Miami–Dade & Sea Level Rise

- Facts v Myths
- ‘Big Picture’ clarity
- Certainties and uncertainties
- Challenges and Opportunities
Not a Future Problem

High Tide on Alton Road

saltwater on the streets

every month at peak tide
Storms, Tides, and Sea Level Rise
- Combine for maximum effect
- Sea level rise is “permanent”
- Storm Surge
- Moderate Extreme Tide
- Topographic Amplification
- Minor subsidence
- Global ocean redistribution
- Rising Sea Level – EARLY stage
Rising Seas & Shifting Shorelines

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@ Google HQ
2-13-14
Sacramento, CA is 80 miles from the Pacific but has extreme vulnerability to rising sea level and over a thousand miles of earthen levees.
Myths about sea level rise (“SLR”)

1. Melting polar ice cap (North) big factor
2. “Being green” & sustainable can stop SLR
3. Technology could stop all sea level rise
4. Sea walls can protect south Florida
5. “Just a natural cycle”; humans no effect
6. Similar to storm surge and extreme tides
Sea level facts

1. SL reflects long-term temperature and ice.
2. Changed little in 6,000 years.
3. 100,000 year natural cycle (the ice ages) moves SL approx. 350 feet up & down.
4. Now moving slowly up; will continue for centuries, eventually rising ten feet and more.
5. We have not just accelerated, but have now changed the direction of the natural cycle.
FLORIDA THROUGH TIME

Today

18,000 yrs ago

120,000 yrs ago

- 120 meters (- 390’)

+ 8 meters (+ 25’)

Adapted from Wanless and Harlem
Sea Level Rise: 20th Century

20th Century rate
Satellite rate since 1993
Measured rate since 1993
Current sea level rise

1.9 mm yr⁻¹
3.2 mm yr⁻¹
3.0 mm yr⁻¹
3.4 mm yr⁻¹

(Updated from Church and White 2004)

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Global average sea level has increased 8 inches since 1880. Sea levels along the U.S. East Coast and Gulf of Mexico are rising much faster.

Local Sea Level Rise
1880-Present

The rate of local sea level rise varies depending on both global and local factors, including currents, ocean floor topography, variations in ocean density, and land uplift or subsidence due to geological reasons or human activities.
Sea level – primary factors

- Amount of Ice frozen *on land*
  - Natural Cycles, e.g. Ice Ages
  - Warming beyond cycles
- Thermal expansion of seawater
- Land uplift / subsidence
- Currents, e.g. Gulf Stream

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- Soil retention, dams, groundwater
Post-Glacial Sea Level Rise

- Meltwater Pulse 1A
- Last Glacial Maximum
- 390 ft

Thousands of Years Ago

Sea Level Change (ft)
The very long term correlation of sea level and global average temperature

The question is: What’s the lag time?

From Archer & Brovkin 2009
By 2100, new IPCC Projections: “10 – 32 Inches of SLR”

#’s do not include the “wild card” amplifiers:
- Methane
- West Antarctic glaciers
Actual SL Exceeding Projections

Sea Level Change (cm)

Year


Blue – 1990 Projections

Rahmstorf et al 2012

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Actual SL Exceeding Projections

Sea Level Change (cm)

Year


Blue – 1990 Projections  Green – 2002 Projections

Rahmstorf et al 2012

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Actual SL Exceeding Projections

Sea Level Change (cm)

Year


Blue – 1990 Projections
Gold – Actual Sea level
Green – 2002 Projections
Red – SL with trend line smoothing

Rahmstorf et al 2012

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How high will sea level rise in 30 years?
Takeaways

1. Storms + tides + SLR = vulnerability now
2. After years of stability, SL is rising and will continue for centuries
3. We can slow SLR, but not stop it
4. Inches matter
5. Know your risk; plan and adapt
6. Plan for 3 ft, - official estimates are low
the silver lining
1. Provides decades of notice
2. We do best when challenged
3. Could transform our priorities
Time to think of future generations.
My recommendations

1. Inform. Build Support: Businesses + voters for 30 year plan

2. Confront squarely. Don’t hide from it. **Adapt to three feet.**

3. Have a “risk assessment” done to guide your priorities. Some assets can be protected with engineering or be elevated; some will eventually have to be abandoned.

4. Initiate a carefully tiered series of engineering studies & plans to lay out the realistic options and how to phase them in. Critical is to know what questions to ask and of whom.

5. Establish an Institute to be a global center of excellence, working WITH local universities. This would attract ideas, tourism, and business. Creates confidence and leadership.
For more information:
www.johnenglander.net

“High Tide On Main Street”
2nd Edition

• Amazon
• Kindle