Unstoppable Sea Level Rise Demands Adaptation Now

Coastal Futures 2020
John Englander
London
NO WAKE ZONE
5 MPH
_IDLE SPEED

MOT PLANS
19436 CUMMINS

(IDLE SPEED)

(IDLE SPEED)
Climate Change
Climate Change

Energy Issues
GHG Reduction

Water
Weather
Temperature
Ecological
Disease
Food

Rising Sea Level
Climate Change

ENERGY related: reduce CO2 emissions (Greenhouse Gases) to slow and eventually halt the warming

EFFECTS: extreme weather, rain, droughts, high heat, wildfires, ocean acidification, melting glaciers

RIISING SEA LEVEL – can be slowed but not stopped this century – affects coastlines, migration, humanitarian, national security, real estate

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5 Flood Factors + Erosion

1. Storms
2. Rain
3. Runoff
4. Extreme Tides
5. Rising Sea Level
6. Erosion
GLOBAL TEMP CHANGE 2018 v 20th Century averages

NASA/GSFC GISS

-4.1 -4.0 -2.0 -1.0 -0.5 -0.2 0.2 0.5 1.0 2.0 4.0 11.6 (ºC)

-4.1 -4.0 -2.0 -1.0 -0.5 -0.2 0.2 0.5 1.0 2.0 4.0 11.6 (ºF)
GHG Traps Excess Heat equal to 500,000 atomic bombs a day. 
5 every second, 24 / 7 
93% of the heat is stored in the ocean.
MELTING ICEBERGS have no effect on sea level
ICE ON LAND: MAIN CAUSE OF SEA LEVEL RISE
LAST ICE AGE SEA LEVEL

LAST ICE AGE — 20,000 YEARS AGO

390 FT

TIME (YEARS AGO)

20,000
16,000
12,000
8,000
4,000
0

SEA LEVEL CHANGE (FT)

100
200
300
400

24,000
20,000
16,000
12,000
8,000
4,000
0

Miami Tower, Bank of America
Sea level Rise Since Last Ice Age
– Last 18,000 years

Doggerland and Doggerbank

British Isles and maritime area of sunken Doggerland with Viking Bank and Doggerbank Shoal

Land above Sea-Level:
- 16,000 BC
- 8,000 BC
- 7,000 BC
- Doggerbank 5,500 BC
- Storrega landslide
- ancient lake

Vistula-Würm glaciation (115,000 to 10,000 BC)
Greatest extent of the ice shield c. 20,000 BC

1 = Berlin
2 = Amsterdam
3 = London

Iceland
Scandinavia
Würm Glacier
Pack Ice Limit
Ice Shield Limit

Later Channel
Today
Today: 390 feet
20,000 yrs ago: -390 feet
120,000 yrs: +25 feet
20TH CENTURY SEA LEVEL RISE

- Sea level rise (MM) vs. year:
  - Measured data
  - Satellite data

- Sea level rise (in) from 1850 to 2000:
  - Measured data shows a steady increase.
  - Satellite data indicates a significant rise in recent years.

- Historical data highlights the acceleration of sea level rise in the 20th century.
RATE IS ACCELERATING

MEAN SEA LEVEL (CM)


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1.5 mm/yr.
3.2 mm/yr.
5 mm/yr.
IPCC Sea Level Rise Projections
IPCC Sea Level Rise Projections
IPCC Sea Level Rise Projections

4\textsuperscript{th} Scenario (RCP 8.5)

Sea Level @2100 +92 cm
## Unified Sea Level Rise Projection
*Southeast Florida Regional Climate Change Compact, 2015*

<table>
<thead>
<tr>
<th>Year</th>
<th>IPCC AR5 Median (inches)</th>
<th>USACE High (inches)</th>
<th>NOAA High (inches)</th>
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</thead>
<tbody>
<tr>
<td>2030</td>
<td>6</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>2060</td>
<td>14</td>
<td>26</td>
<td>34</td>
</tr>
<tr>
<td>2100</td>
<td>31</td>
<td>61</td>
<td>81</td>
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</tbody>
</table>

Southeast Florida Regional Climate Change Compact - 2015
LAST ICE AGE SEA LEVEL

LAST ICE AGE — 20,000 YEARS AGO

390 FT

TIME (YEARS AGO)

SEA LEVEL CHANGE (FT)

0

100

200

300

400

24,000

20,000

16,000

12,000

8,000

4,000

0

Miami Tower, Bank of America

30th floor
Sea Level, Temperature & CO₂

move together over thousands of years – 4 “ice age cycles” shown

Based on Work of James Hansen & Makiko Sato

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Sea Level, Temperature & CO₂ move together over thousands of years – 4 “ice age cycles” shown

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24 m / 1°C
Sea Level, Temperature & CO₂ move together over thousands of years – 4 “ice age cycles” shown

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SOME SALTY TRUTHS

• Rising seas and shifting shorelines are unstoppable, regardless of GHG reduction
• Every inch makes short term flooding worse
• Impossible to predict precisely
• Vulnerable property values will be discounted much sooner than people expect
• Property values go “underwater” 3 ways…
WHAT CAN YOU DO

• Educate yourself & others
  • Friends, family, neighbors, business associates
  • Investment advisor
  • Elected Officials: local, state, federal – revise building codes

• Evaluate your assets
  • Based on vulnerability, age, $, % at risk
  • Modify asset, sell it (move), or enjoy!
At a Deeper Level…

• Don’t panic
• Assess your vulnerability
• General Guideline: Plan for the first meter as soon as possible
  • Elevate
  • Retreat
  • Invest
### SAFE-Design Heights Future Flooding
#### “Englander 9 Box Matrix”

<table>
<thead>
<tr>
<th>Risk Sensitivity</th>
<th>30 years</th>
<th>60 years</th>
<th>100 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>30 cm</td>
<td>60 cm</td>
<td>2 m</td>
</tr>
<tr>
<td>Medium</td>
<td>60 cm</td>
<td>1.3 m</td>
<td>4 m</td>
</tr>
<tr>
<td>High</td>
<td>1 m</td>
<td>2 m</td>
<td>6 m</td>
</tr>
</tbody>
</table>

Figures shown are global average estimates for illustration only.
Antarctica Is Melting Three Times as Fast as a Decade Ago

The continent’s rate of ice loss is speeding up, which is contributing even more to rising sea levels.
1. Early 1970s. Pine Island Glacier is grounded at a bedrock ridge.
2. Warm, inflowing Circumpolar Deep Water melts the base of the glacier. The glacier steepens and accelerates.
3. Present day, observed by a remotely operated vehicle (ROV). Glacier is thinning and receding.
Only two major sources of potential sea level rise (SLR)

Greenland = 24 feet of SLR

Antarctica = 186 feet of SLR
WE CAN DESIGN FOR FLOODING
WE MUST RISE WITH THE TIDE
• Policy Centre & Think Tank
• Global Resource Hub
• Centre of Excellence for Professionals
• London could be global HQ
Sea Level, Temperature & CO₂

move together over thousands of years – 4 “ice age cycles” shown

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