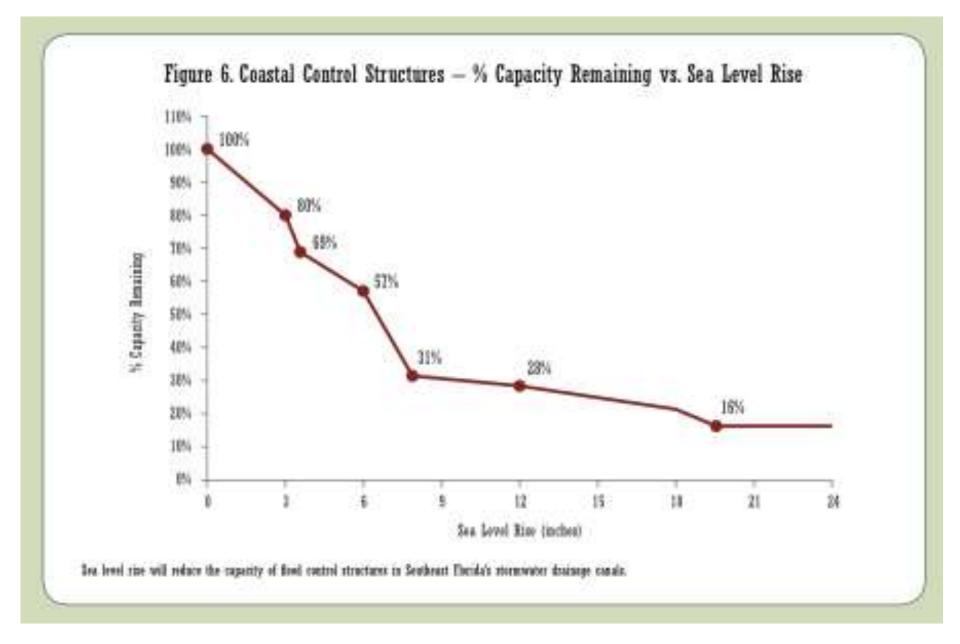
heavy storms, city leaders are weighing a \$206 million overhaul of an antiquated drainage system increasingly compromised by rising sea level.

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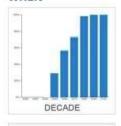


WHERE



Place name or zip

WHEN



Place name or zip

WHAT



Place name or zip

COMPARE



Category

Jump to Another State

Surging Seas Version 1: All States

RELATED RESILIENCY RESOURCES

Southeast Florida Regional Compact Climate Change

The Southeast Florida Regional Partnership (SFRP)

Broward County: Climate Change Action Plan

Miami-Dade County: Miami-Dade Greenprint

Florida Department of Economic Opportunity: State of Florida Community Resiliency Project

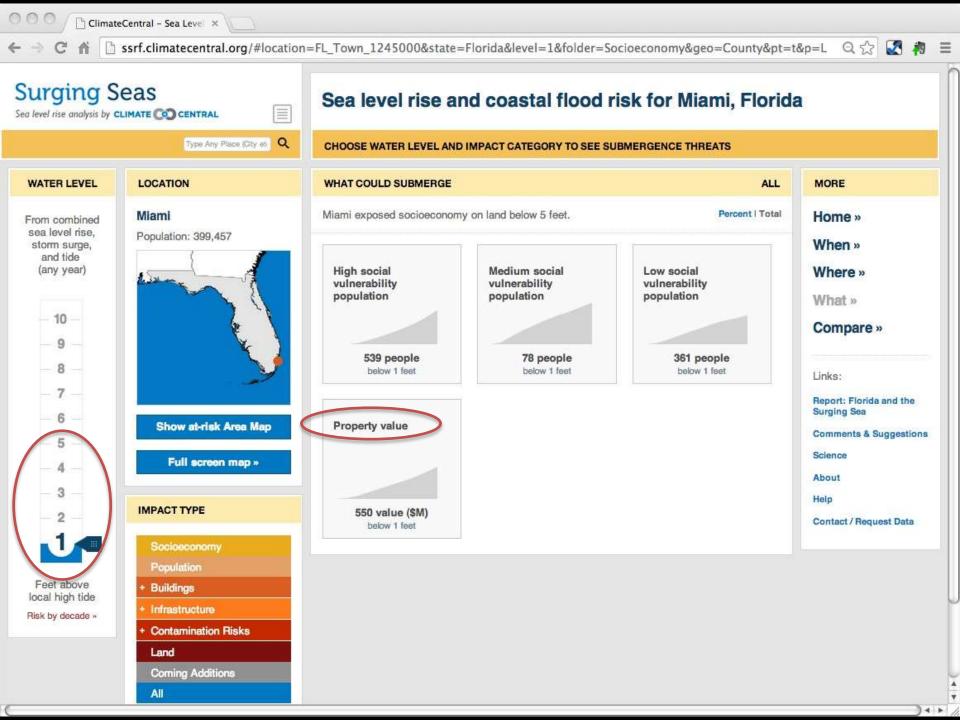
The Florida Center for Environmental Studies (CES)

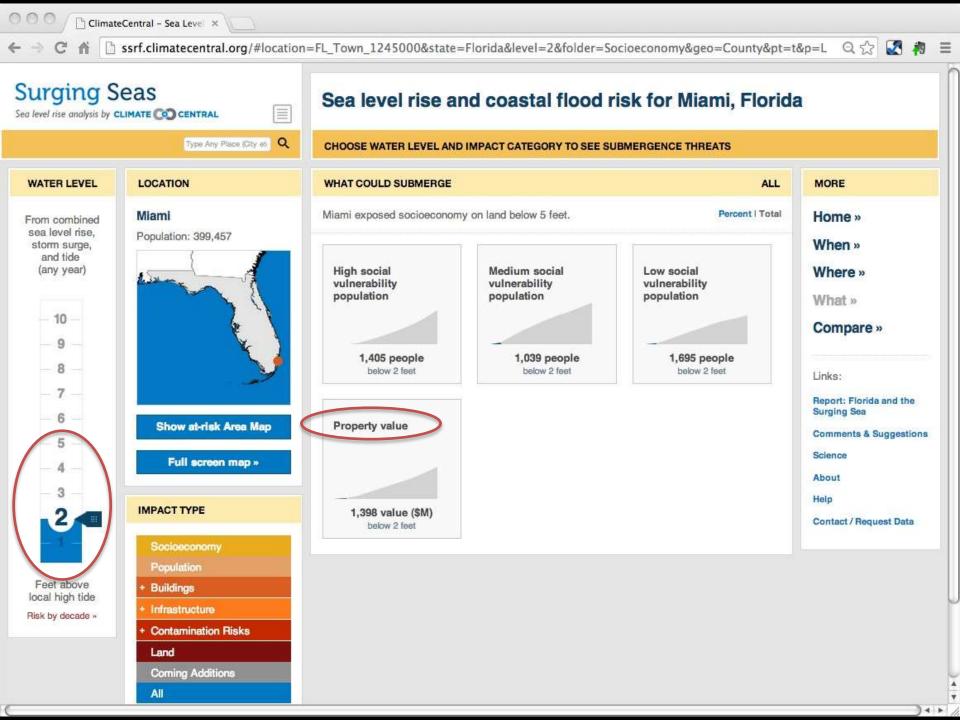
Florida Sea Grant

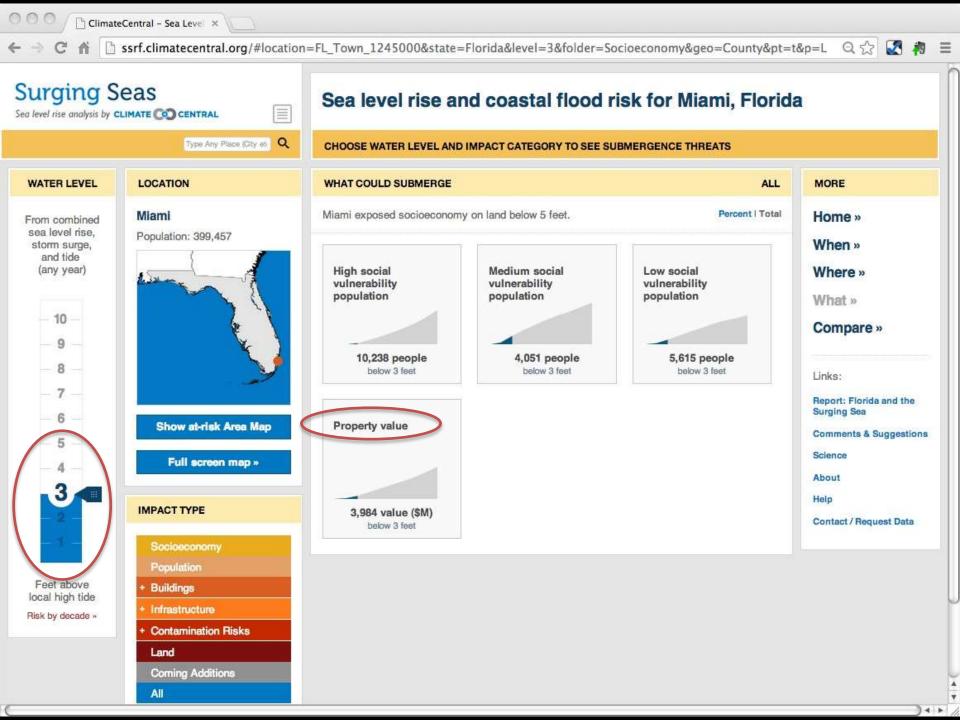
Florida Division of Emergency Management

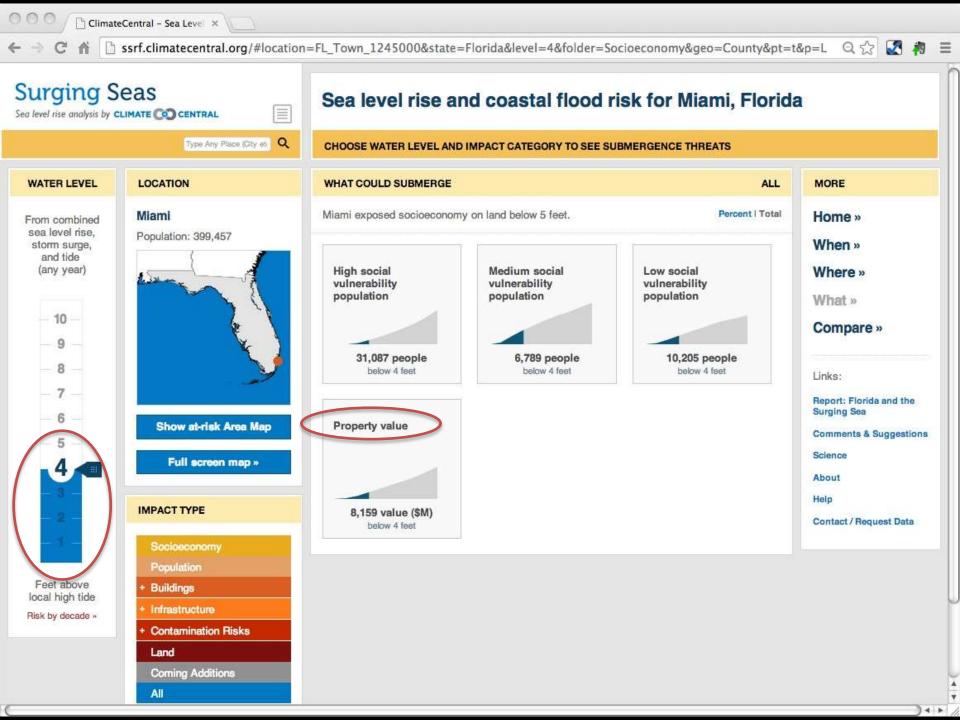
The Nature Conservancy: Coastal Resilience - Gulf

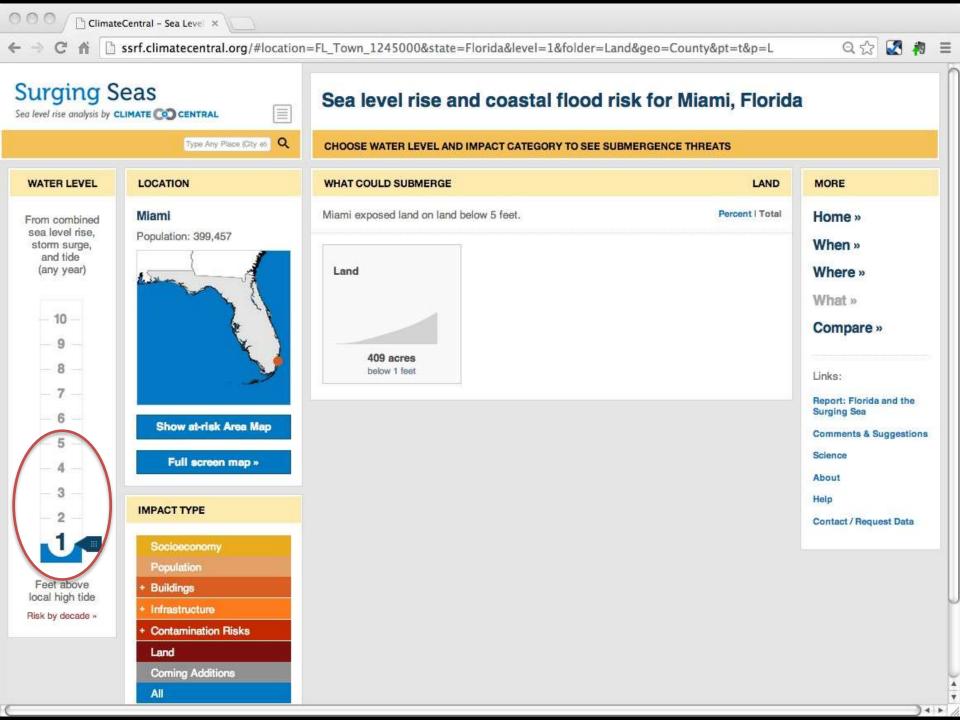
NOAA: Sea Level Rise, Coastal Flooding Impacts Viewer

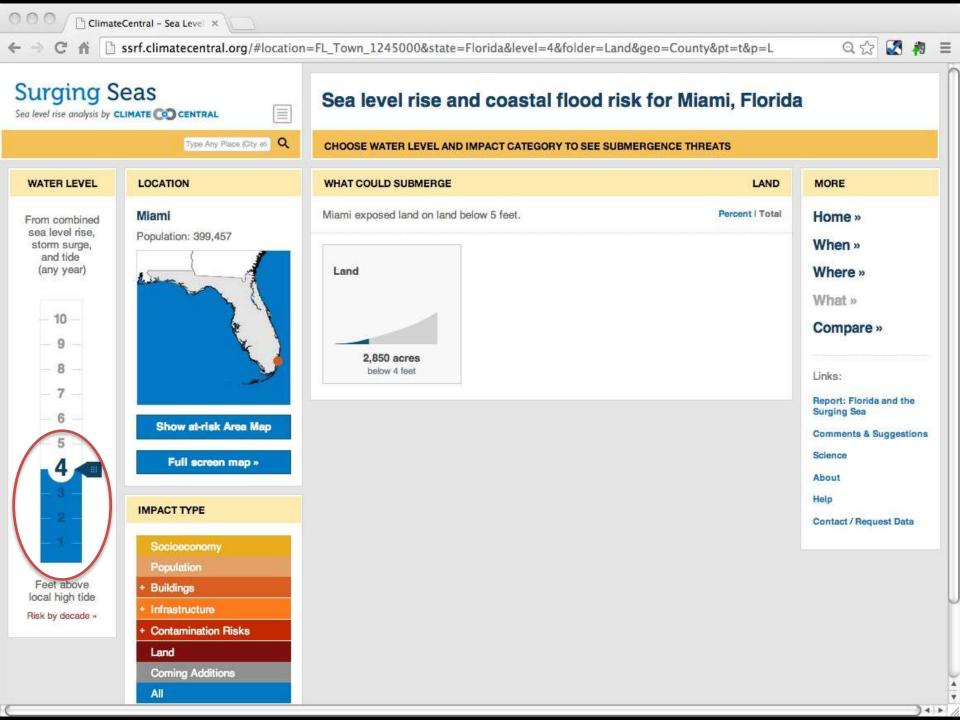




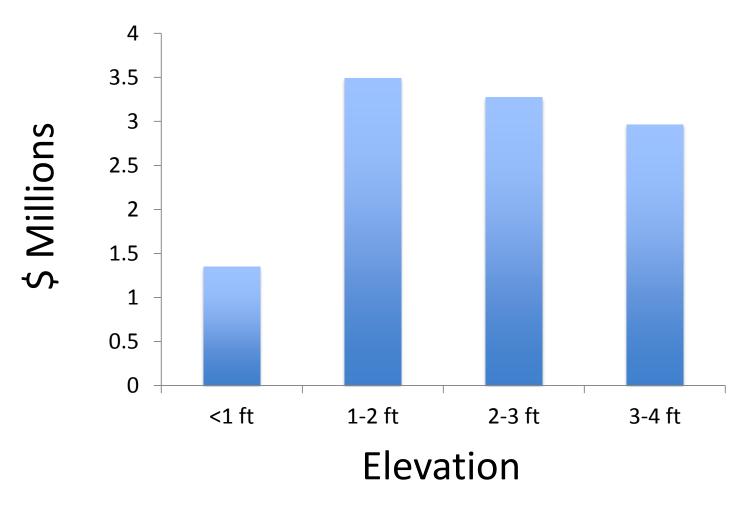








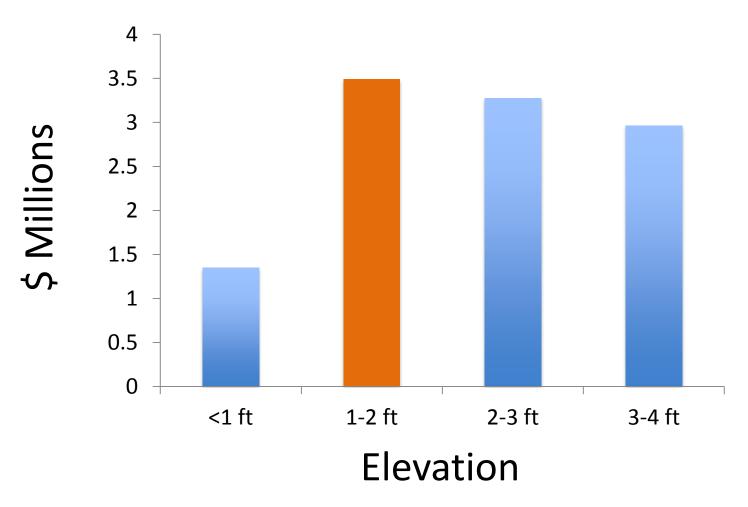
Property value per acre - Miami



(above local high tide line, MHHW)



Property value per acre - Miami



(above local high tide line, MHHW)









Surging Seas

Sea level rise analysis by CLIMATE CO CENTRAL

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Sea Level Rise & Flood Threats in Florida



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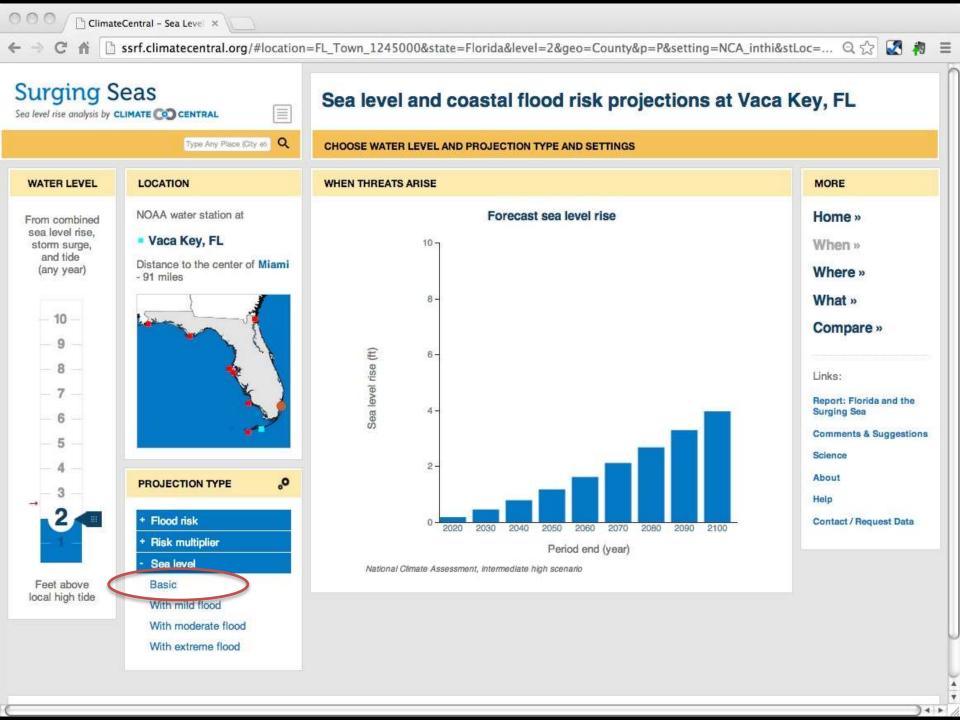
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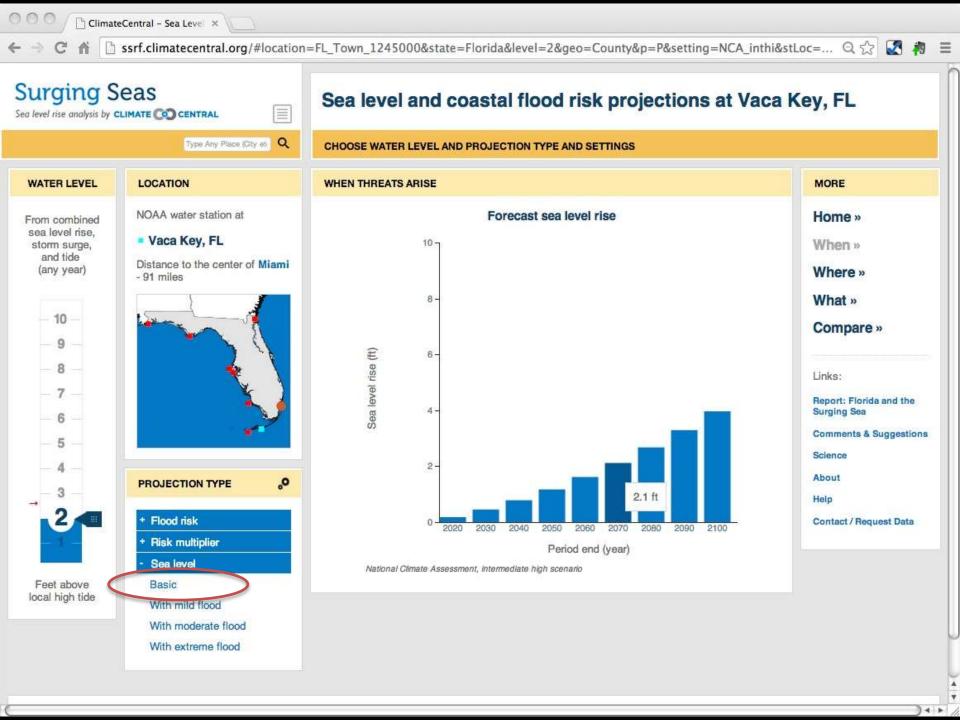
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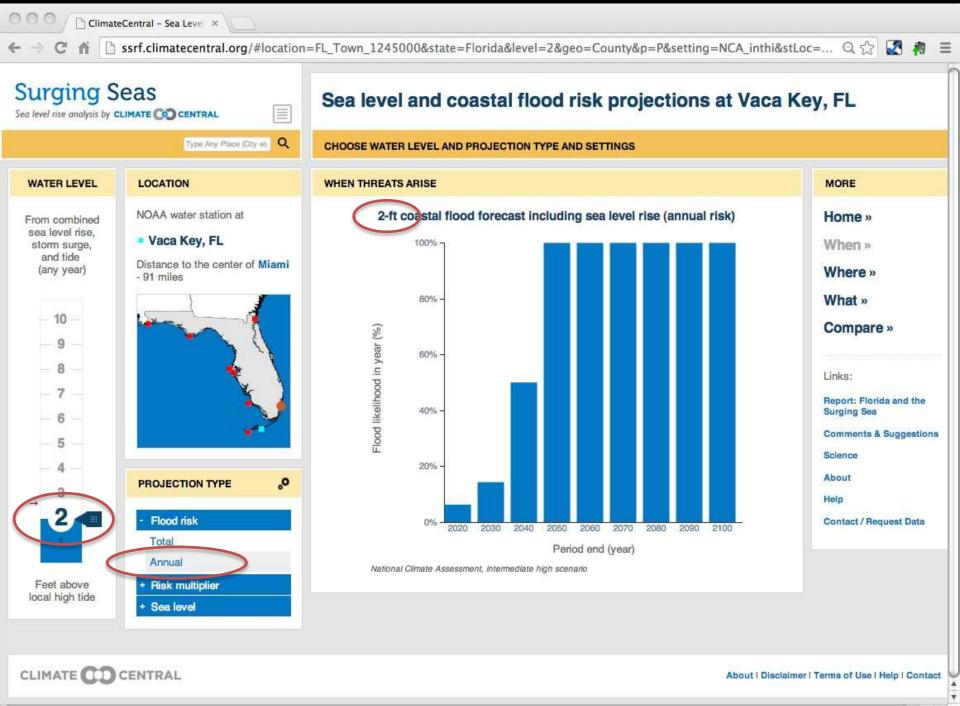
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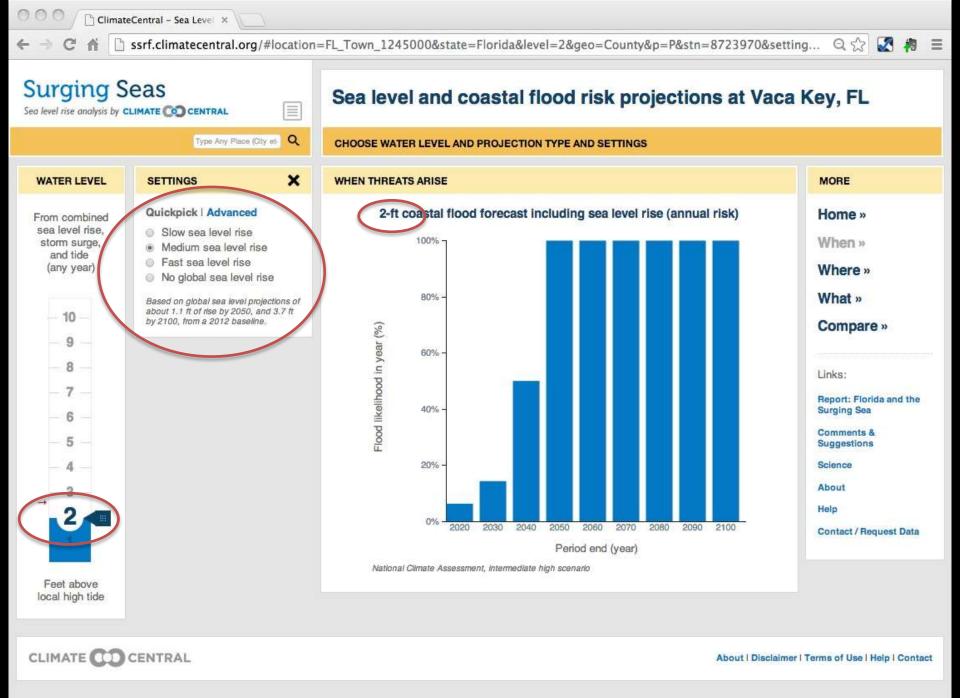
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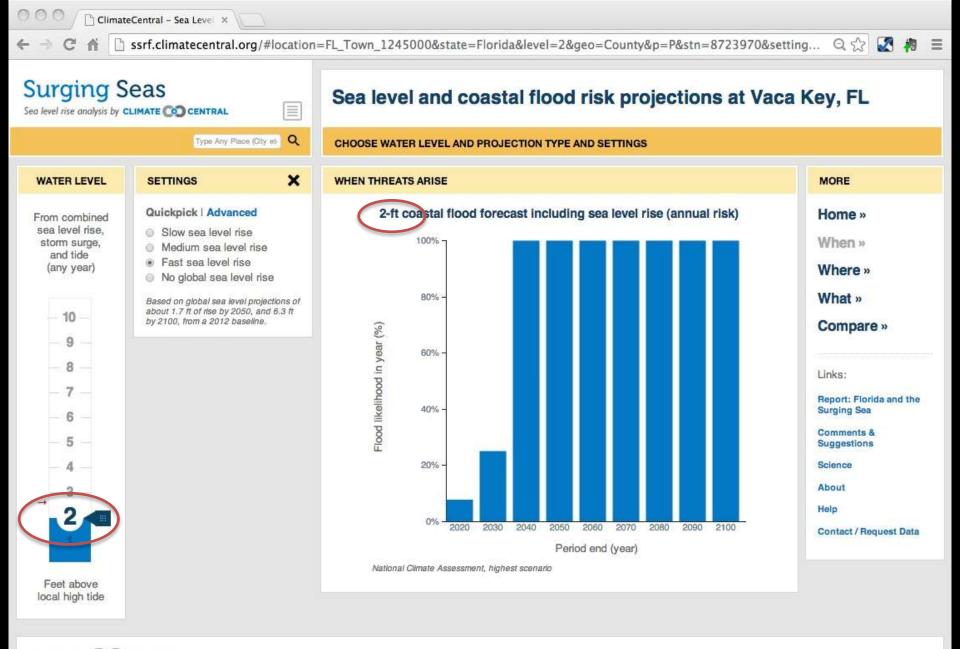
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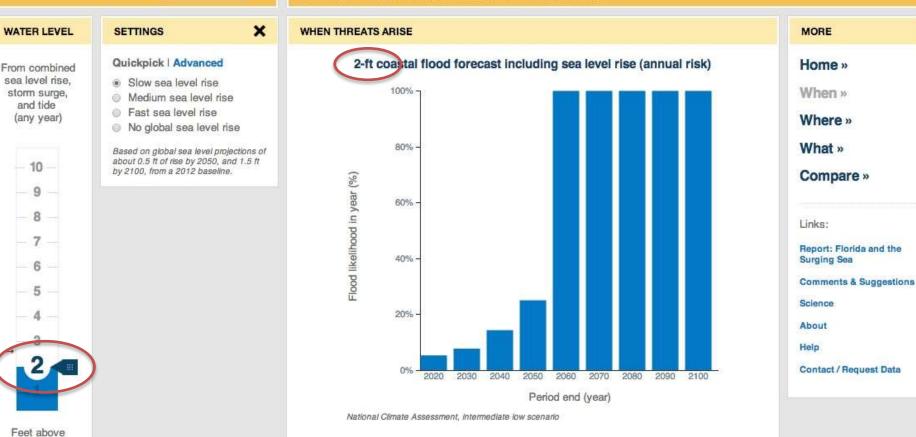








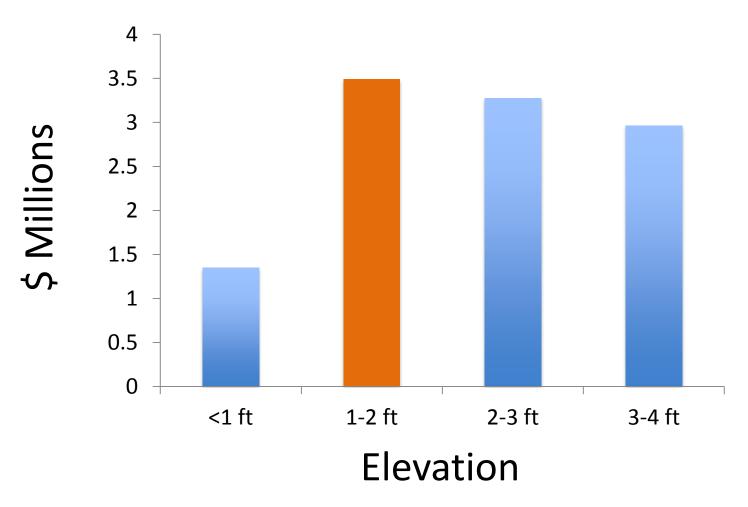






local high tide

Property value per acre - Miami



(above local high tide line, MHHW)









Surging Seas

Sea level rise analysis by CLIMATE CO CENTRAL



Sea Level Rise & Flood Threats in Florida

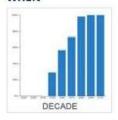


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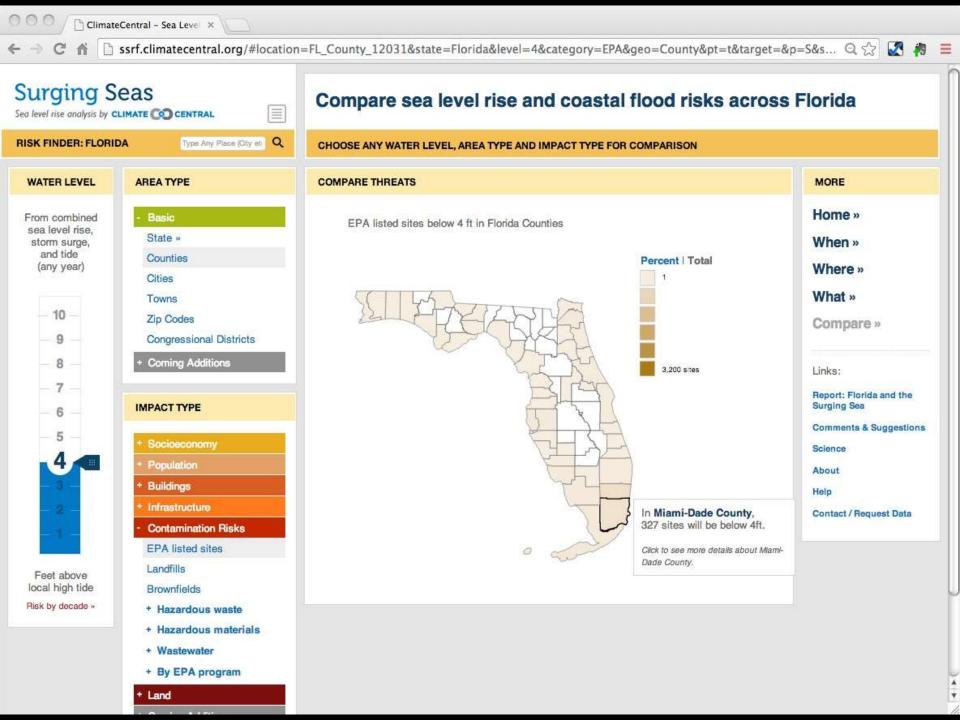
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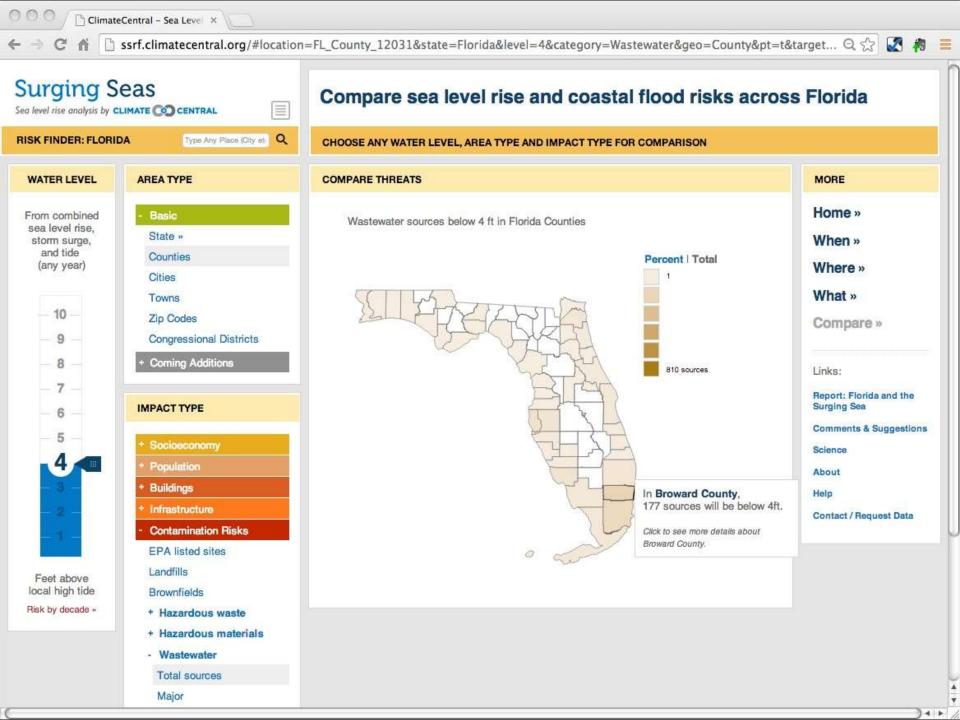
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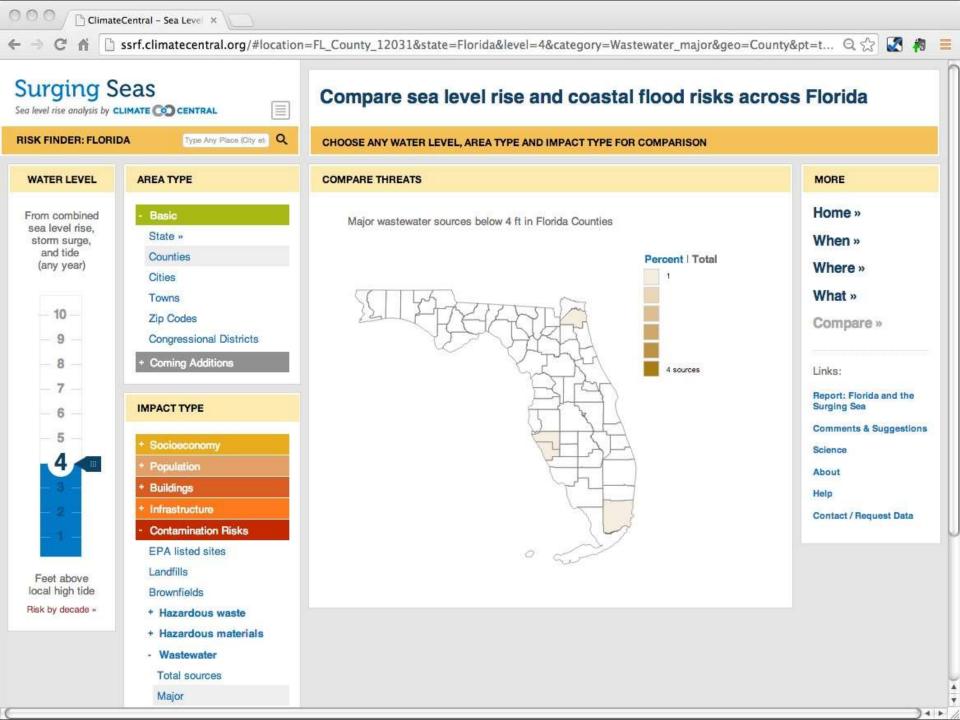
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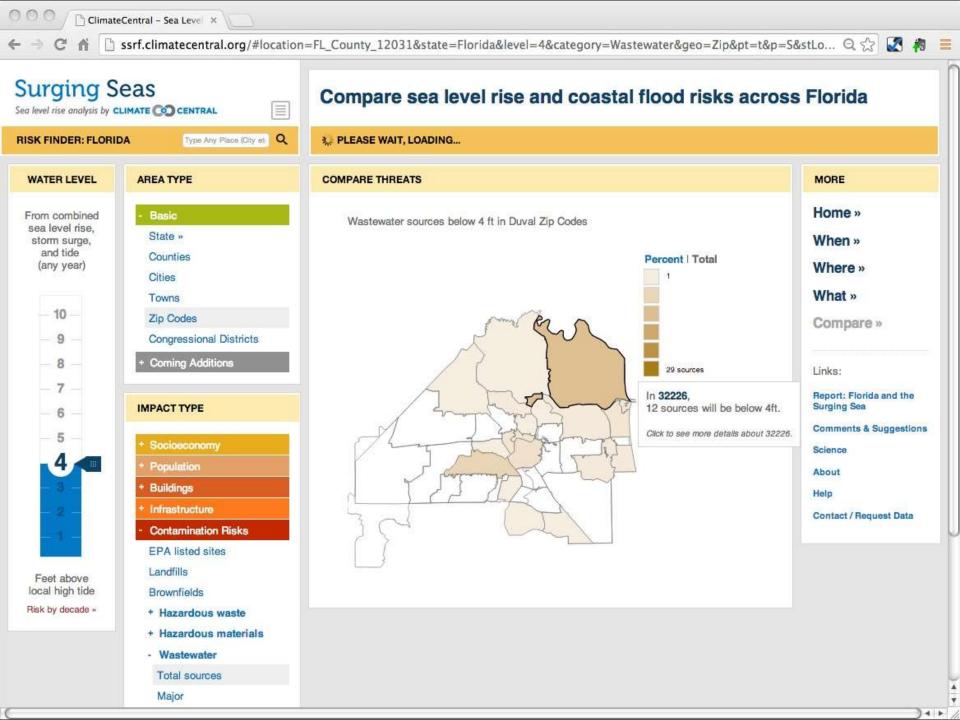
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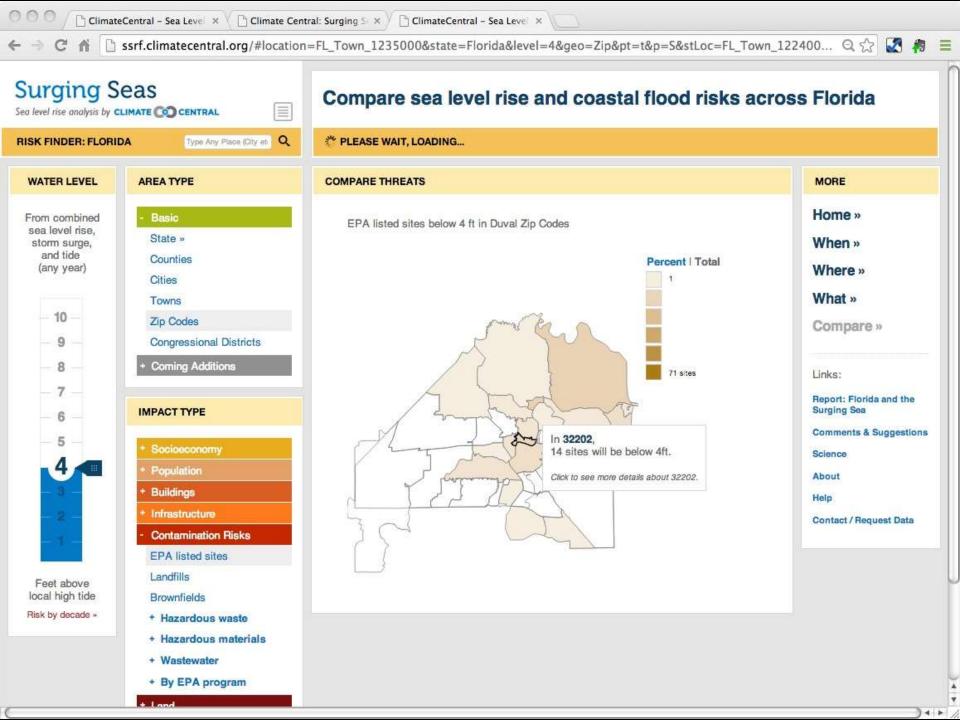
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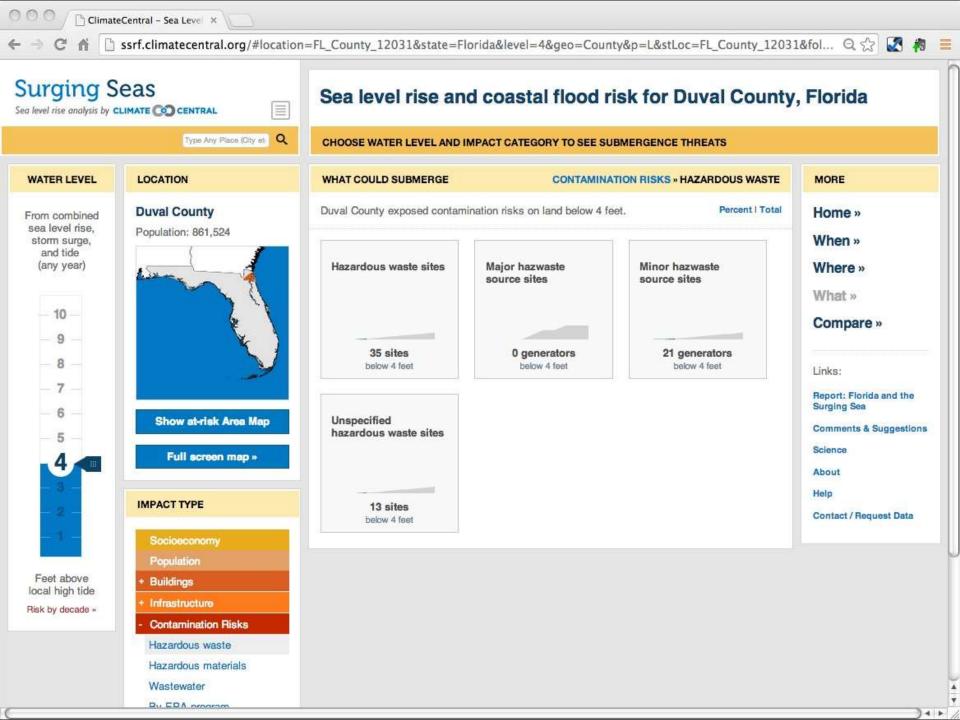


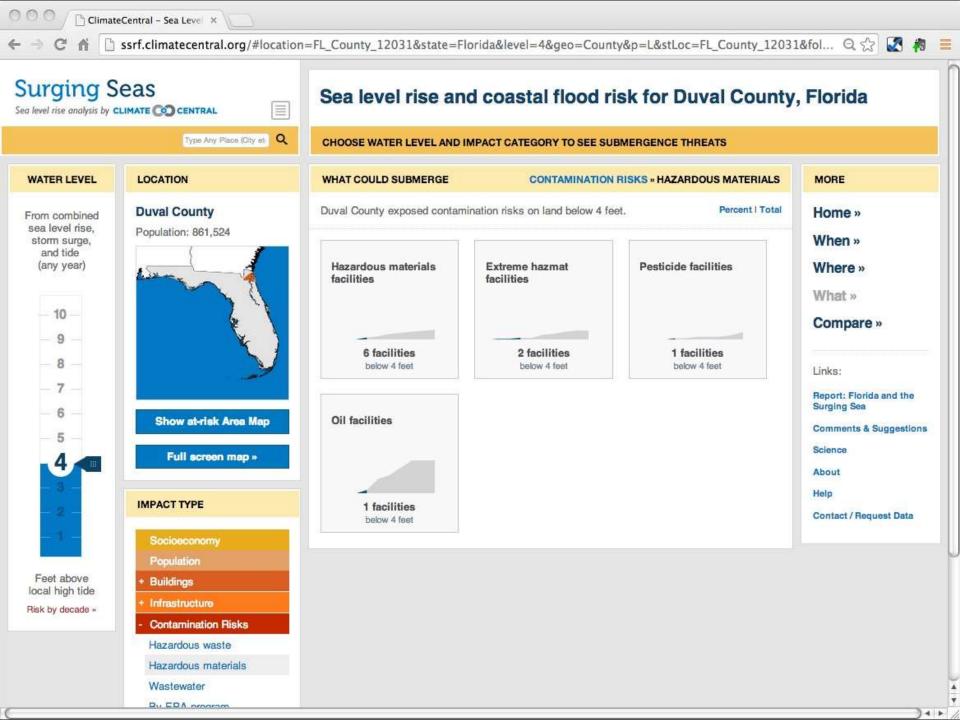


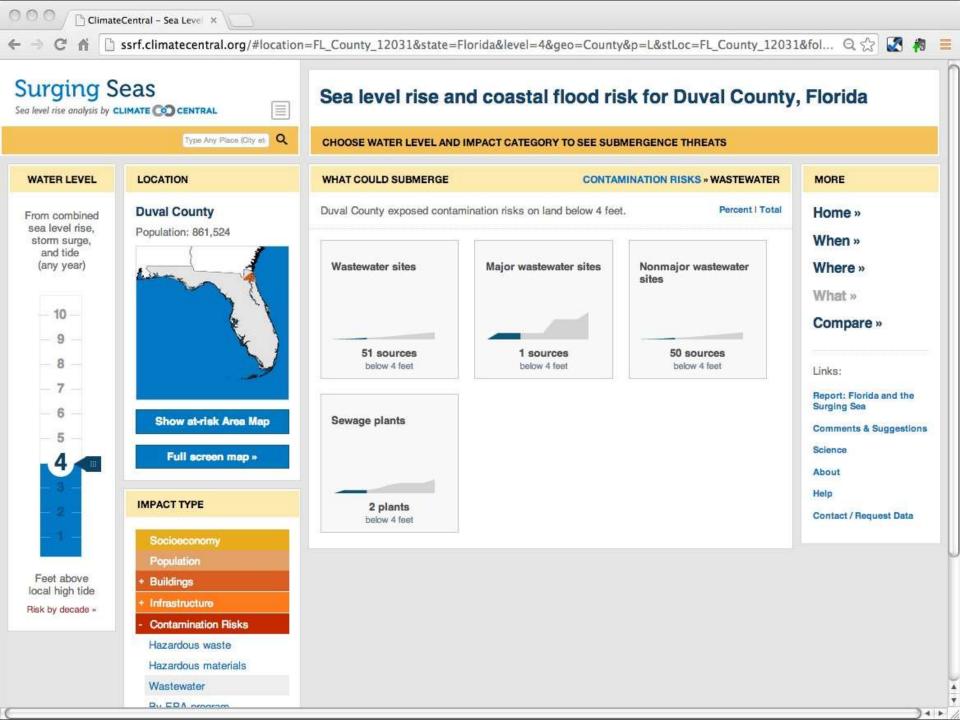


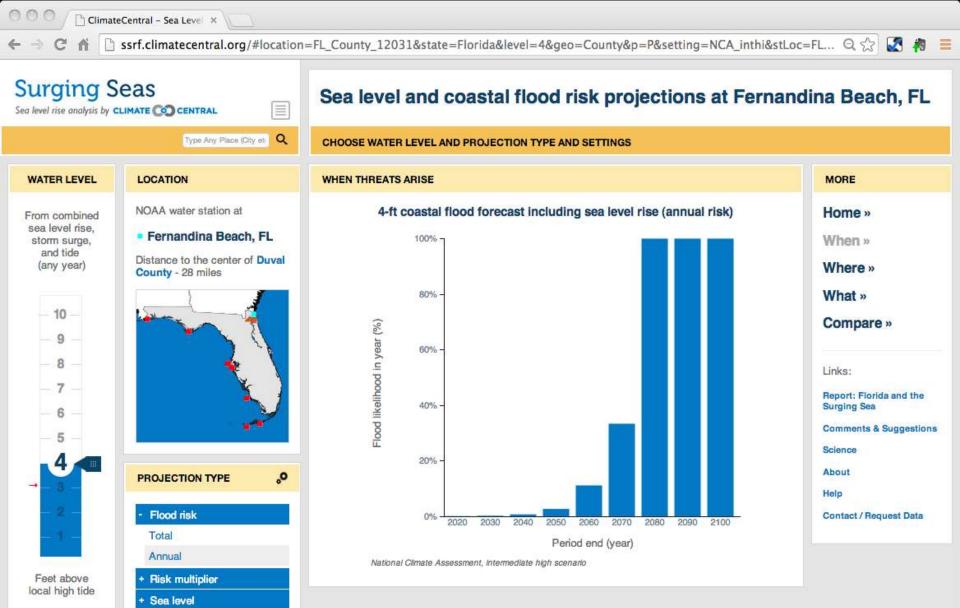




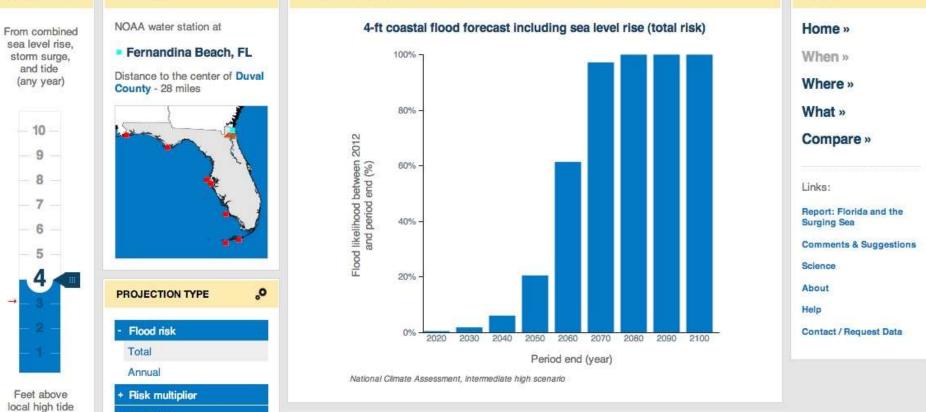






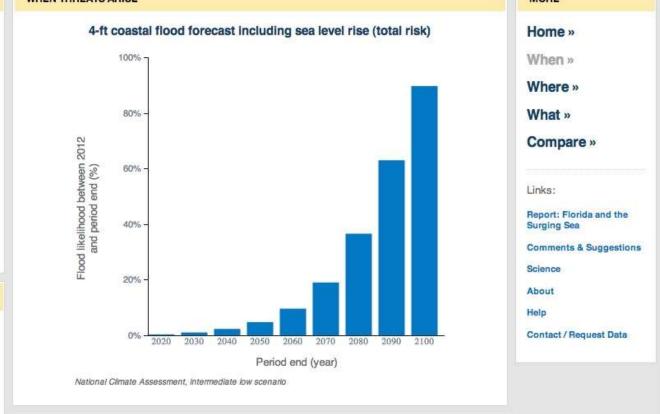






+ Sea level





PROJECTION TYPE

Risk multiplier

Flood risk

Total

Annual

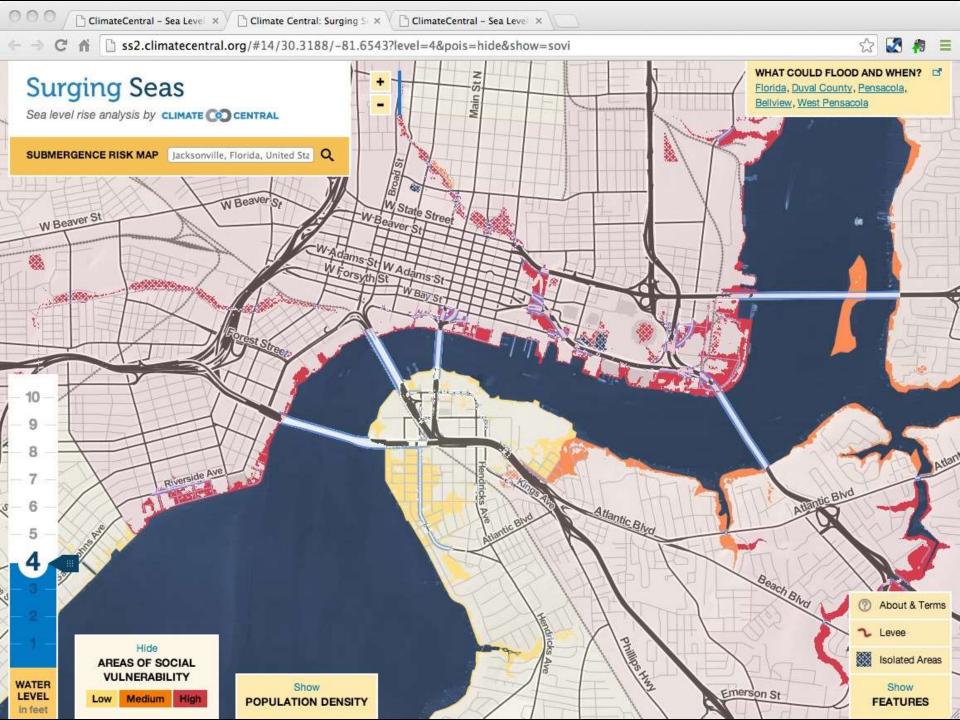
+ Sea level

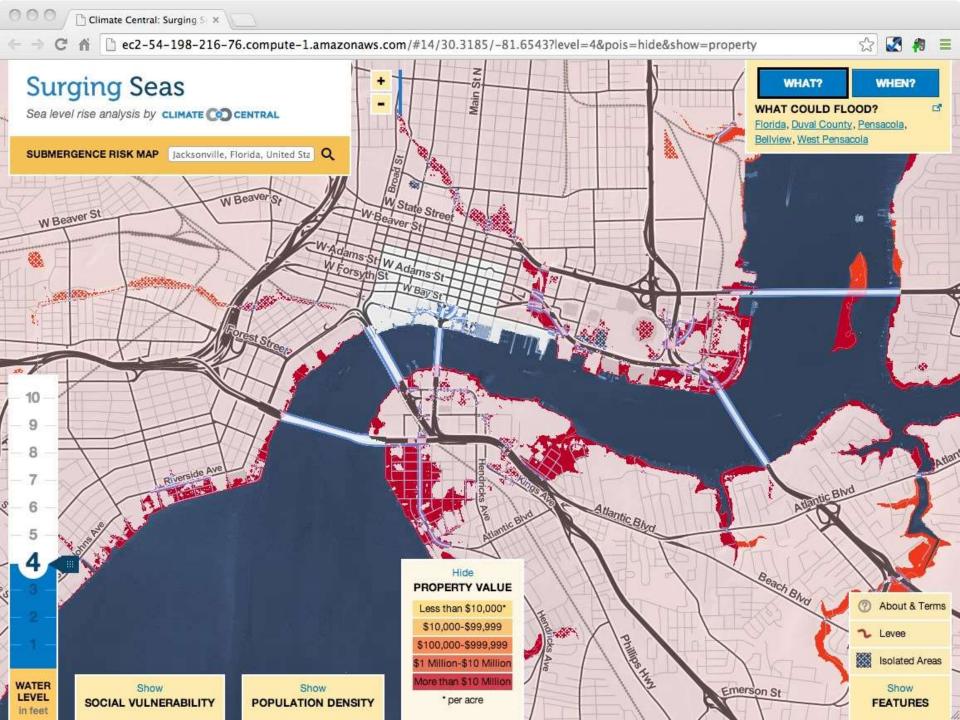
8

5

Feet above

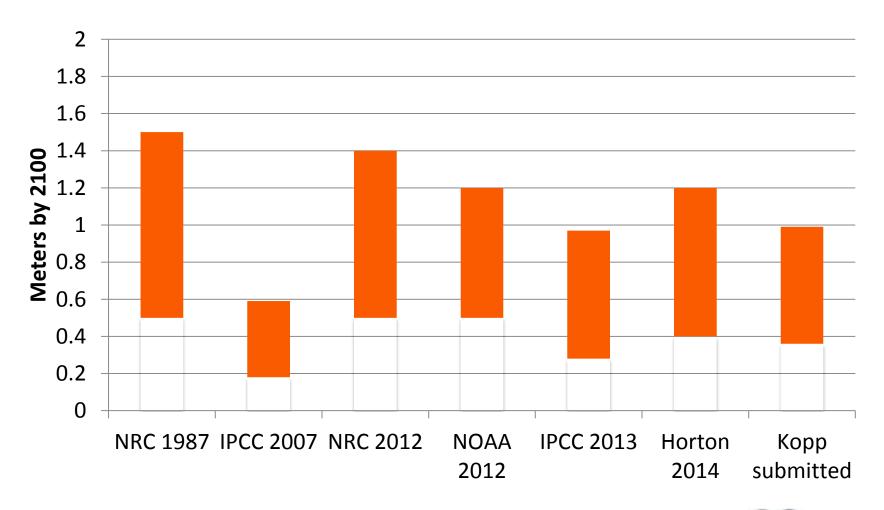
local high tide





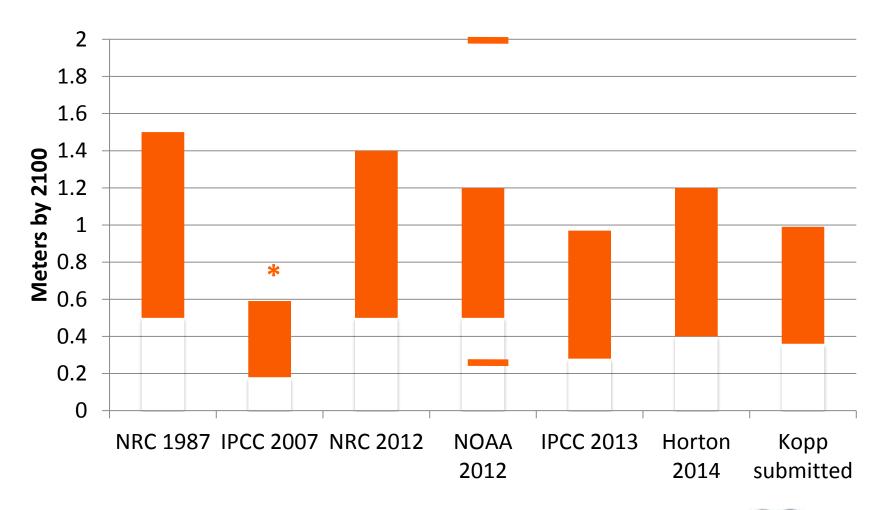
Likely

Likely SLR by 2100, Across Scenarios



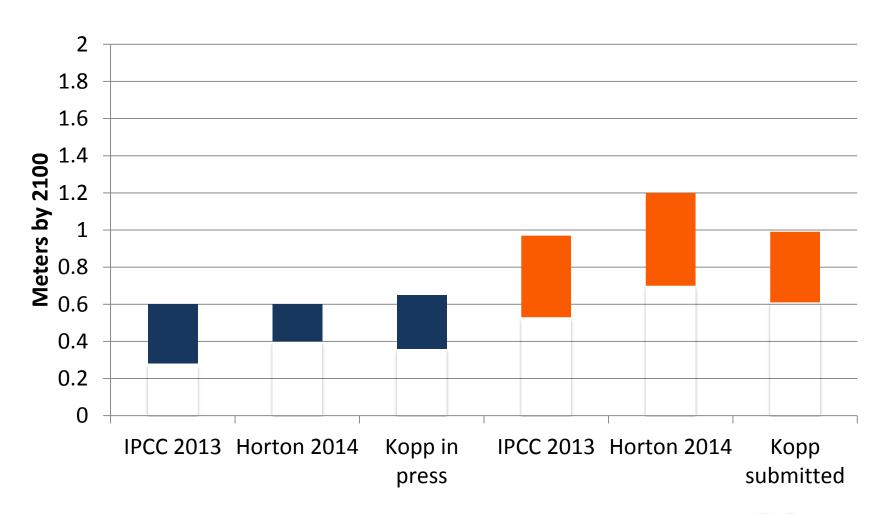


Likely SLR by 2100, Across Scenarios



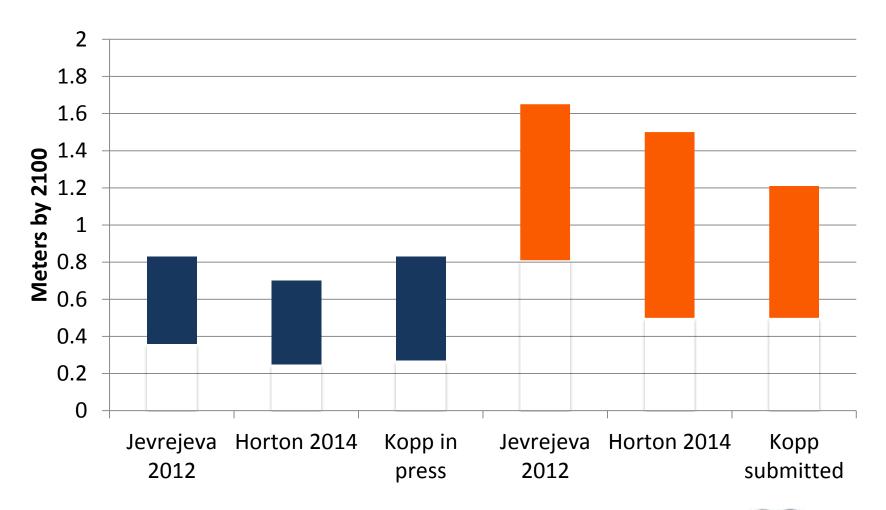


Likely SLR by 2100, RCP 2.6 vs. 8.5



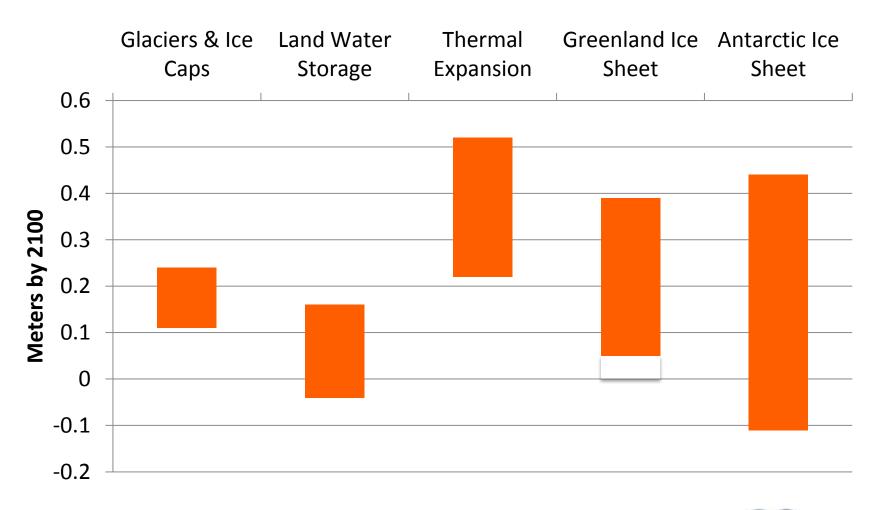


Very likely SLR by 2100, RCP 2.6 vs. 8.5





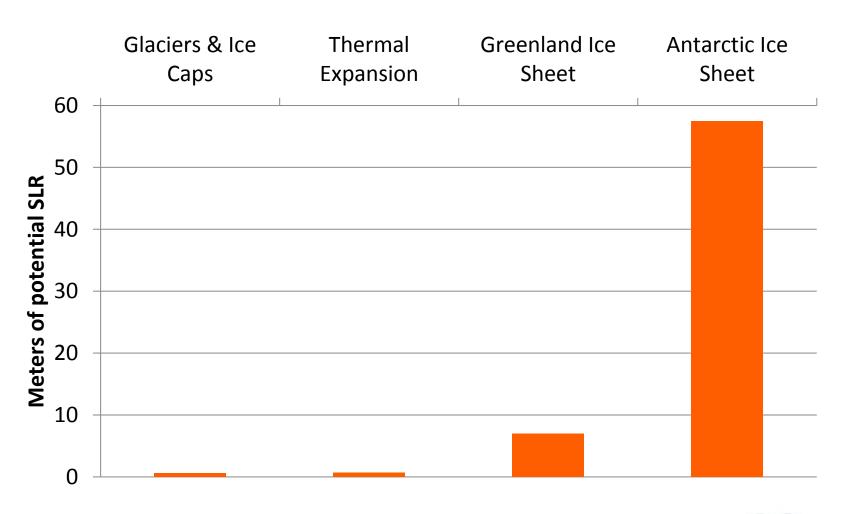
Components of very likely SLR by 2100



Source: Kopp et al (submitted)



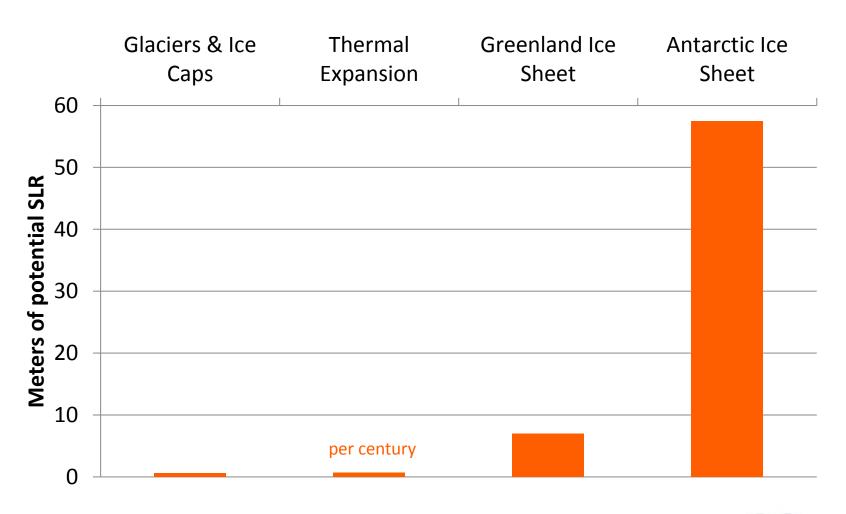
Components of total potential SLR



Source: Levermann et al 2013, PNAS



Components of total potential SLR



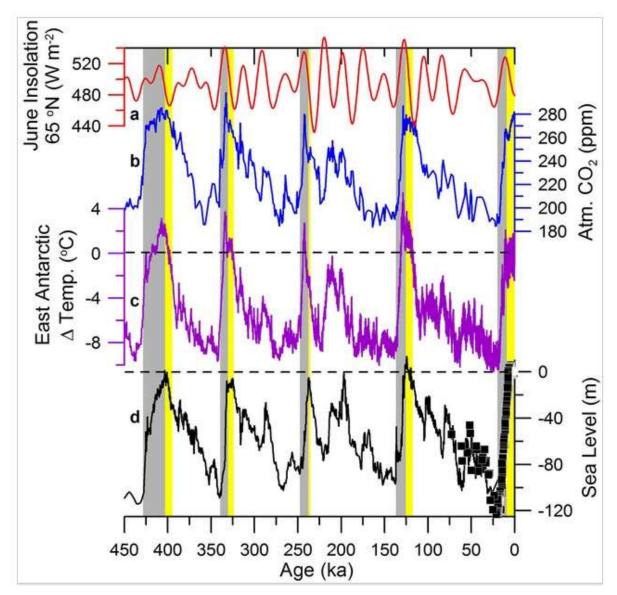
Source: Levermann et al 2013, PNAS

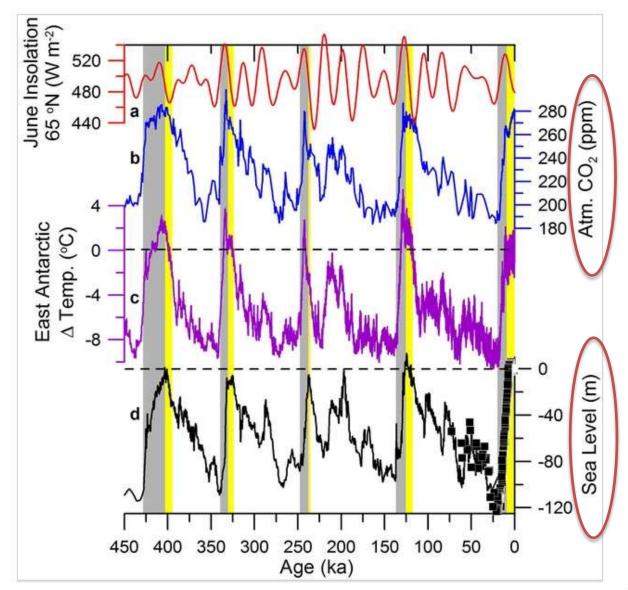


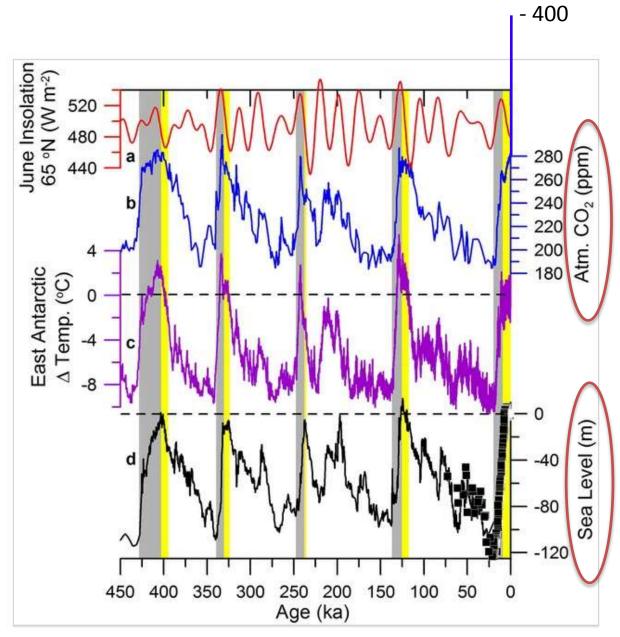


Inevitable







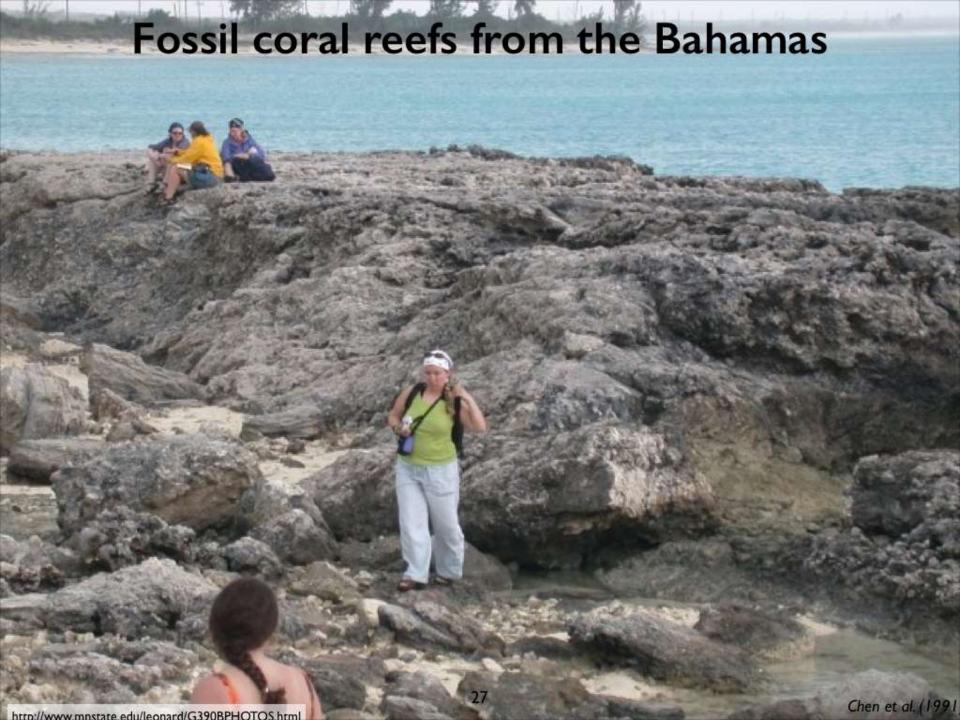


Ice Volume and Sea Level During the Last Interglacial

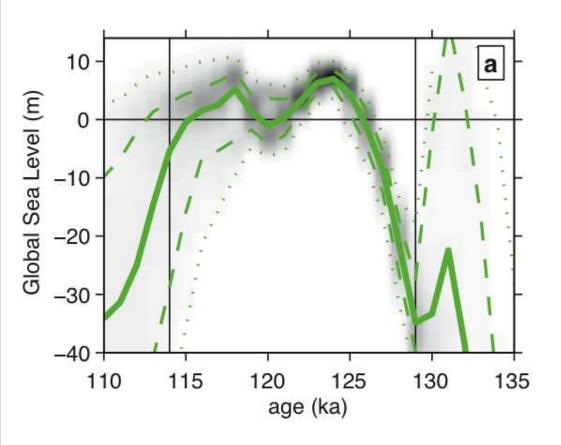
A. Dutton 1,2, and K. Lambeck 1,3

During the last interglacial period, ~125,000 years ago, sea level was at least several meters higher than at present, with substantial variability observed for peak sea level at geographically diverse sites. Speculation that the West Antarctic ice sheet collapsed during the last interglacial period has drawn particular interest to understanding climate and ice-sheet dynamics during this time interval. We provide an internally consistent database of coral U-Th ages to assess last interglacial sea-level observations in the context of isostatic modeling and stratigraphic evidence. These data indicate that global (eustatic) sea level peaked 5.5 to 9 meters above present sea level, requiring smaller ice sheets in both Greenland and Antarctica relative to today and indicating strong sea-level sensitivity to small changes in radiative forcing.

Source: Dutton & Lambeck 2012, Science CLIMATE CENTRA



Mean global sea level reconstructed for the Last Interglacial



95% probability >6.6 m higher than today.

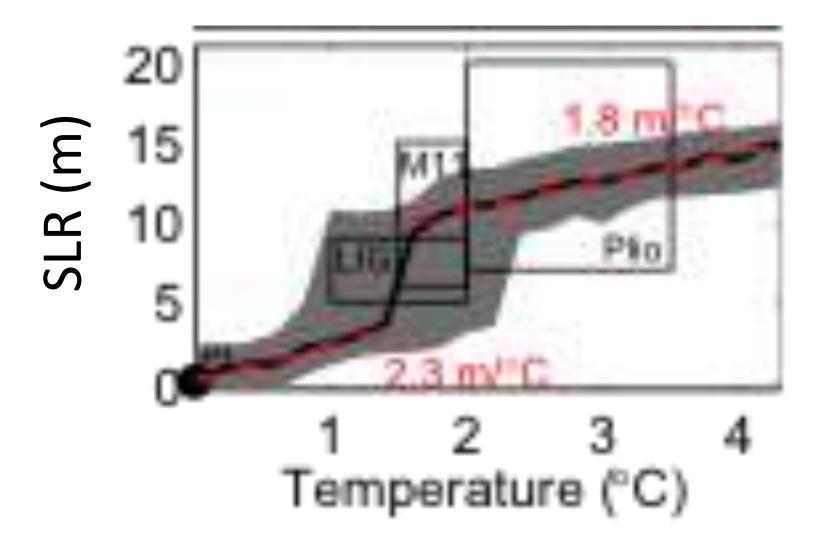
33% probability >9.4 m

CLIMATE CO CENTRAL

Pliocene global sea-level, three million years ago (last time CO₂ was comparable to today), peaked about 50-80 feet higher than today

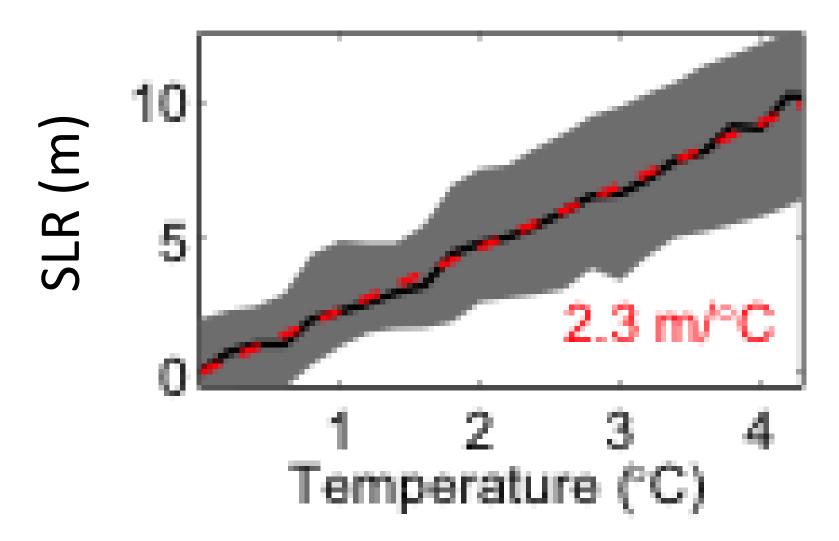


Lock-in relationship: time-indefinite

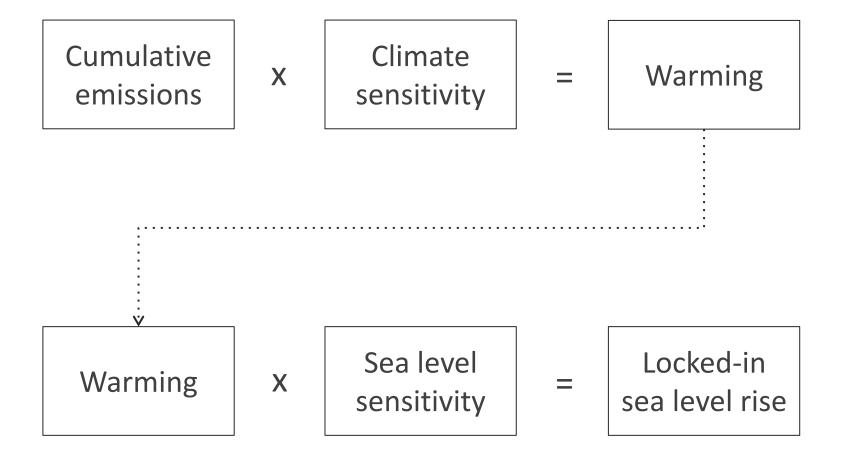




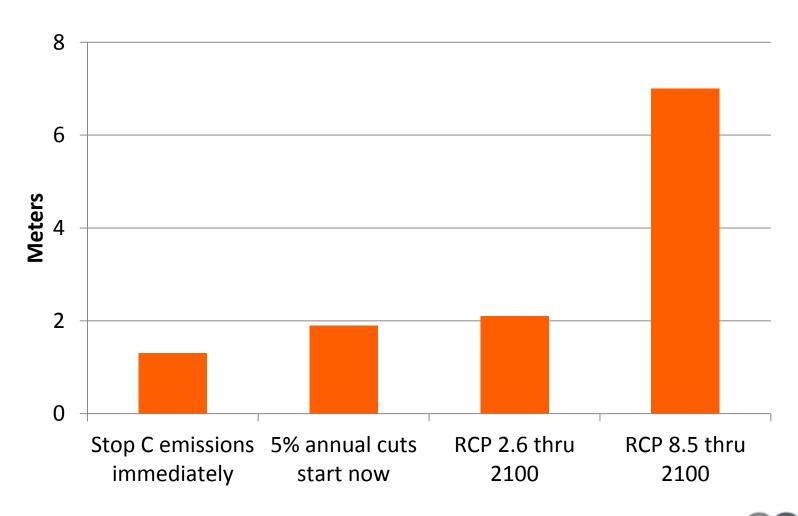
Lock-in relationship: by 2000 yrs







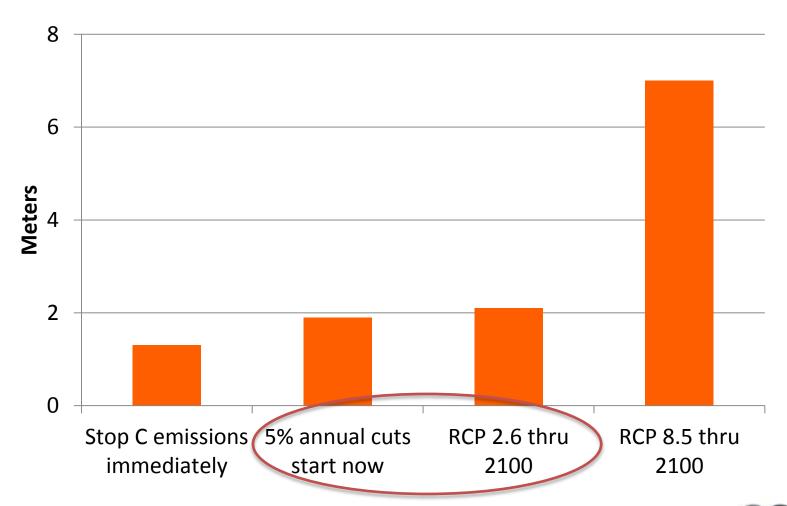
Locked-in SLR by scenario (by 2ky)



Source: Strauss 2013, PNAS

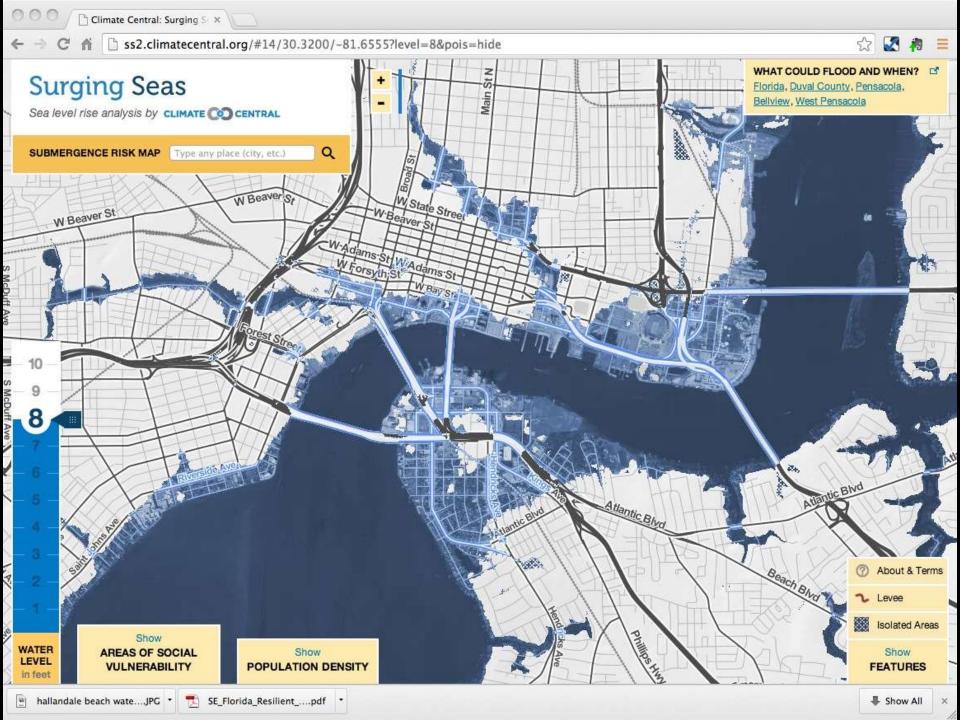


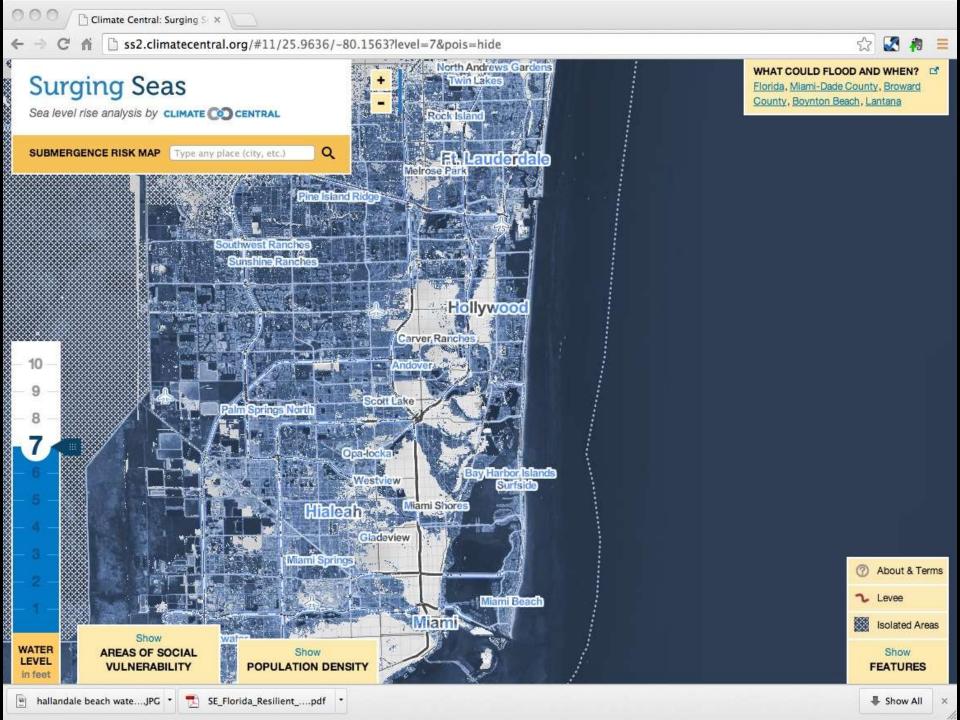
Locked-in SLR by scenario (by 2ky)



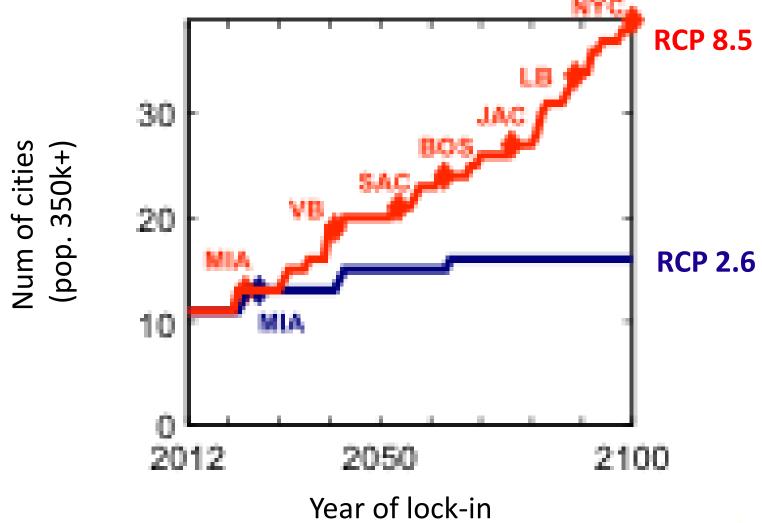
Source: Strauss 2013, PNAS

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Large cities locking in to >1/4 below tide



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Source: Strauss 2013, PNAS

Which legacy?

Swift carbon cuts

Business as usual



Based on recent scientific projections. Carbon emissions today lock in future sea-level rise.

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