SOUTH FLORIDA WATER MANAGEMENT DISTRICT

How to Build a Bigger Florida Bay

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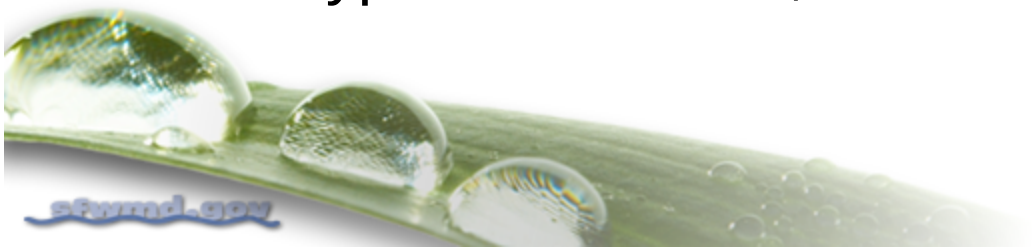
Appreciation

"The Everglades is one of the most special places in our country. But it's also one of the most fragile. Rising sea levels are putting a national treasure—and an economic engine for the South Florida tourism industry—at risk."

President Barack Obama, April 18, 2015

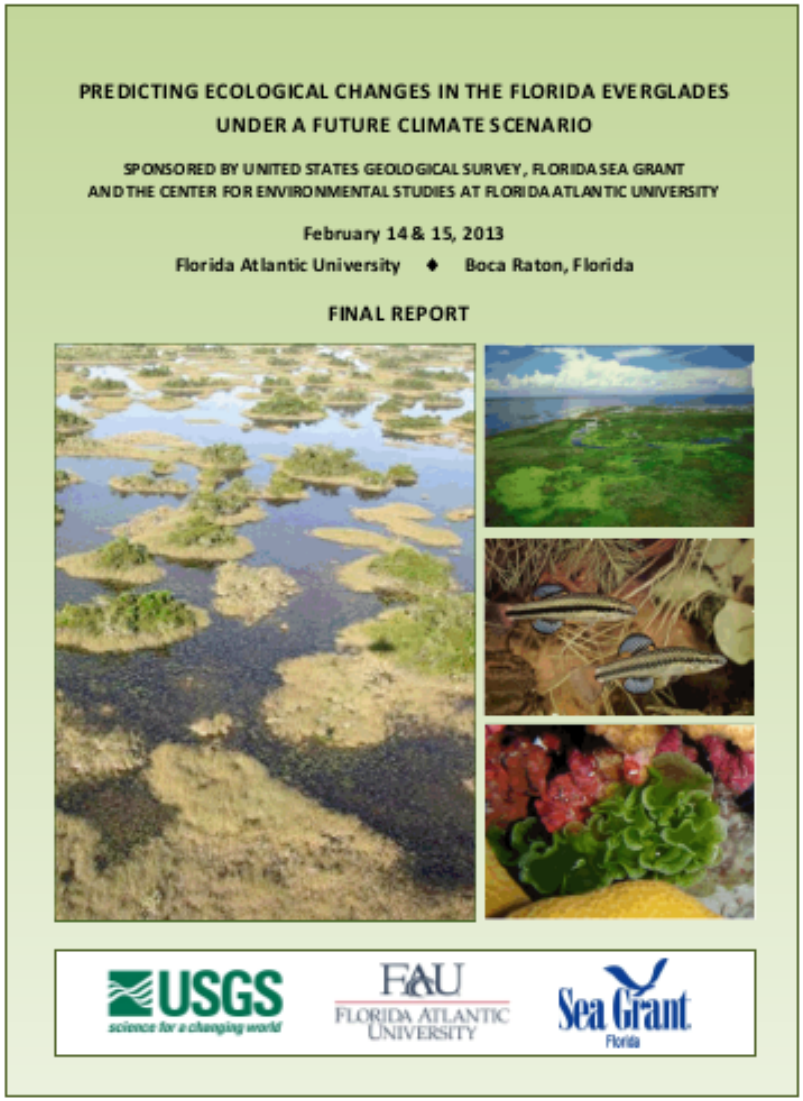
Climate change and sea level rise - overview

- Both sea level rise and climate change will affect Florida Bay and the Everglades
- Climate change will cause temperature and evapotranspiration to rise; changes to rainfall uncertain
- Sea level rise is occurring, rates uncertain (~1-2 m by 2100)
- Florida Bay will increase greatly in size at expense of freshwater wetlands in Everglades National Park, Big Cypress Preserve, and Water Conservation Areas

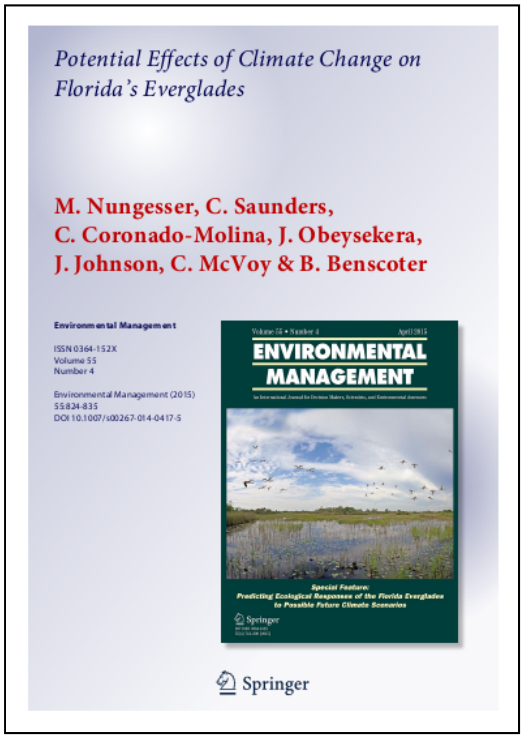


Media focus on sea level rise

Climate Change in the Everglades



- 2013 Workshop on Ecological Effects of Climate Change on the Everglades
- Special Issue of *Environmental Management*



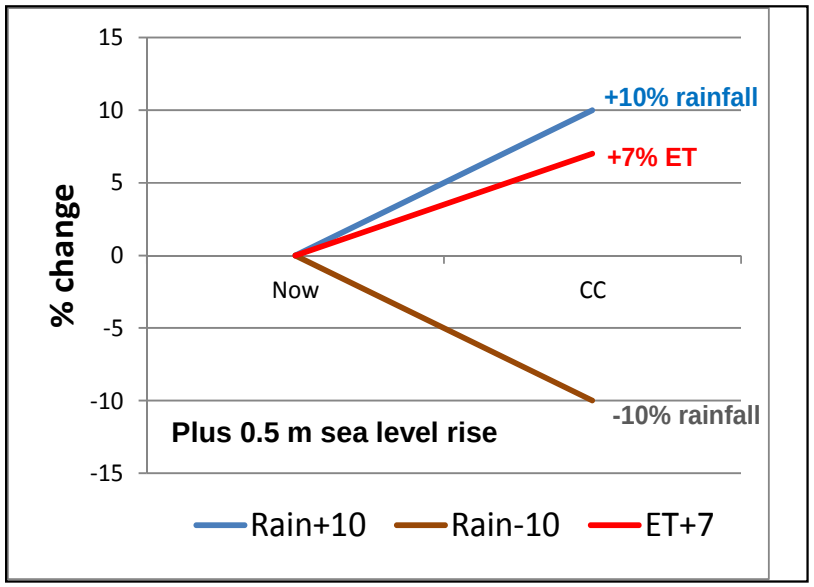
Ecological Implications of Climate Change

- Everglades soils are **peat**.
- Freshwater peat exists in south Florida only because of surplus water (Rainfall > Evapotranspiration)
- Rainfall exceeds ET now but is likely to switch in future (ET > Rainfall)
- With significant droughts, peat will be lost
- Significant peat loss in Everglades alters hydrology and ecosystem structure (catastrophically)

Climate Change and Hydrological Implications

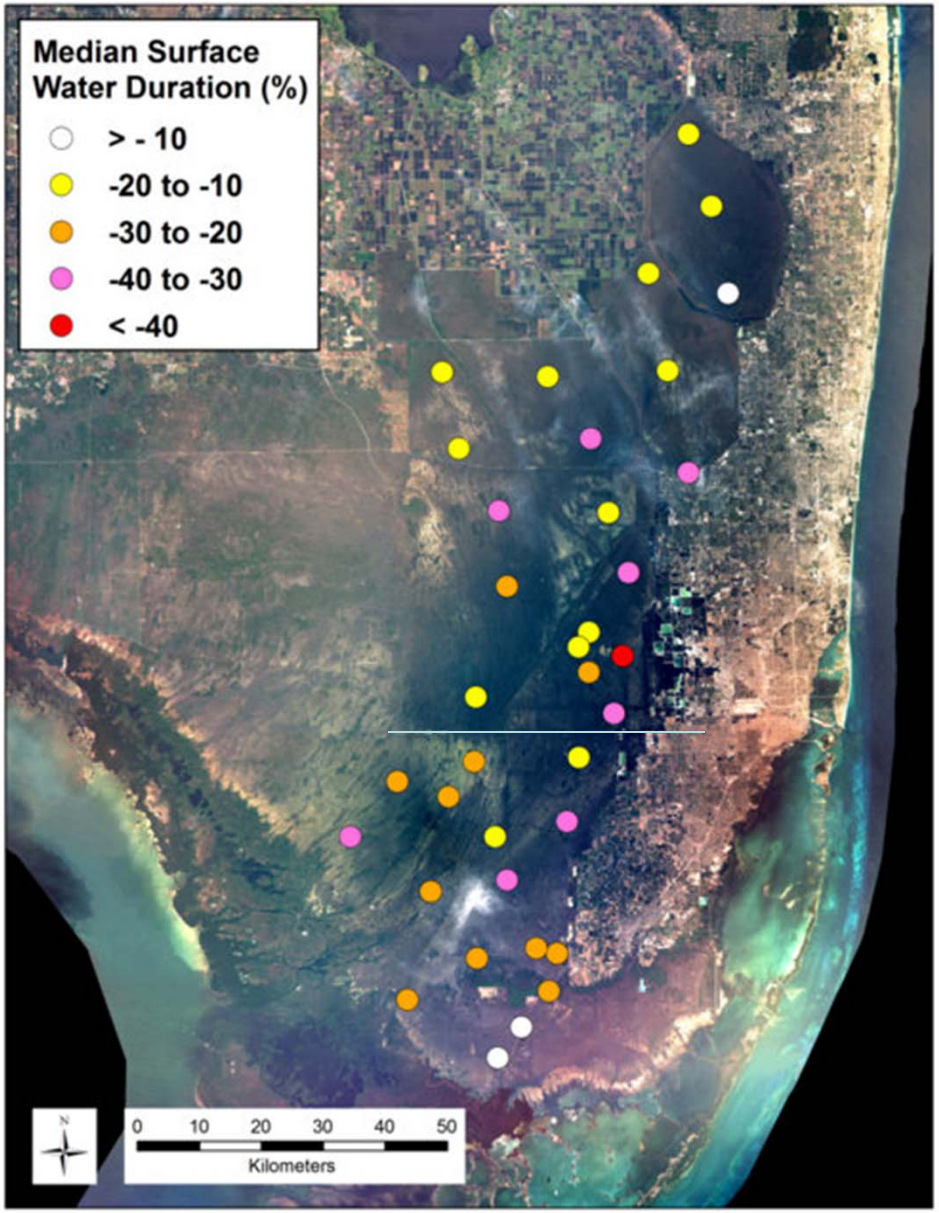
Temperature rise of 1.5º C (+7% ET)
Rainfall ± 10%
Sea level rise of 0.5 m

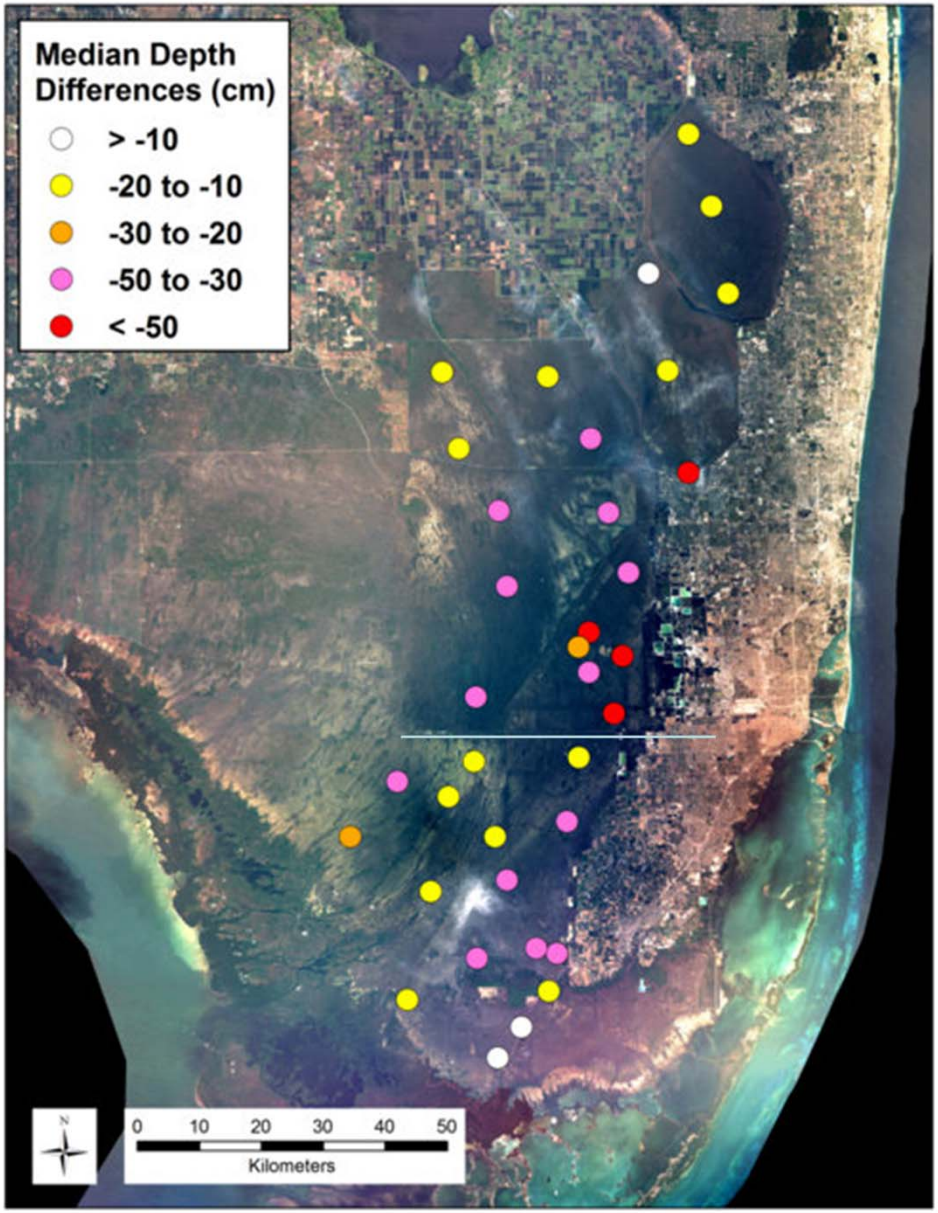
Climate Change Scenarios



Simulated Rainfall and ET Changes Central ENP

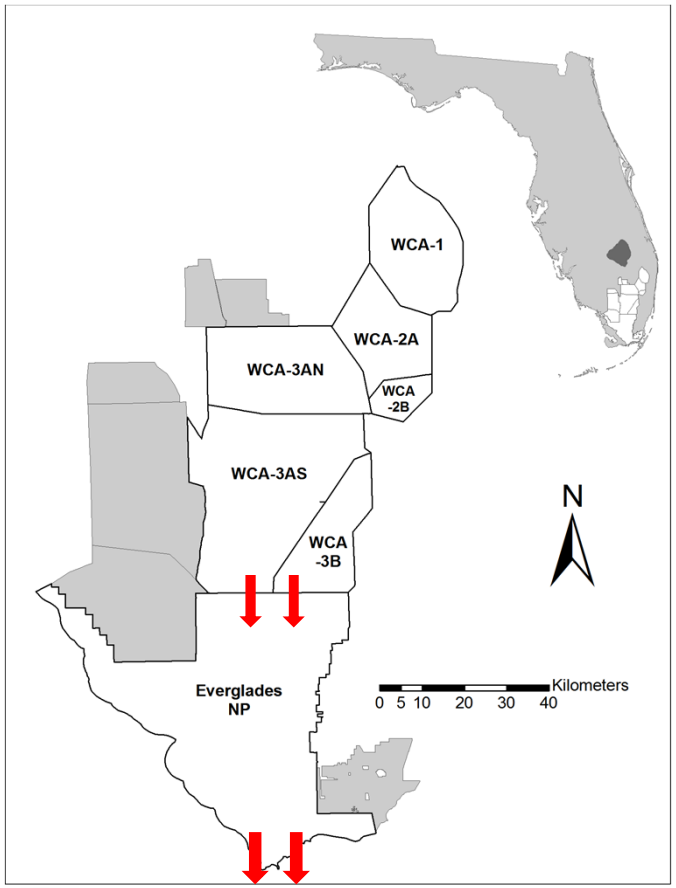
	ET (cm)	Rain (cm)	Pct R:ET
Base	145.0	150.0	**3.4%**
ET only	155.0	150.0	**-3.2%**
+RF+ET	155.0	165.0	**6.5%**
-RF+ET	155.0	135.0	**-12.9%**





* Differences of –RF+ET scenario relative to base conditions

Major Flow Reductions into Everglades N.P. and Florida Bay



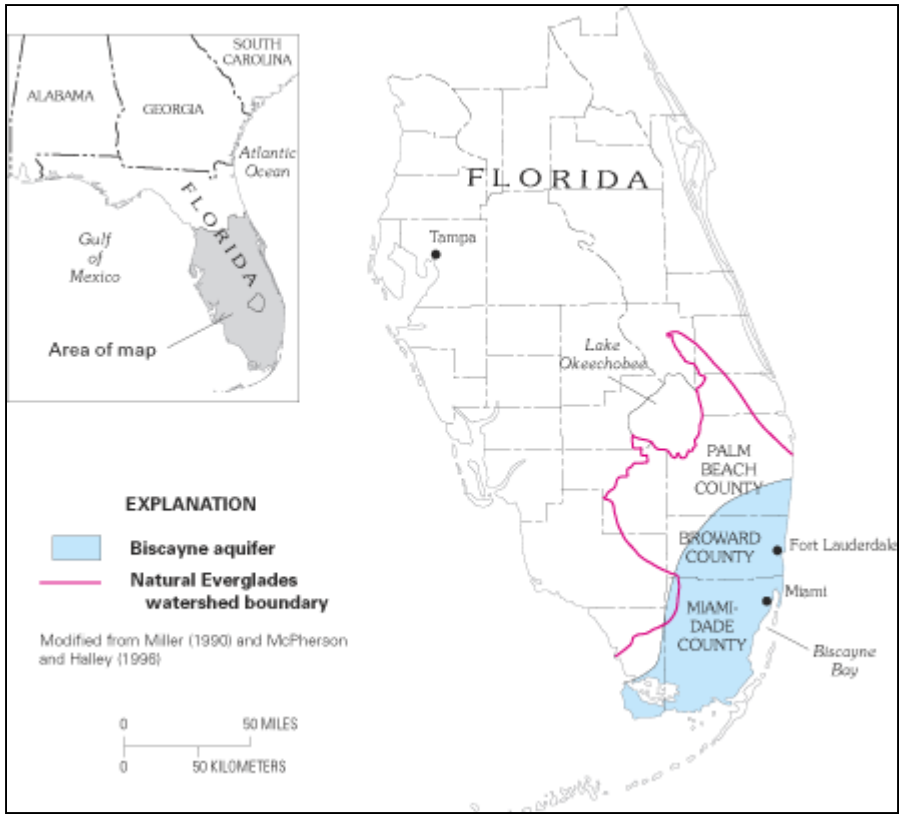
	Into ENP		Into FB	
	ENP (Mil. m3/year)	Relative to Base	FB (Mil. m3/year)	Relative to Base
Base	1016	--	190	--
+RF+ET	1271	**49%**	238	**25%**
-RF+ET	282	**-72%**	68	**-64%**

ENP=Everglades National Park FB=Florida Bay

Saltwater Intrusion

Coastal well-fields

Extent of Biscayne Aquifer along FB

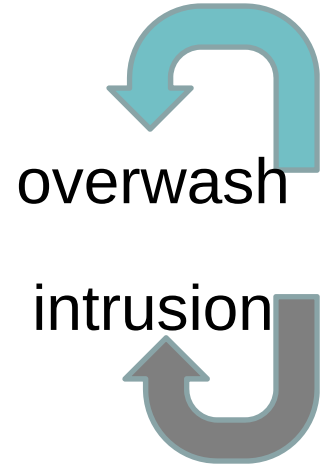


Source: Barlow 2003, p. 61

Natural areas affected by same saltwater intrusion processes as urban areas

What will effects be on peat?

Sea level rise and peat collapse

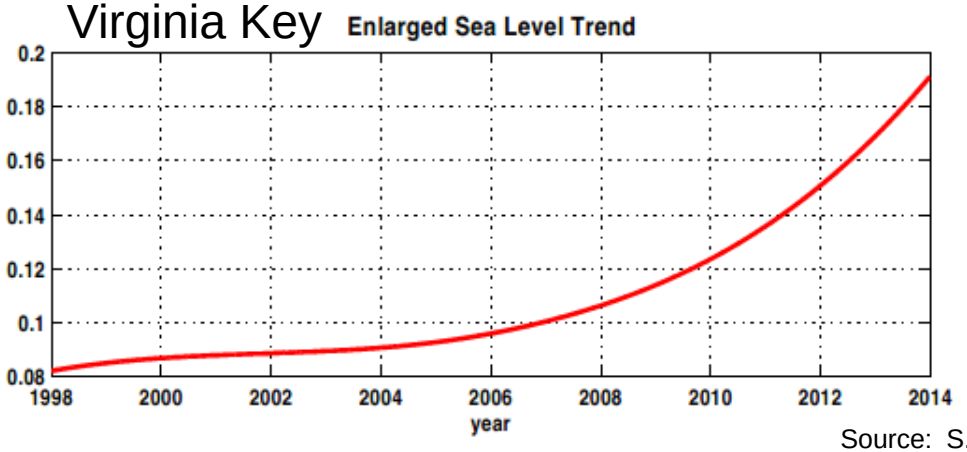


Credit: Prof. Hal Wanless

What is Happening Now?

Sea level is rising. Rates are accelerating.

Virginia Key

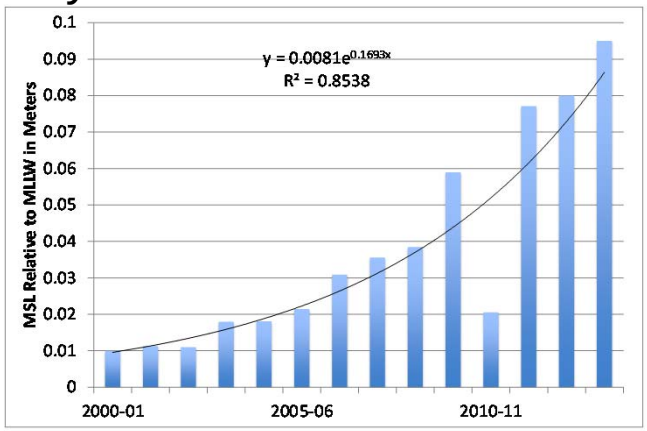


Acceleration of SLR since 2006

Total trend increase since 2006 – 10 cm

Source: S. Wdowinski et al. 2014

Key West



Total increase of 7.5 cm at Key West since 2006

Source: J. Lorenz, pers. comm.

South Florida sea level rise at Vaca Key, Florida Bay, and Virginia Key is ~ 2x the linear rate since 2004 (J. Park, pers. comm.)

All gauges show increased average weekly stages starting in 2008

Approx. 10 cm increase at Taylor Slough (upstream from USGS MFL site)

Peterson Key

Bob Allen Key

Butternut Key

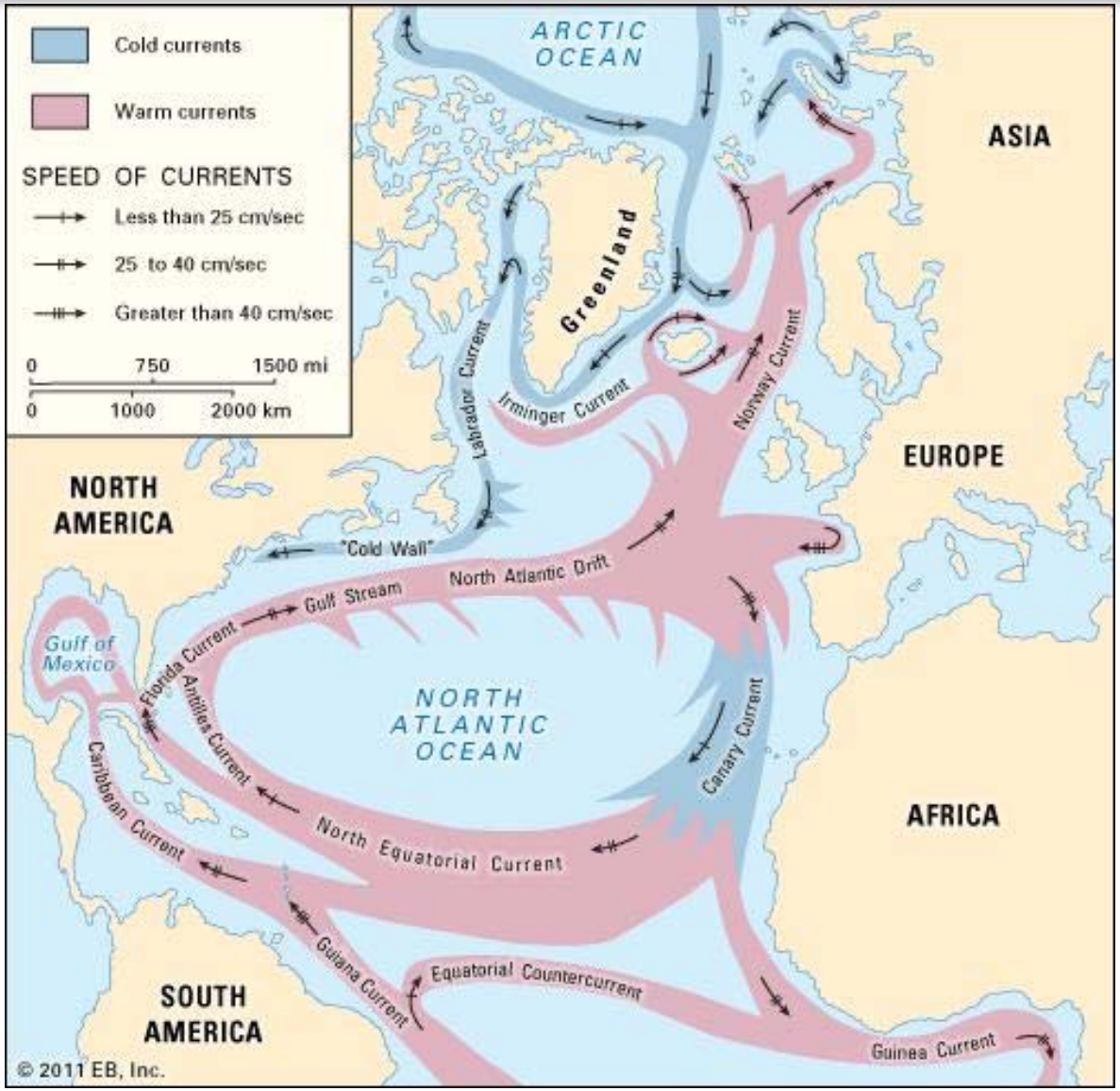
Little Madeira Key

Source: J. Lorenz, Everglades Science Center, Tavernier, FL

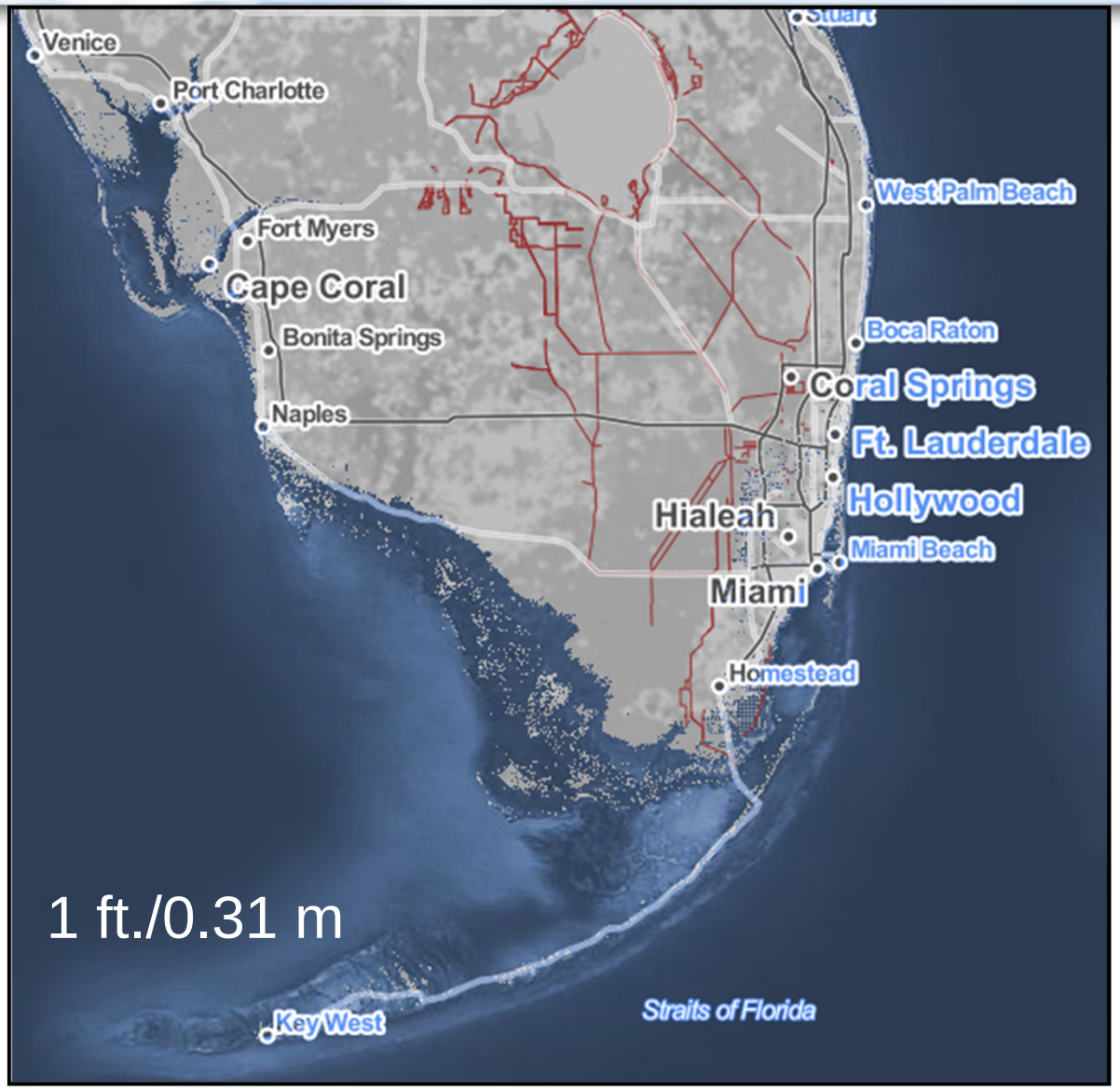
Gulf Stream has slowed

Gulf Stream flow velocity is slowing:

- Weakening Gulf Stream since 2004, sea level rise accelerated along Mid-Atlantic beginning in 2006 (Ezer et al. 2013)
- Natural variability and also Greenland ice sheet melting (Rahmstorff et al. 2015)
- Duration unknown



How Big Will Florida Bay Be?



Maps include storm surge (Climate Central 2012, *Surging Seas 2.0*)

1-2 m sea level rise predicted by 2100

ENP is 205,904 ha (795 mi^2)

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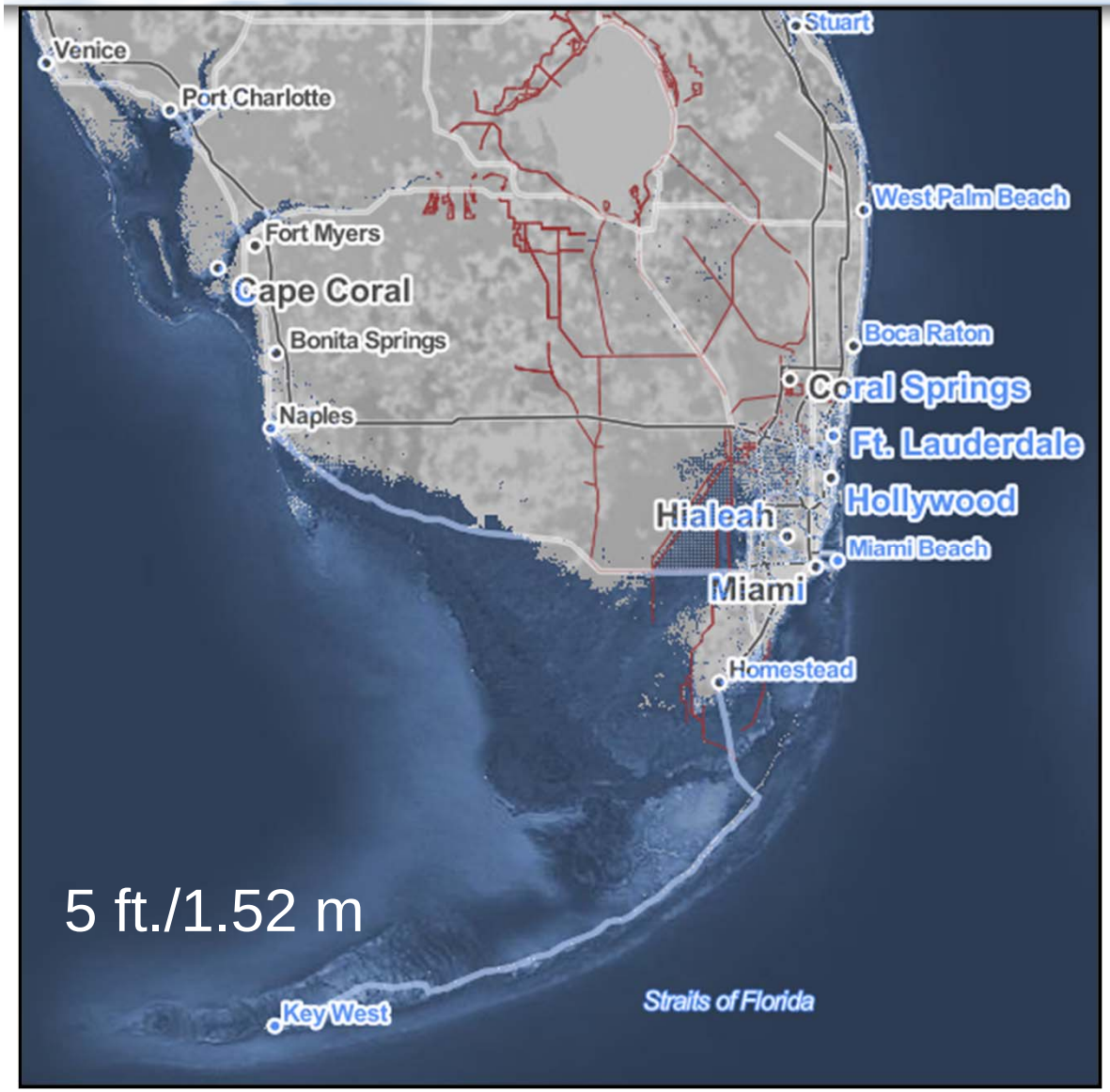

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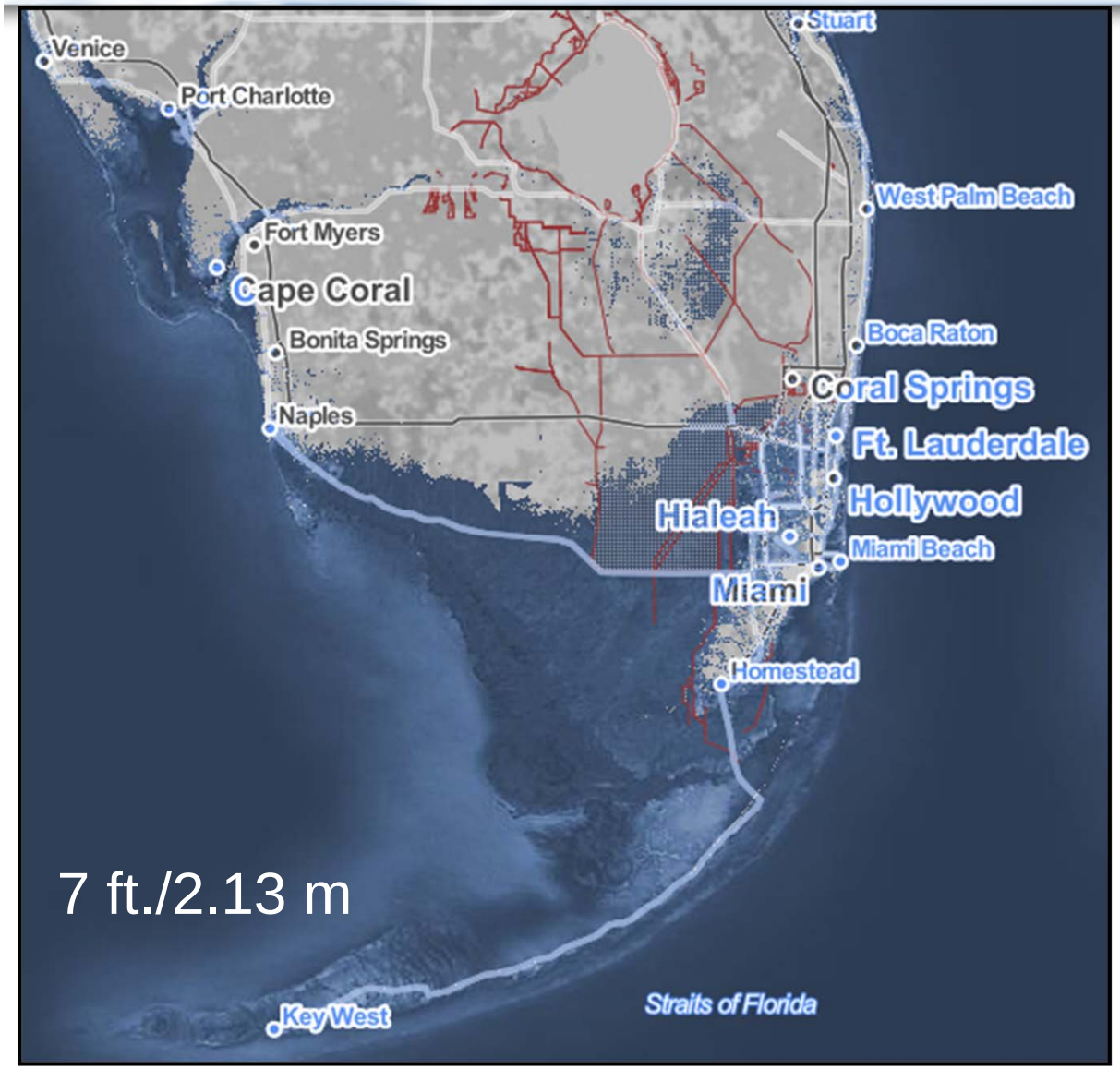

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A Bigger Florida Bay

Expected Near term:

- Climate will be dryer
- Freshwater inflows will decrease
- Existing freshwater peat will disappear
- Sea levels will rise regionally and locally

Expected Long term (sea level rise of 1-2 m):

- Conversion of most of ENP (1 m) and WCAs (2 m)
- Massive disruptions of ecosystems
- Greatly expanded area of shallow bays

Florida Bay's size will increase greatly at expense of Everglades National Park, Big Cypress Preserve, and WCAs

Thanks for Technical Assistance

- Interpretations are mine
- Jayantha Obeysekera
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  Jerry Lorenz