

Integrating Climate Change and Sea Level Rise into Water Resources Management

How We Got Here: Legal Perspectives

Keith Rizzardi

Office of Counsel

Governing Board Presentation

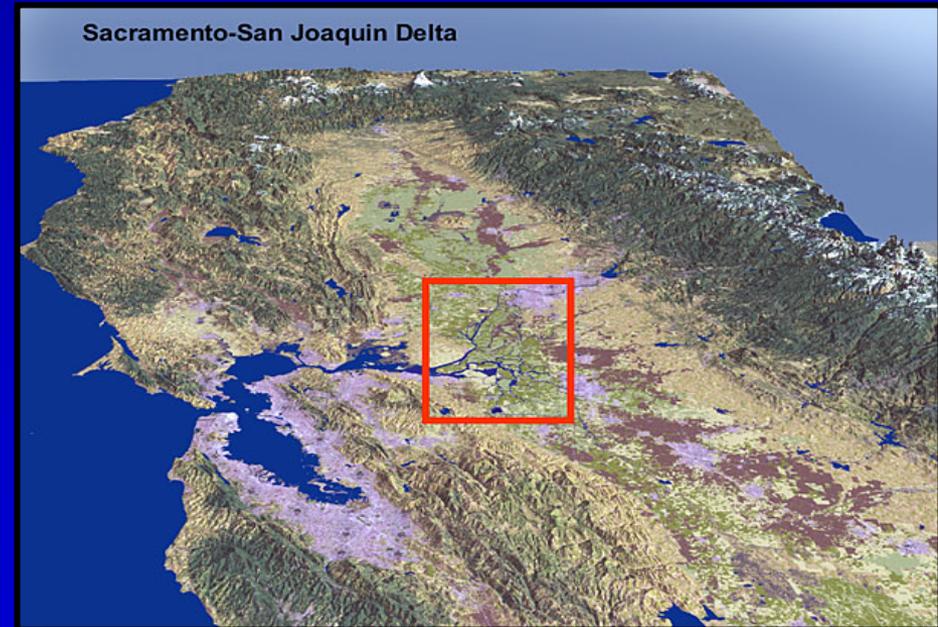
May, 2008

Supreme Court and Climate Change

- Massachusetts v. EPA, 549 U.S. ___ (2007)
- U.S. Supreme Court
 - “The harms associated with climate change are serious and well recognized... [including] a number of environmental changes that have already inflicted significant harms...”
 - global retreat of mountain glaciers
 - reduction in snow-cover extent
 - the earlier spring melting of rivers and lakes,
 - the accelerated rate of rise of sea levels during the 20th century relative to the past few thousand years...

NEPA & Climate Change Litigation

- **NEPA = National Environmental Policy Act**
 - Projects with Federal nexus must consider environmental impacts
- **Water Management in Sacramento Bay Delta**
 - Failure to consider effects of climate change on snowpack
 - Project injunction affects federal water contracts
 - Many similar cases nationwide



Emerging Law of Climate Change

- **Petition to White House CEQ (Mar. 2, 2008)**
 - International Center for Technology Assessment, NRDC, Sierra Club
 - "Rather than addressing issues on a case by case basis in the courts, the petition seeks to create systematic review of climate change in NEPA documents."
- **Endangered Species Act**
 - Listing of polar bear and coral species create potential for litigation over effects of federal actions on climate change

Legal departments tackle climate change



Florida and Climate Change

- Executive Order 07-126: *Leadership by Example*
- Executive Order 07-127: *Immediate Actions*
 - Actions and policies to reduce greenhouse gas.
- Executive Order 07-128:
Florida Governor's Action Team on Energy and Climate Change
 - Report underway, with 6 work groups:
 - Adaptation (protection, retreat, accommodation)
 - Agriculture Forestry & Waste
 - Cap and Trade
 - Energy Supply and Demand
 - Government Policy
 - Transportation & Land Use

SFWMD & Climate Change

- **SFWMD staff conducted initial literature review**
 - Largely global or national perspective
 - Less information specific to Florida
 - Awaiting FDEP Action Team report
- **Planning to obtain consultant assistance**
 - Complete literature review
 - Identify knowns and unknowns
- **Future staff participation and research efforts:**
 - Address NEPA and management concerns
 - Monitor key indicators, determine action triggers

Integrating Climate Change and Sea Level Rise into Water Resources Management

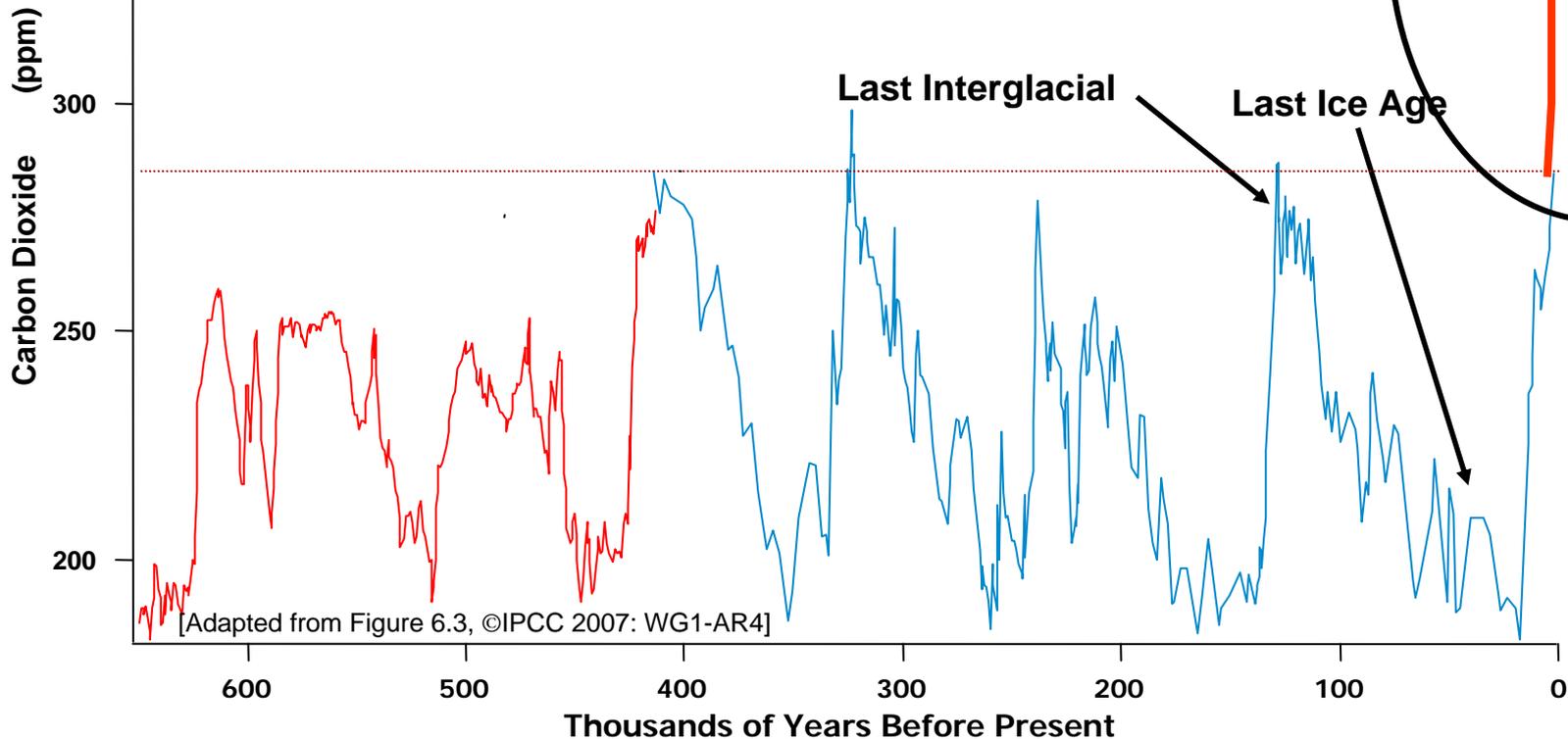
What We Need to Know: Scientific Perspectives

Jayantha Obeysekera
Hydrologic & Environmental
Systems Modeling

Intergovernmental Panel on Climate Change (IPCC)

- **Established in 1988 by United Nations (WMO, UNEP)**
- **Fourth Assessment Report (AR4) finalized in November, 2007**
- **Science based report (450 lead authors, 800 contributing authors, >2500 expert reviewers)**
- **Nobel Peace Prize along with Al Gore**

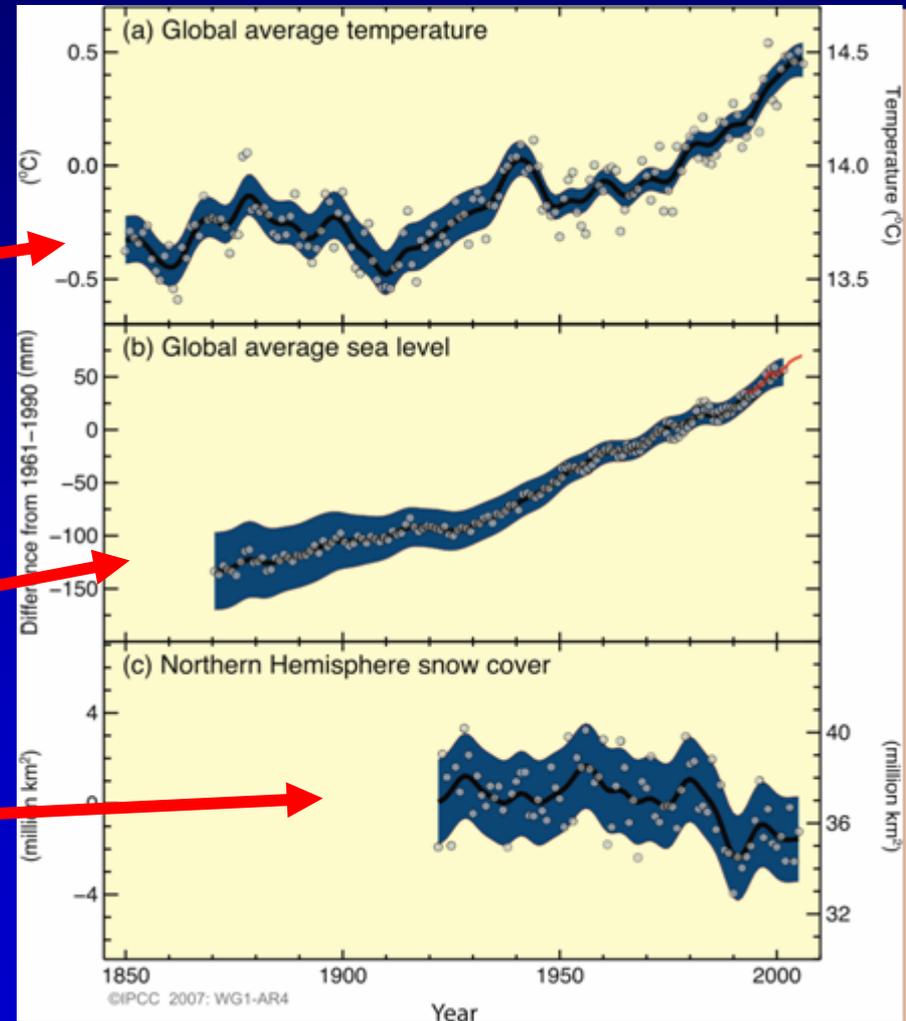
Carbon Dioxide (CO₂) increases of much greater magnitude than geological historical record



- Increase greenhouse gasses -> warming

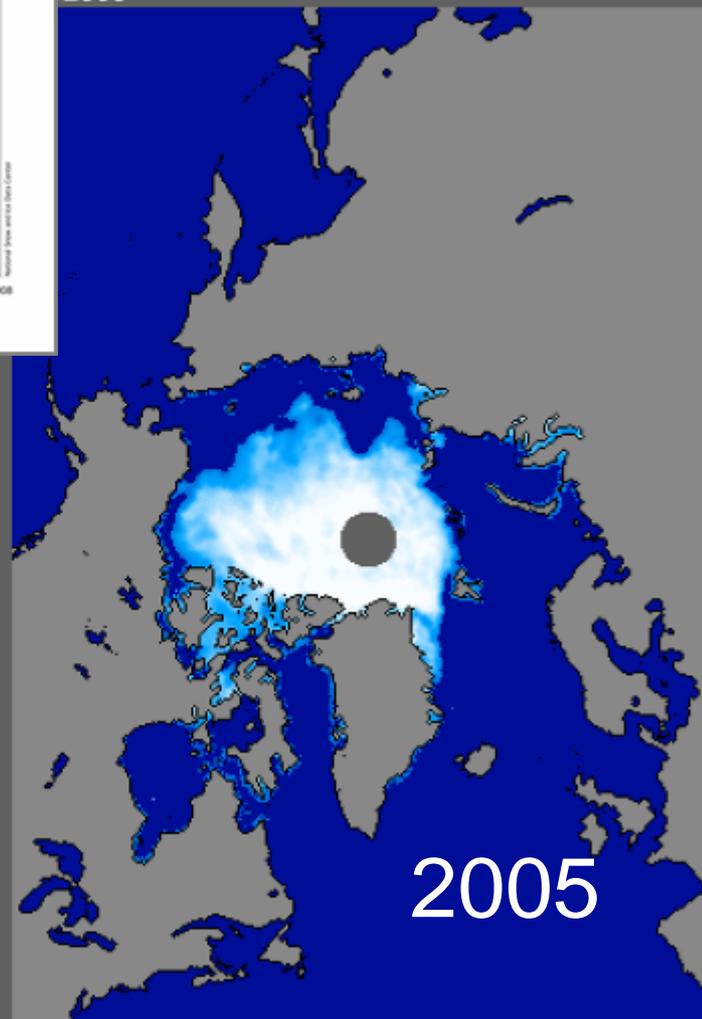
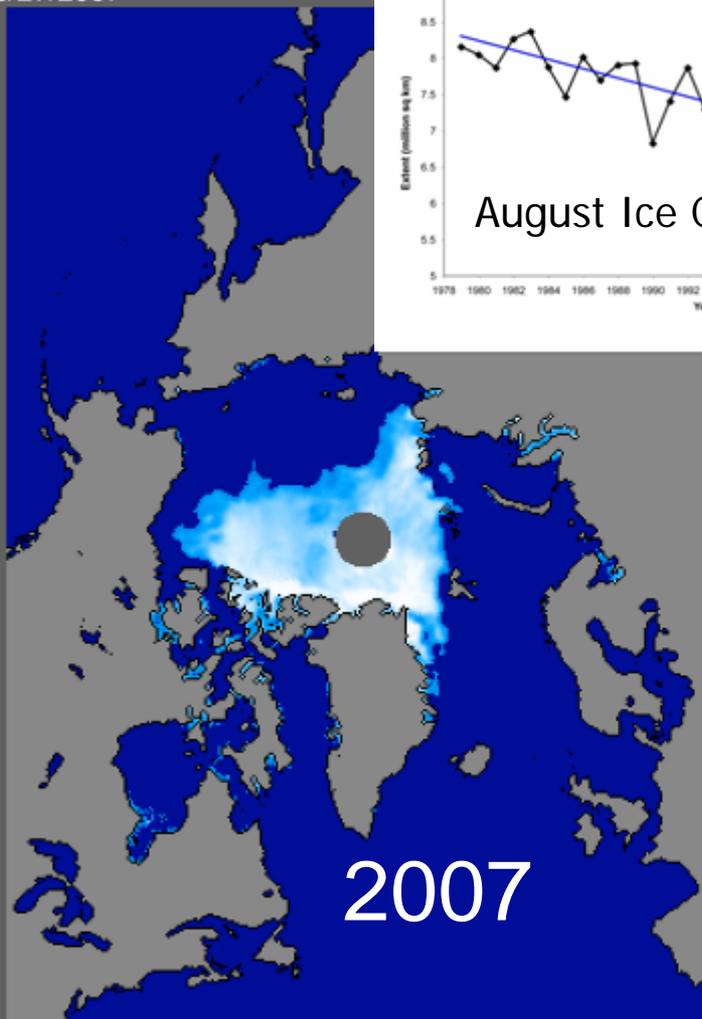
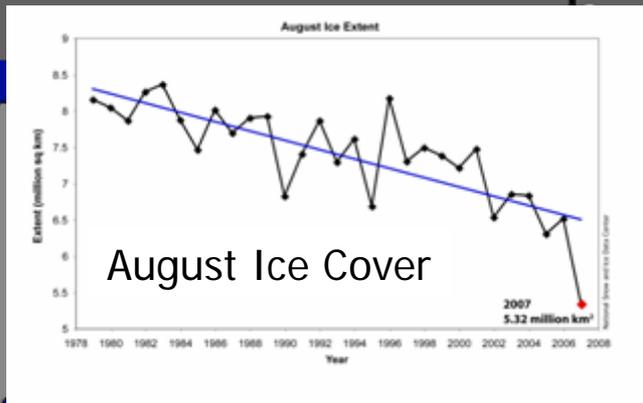
Three Primary Indicators of Global Warming

- “Warming of the climate system is unequivocal.”
— IPCC, AR4
- Average air and ocean temperatures
- Rising Sea Level
- Widespread melting of snow



Sea Ice Conc
08/27/2007

Sea Ice Conc
8/20/2005



Potential Tipping Points:
Accelerated melting of Greenland ice sheets,
reduction on ice cover in Arctic, Antarctica

Global Trends and Human influences

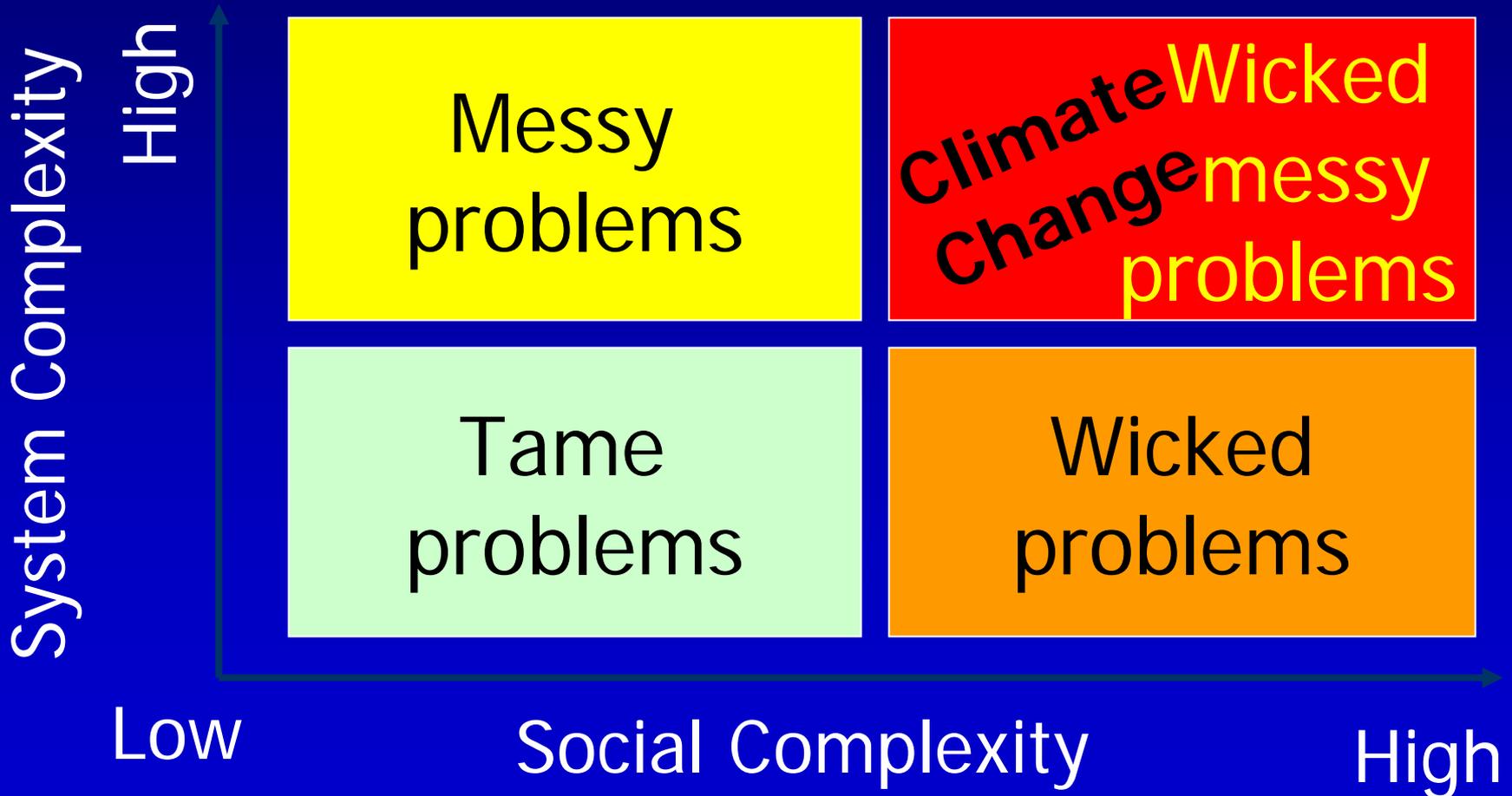
Important Climate Change Trends

- Fewer cold days & nights.
- More frequent hot days & nights.
- Warm spells/heat waves.
- Heavy precipitation events.
- Increased drought effects.
- Increased tropical cyclone activity.
- Increased extreme high sea level.

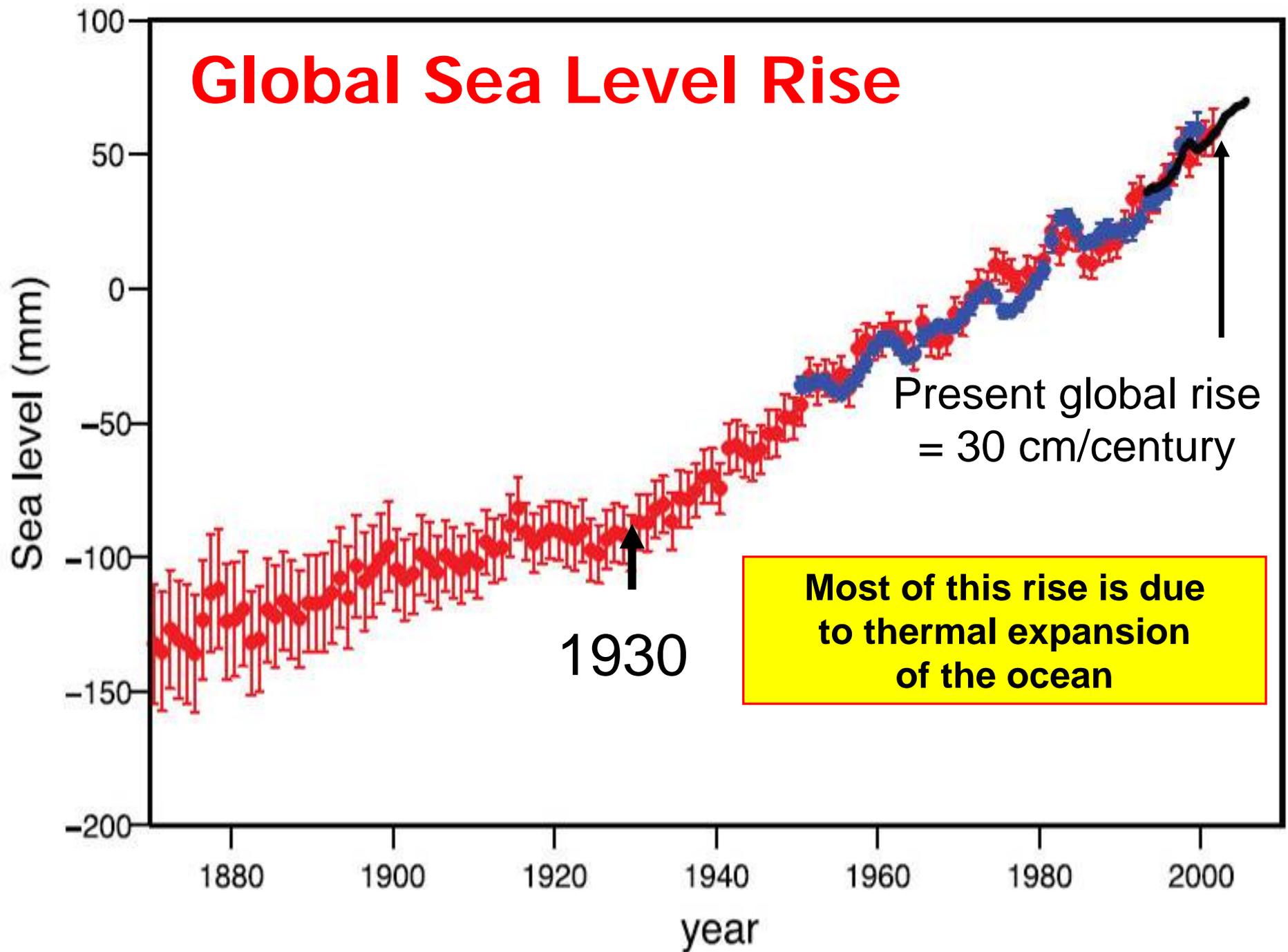
- According to IPCC, humans were most likely the cause of these trends.
- In addition, these trends are likely, **very likely**, and **virtually certain** to continue.

Nature of the Climate Change Problem

(Rik Lewis, MWH)



Global Sea Level Rise



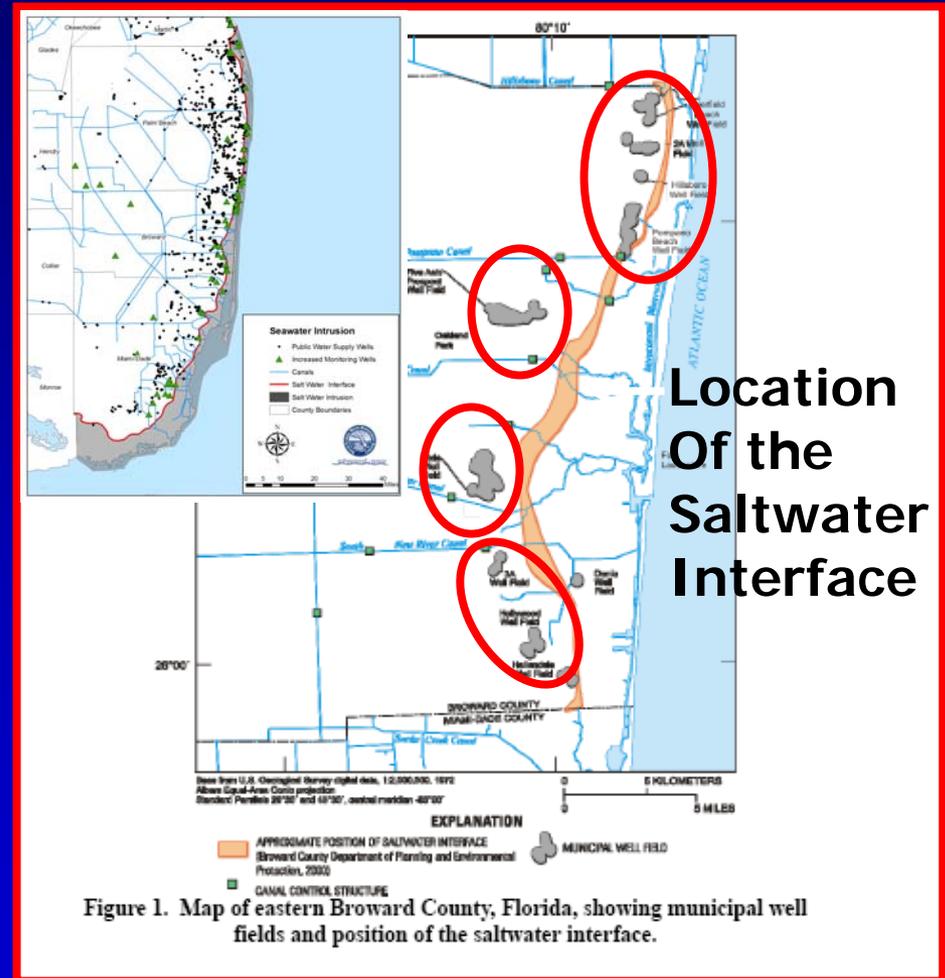
Sea Level Rise Projections

	2050	2100
IPCC (2007)		0.6-1.9 feet
CERP Guidance Memorandum (2004)	0.4 feet <i>Underestimated?</i>	0.9 feet
More likely (STC*, Miami-Dade)	1.5 feet	3-5 feet

* Science & Technology Task Force

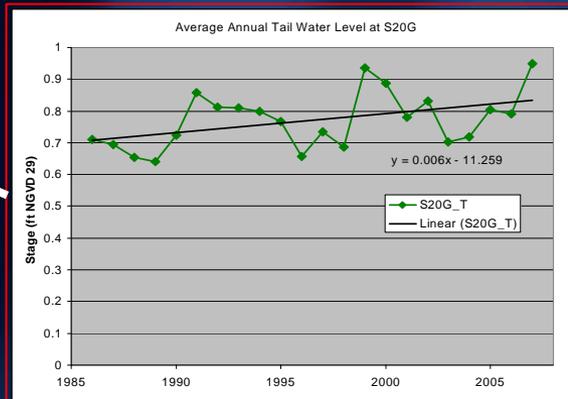
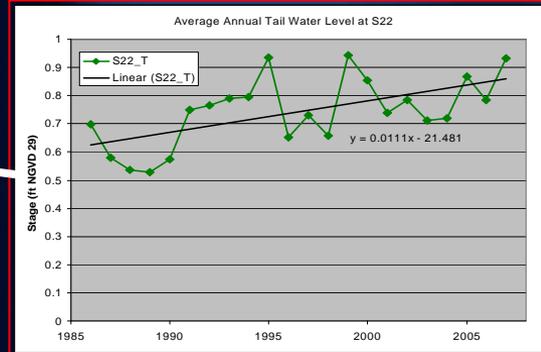
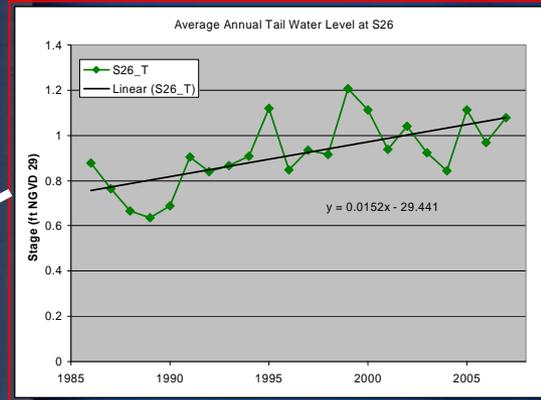
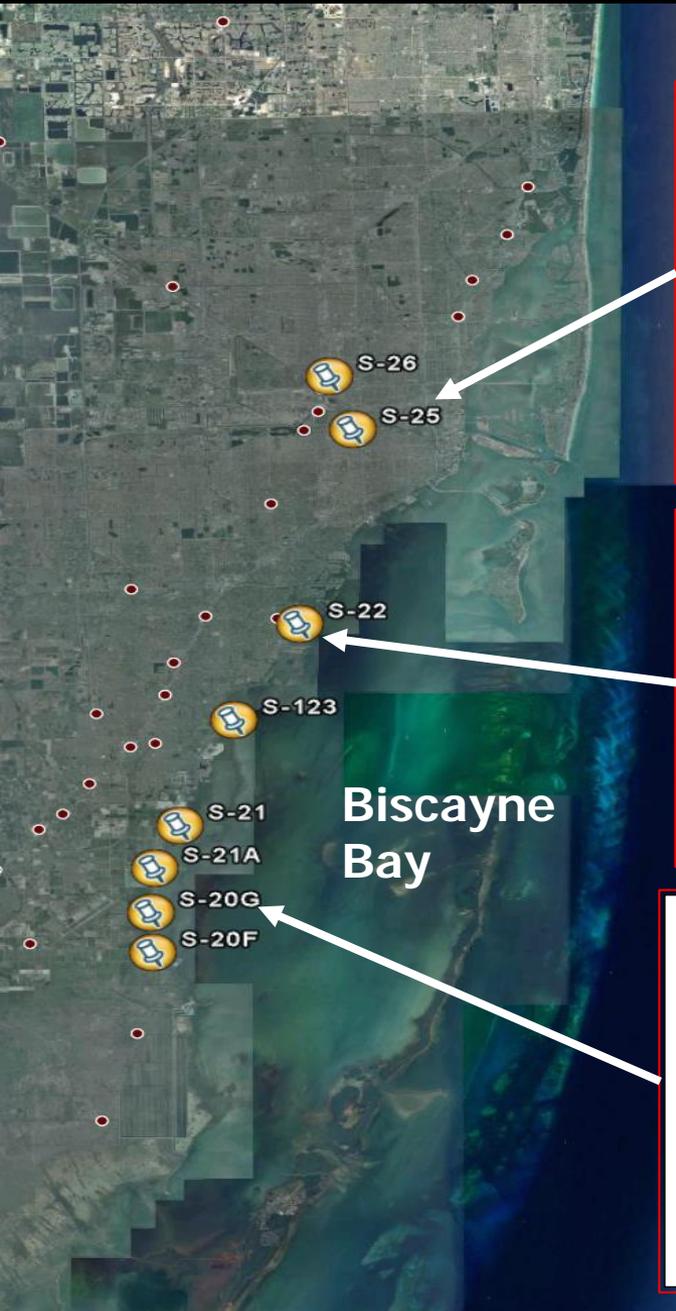
Impact on Coastal Wellfields

- Threat of saltwater intrusion on coastal wellfields is already a reality
- A USGS study: *“If the sea level rises about 48 centimeters over the next 100 years as predicted, then inland movement of the saltwater interface may cause well-field contamination”*





Increasing Trends in ocean-side water levels at SFWMD coastal structures



South Florida 1995

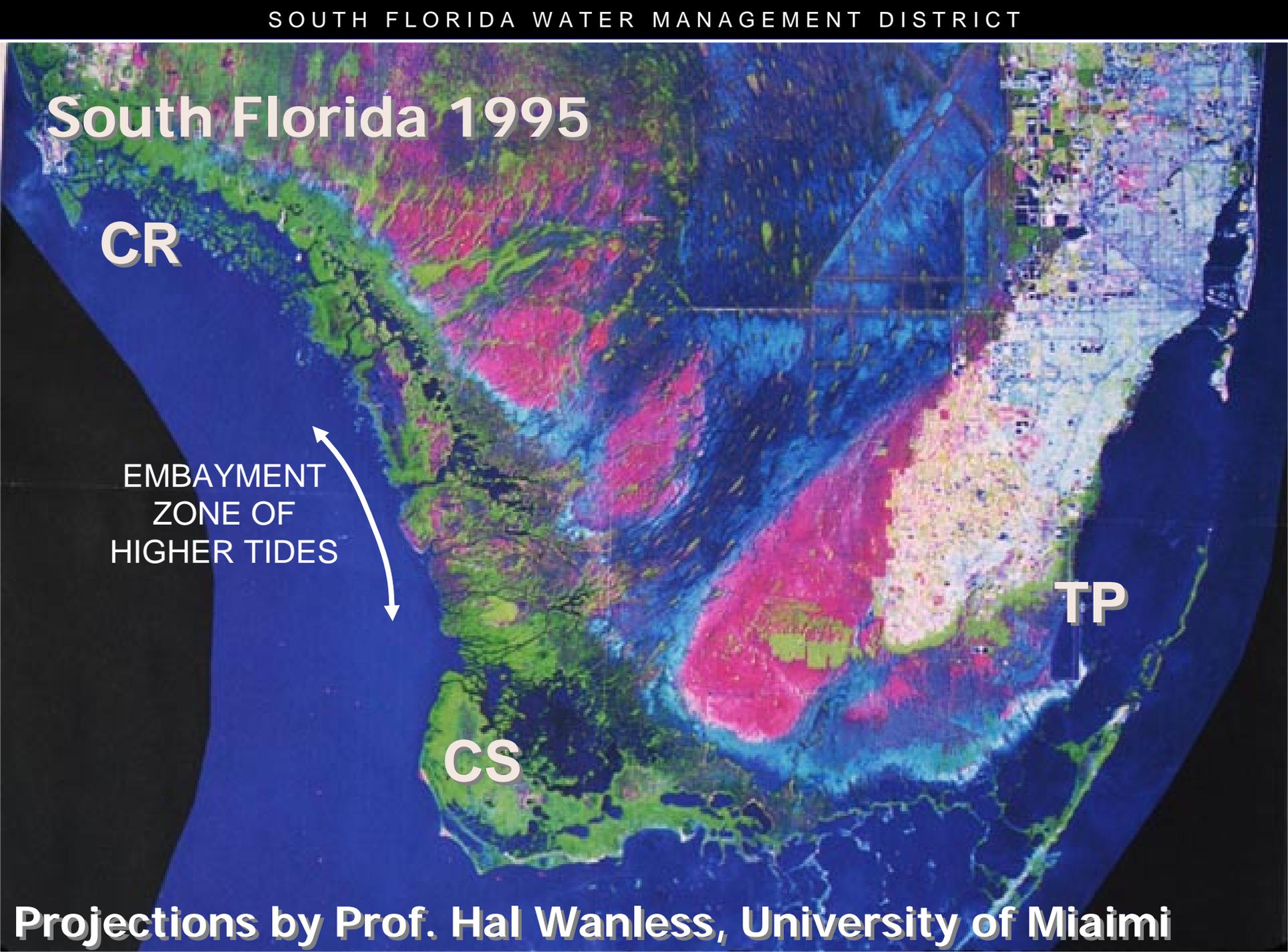
CR

EMBAYMENT
ZONE OF
HIGHER TIDES

TP

CS

Projections by Prof. Hal Wanless, University of Miami



+2 foot rise (mhhw = +4.5' above 1929 MSL)

CR

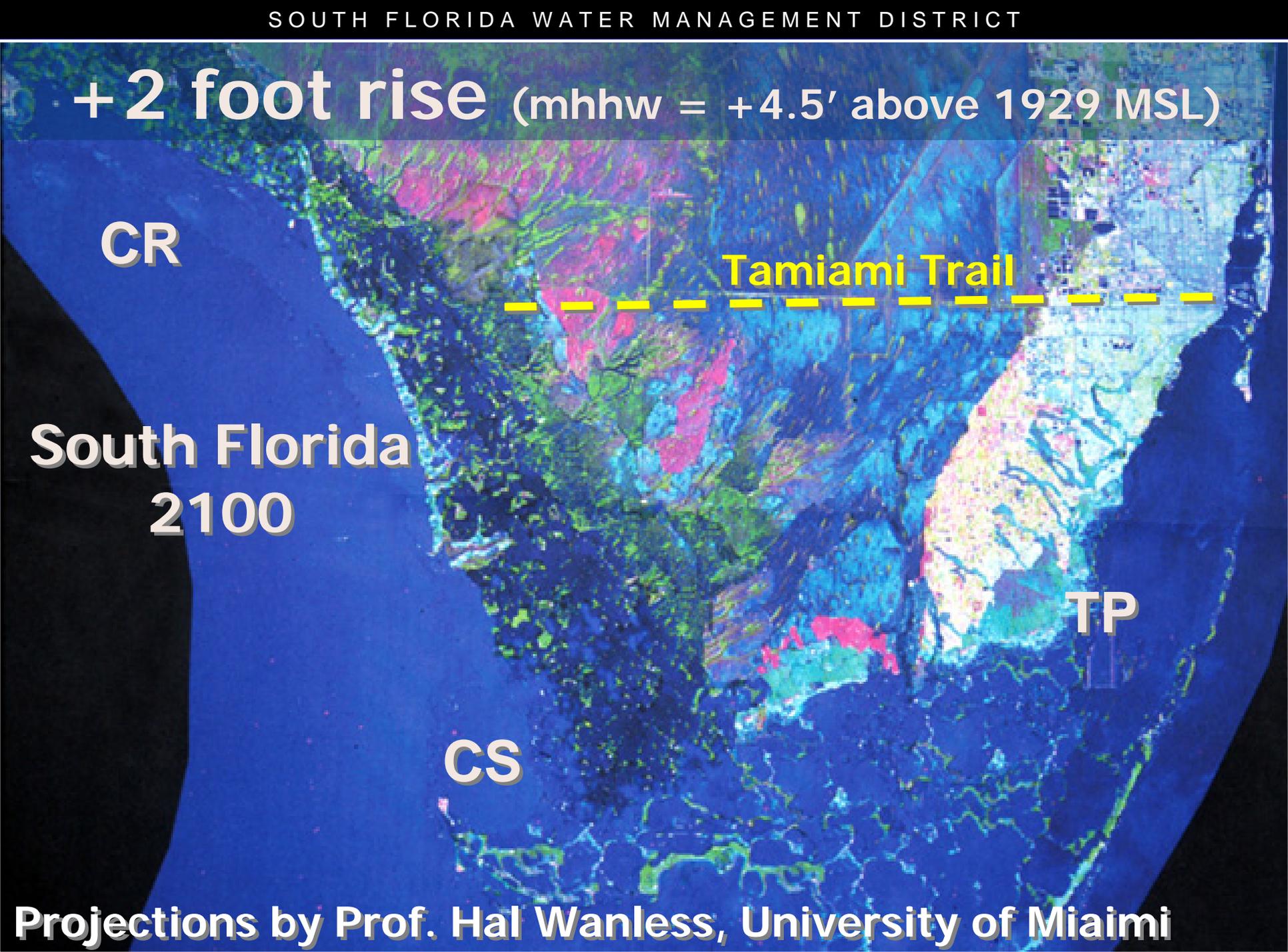
Tamiami Trail

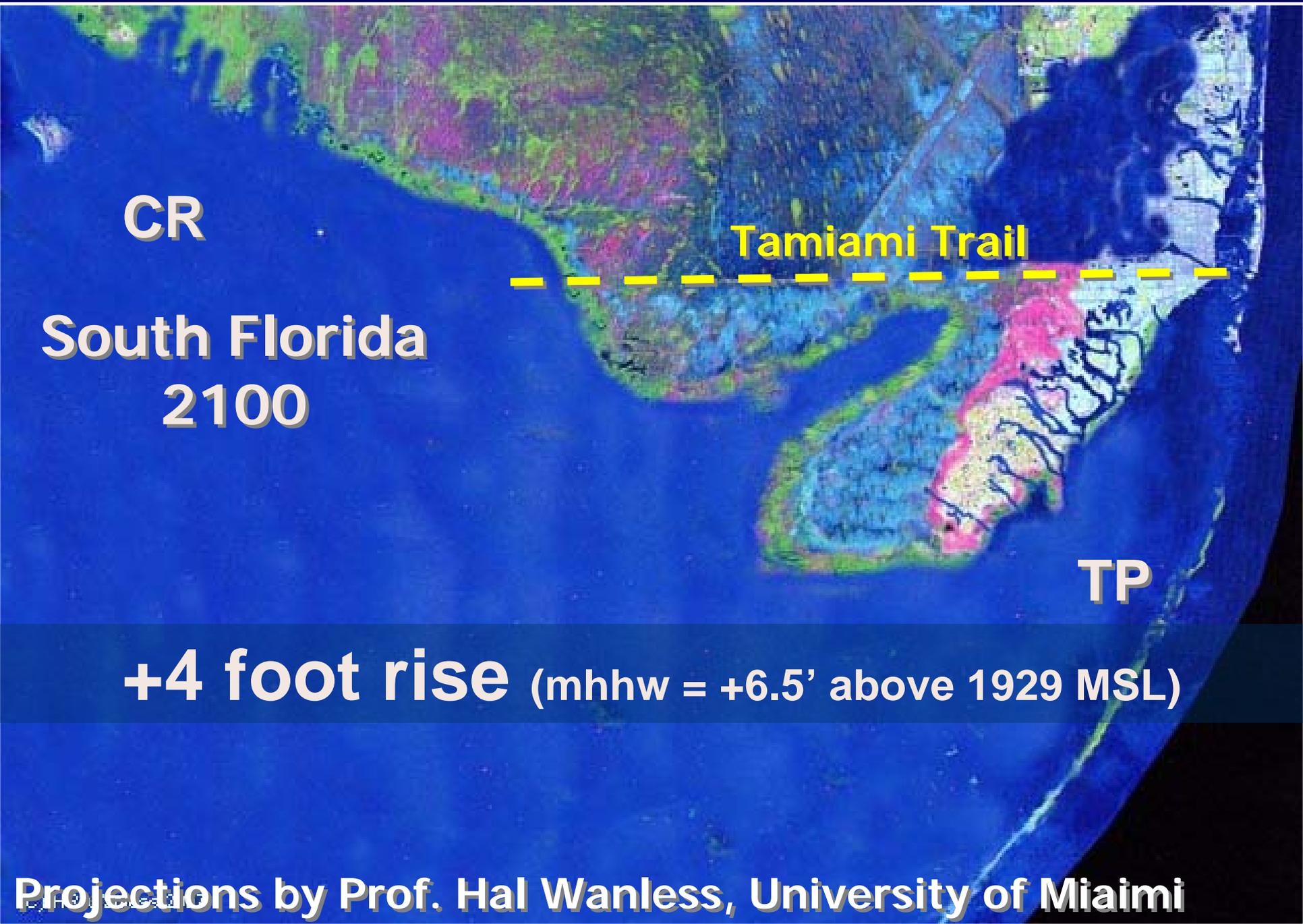
**South Florida
2100**

TP

CS

Projections by Prof. Hal Wanless, University of Miami





CR

Tamiami Trail

**South Florida
2100**

TP

+4 foot rise (mhhw = +6.5' above 1929 MSL)

Projections by Prof. Hal Wanless, University of Miami



CR

Tamiami Trail

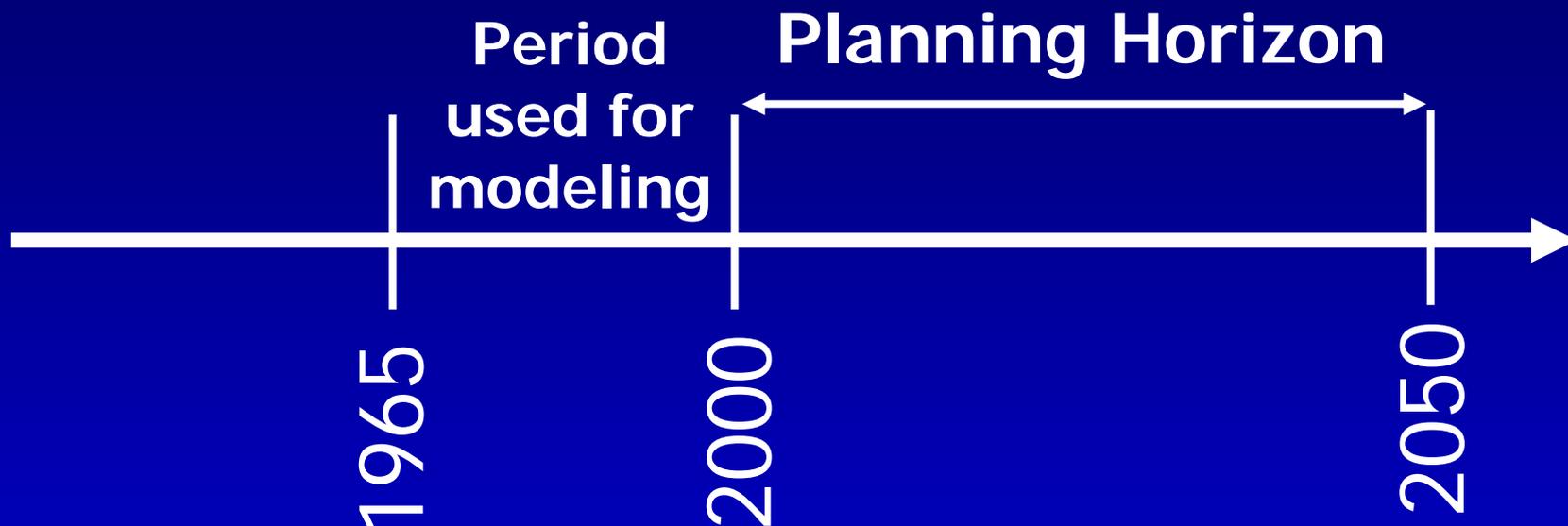
**South Florida
2100**

TP

+5 foot rise (mhhw = +7.5' above 1929 MSL)

Projections by Prof. Hal Wanless, University of Miami

Potential Implications for CERP Plan Evaluation



Assumption: 1965-2000 period used for modeling is representative of the climate expected during the future planning horizon = stationarity

Revisiting the Stationarity Assumption

- Due to climate change, experts are questioning even our most basic assumptions
- To quote Bear Stearns:
“Past performance does not guarantee future results.”
- Virtually all District activities could be affected

CLIMATE CHANGE

Stationarity Is Dead: Whither Water Management?

P. C. D. Milly,^{1*} Julio Betancourt,² Malin Falkenmark,³ Robert M. Hirsch,⁴ Zbigniew W. Kundzewicz,⁵ Dennis P. Lettenmaier,⁶ Ronald J. Stouffer⁷

Revisiting the Stationarity Assumption

If stationarity assumption is wrong,
District must (re)evaluate...

- *Flood Control & Operations*
- *Water Supply, Saltwater Intrusion*
- *Coastal Ecosystems*

What's next? (staff suggestion)

- **A multi-departmental staff initiative, with funding as appropriate (\$100K in FY09), to begin reviewing climate change and sea level rise impacts on water resources management**
 - Broader internal discussion and training of the topic.
 - Vulnerability analyses on the threats of climate change on water supply, flood control, and coastal ecosystems.

Questions?