Sea Level Rise in the Florida Keys

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The mean sea level trend is 2.24 millimeters/year with a 95% confidence interval of +/- 0.16 mm/yr based on monthly mean sea level data from 1913 to 2006 which is equivalent to a change of 0.73 feet in 100 years.
Key Finding #6
Coastal areas are at increasing risk from sea level rise and storm surge
The annual average temperature in the Southeast has risen 2°F since 1970, with the greatest seasonal increase in the winter months. There has been a 30 percent increase in fall precipitation over most of the region but a decrease in fall.

Climate change presents U.S.-affiliated islands with unique challenges. Small islands are vulnerable to sea-level rise, coastal erosion, extreme weather events, coral reef bleaching, ocean acidification, and contamination of freshwater resources with saltwater.

Global sea level has already risen due to the warming-induced expansion of the oceans, accelerated melting of most of the world’s glaciers, and loss of ice on the Greenland and Antarctic ice sheets. Sea level is currently rising at an increased rate. A warming climate
Climate.gov

News

NOAA’s Sea Grant Awards Eight ‘Climate Engagement’ Mini-Grants
Wed, 03 Feb 2010
Coastal residents, businesses and decision-makers around the country will consider how their communities can adapt to climate change through eight newly awarded NOAA National Sea Grant College Program grants.

Stratospheric Water Vapor is a Global Warming Wild Card
Thur, 28 Jan 2010
A 10 percent drop in water vapor ten miles above Earth’s surface has had a big impact on global warming, say researchers in a study published online January 28 in the journal Science. The findings might help explain why global surface temperatures have not risen as fast in the last ten years as they did in the 1980s and 1990s.

Emissions of Potent Greenhouse Gas Increase Despite Reduction Efforts
Wed, 27 Jan 2010
Despite a decade of efforts worldwide to curb its release into the atmosphere, NOAA and university scientists have measured increased emissions of a greenhouse gas that is thousands of times more efficient at trapping heat than carbon dioxide and persists in the atmosphere for nearly 300 years.

NOAA: December Global Ocean Temperature Second Warmest on Record
Thu, 21 Jan 2010
The global ocean surface temperature was the second warmest on record for December, according to scientists at NOAA’s National Climatic Data Center in Asheville, N.C. Based on records going back to 1880, the monthly NCDC analysis is part of the suite of climate services NOAA provides. Scientists also reported the combined global land and ocean surface temperature was the eighth warmest on record for December.
The greenhouse effect is a natural phenomenon whereby heat-trapping gases in the atmosphere, primarily water vapor, keep the Earth's surface warm. Human activities, primarily burning fossil fuels and changing land cover patterns, are increasing the concentrations of some of these gases, amplifying the natural greenhouse effect.

Source: Modified from the Marian Koshland Science Museum of the National Academy of Sciences' "Global Warming: Facts & Our Future" 2004
Indicators of a Warming World

- Glaciers
- Temperature Over Land
- Snow Cover
- Permafrost retreating poleward
- Sea Level
- Species migrating poleward and upward
- Spring coming earlier
- Humidity
- Air Temperature Near Surface (troposphere)
- Temperature Over Oceans
- Sea Surface Temperature
- Ice Sheets
- Sea Ice
- Ocean Heat Content

http://www.skepticalscience.com/graphics.php?g=8
Factors Affecting Sea Level Change

A. Components of Change
   a. Water-related
      i. Thermal Expansion
      ii. Volume Increase – Glacial and Ice Sheet Melt
   b. Land-related
      i. Erosion
      ii. Land subsidence and uplift
      iii. Glacial rebound
      iv. Tectonics
Tide Gauge Observations

Average Rate ~ 1.8 mm/year

Source: O. Pilkey, adapted from Church and White (2006)
SE FL Regional Climate Compact’s SLR Rise Planning Projection (Based on USACE)

- **Annual Sea Level at Key West**
- **Projected Sea Level Rise Range based on USACE Guidance**
- **Continuation of Historic Sea Level Rise Rate**

- **2010**: Sea level = 0 inches
- **2030**: 3-7 inches
- **2060**: 9-24 inches
No SE FL Compact Projection Beyond 2060, but Be Aware of the Potential for SLR

Relative Sea Level Rise Scenarios for South Florida

Notes: Projections are for historic, modified National Research Council (NRC) Curve I and modified NRC Curve III rates of sea level change developed for South Florida per USACE Engineering Circular (EC) 1165-2-211. This EC is based on guidance in the NRC report, Responding to Changes in Sea Level: Engineering Implications, dated September, 1987. The projection is developed using the historic rate of sea level rise at Key West as reported by NOAA (2.24 mm/yr). The dashed line indicates that the EC equation is being used past the year 2100. The underlying documents supporting the EC do not address dates beyond 2100.
Conclusions

• Evidence supports that sea level is rising and will continue to rise.
• Precise long term projections are not possible
• A substantial increase in sea level rise within this century is both possible and likely.
• SE FL Compact projection provides guidance to initiate planning now to develop adaptation strategies.
Sea level rise modeling focused on Big Pine Key using fine scale elevation data
  – Potential future shorelines
  – Changes in terrestrial habitat distribution
  – Property value loss estimates

Sea level rise modeling on the entire Keys using coarse scale elevation data

Resilience and adaption responses
2008 Value Data
$1,561,809,861
6,235 acres
BIG PINE KEY SCENARIO 4: +100 cm (39.3 in) 2100 MID RANGE RAHMSTORF ET AL. 2007
+50 cm (19.7 in.) TO +140 cm (55 in.)

-$993,000,000
-4980 acres
### PROPERTY VALUE AND ACREAGE AT RISK UNDER VARIOUS SLR SCENARIOS (MONROE COUNTY; 30M NED)

<table>
<thead>
<tr>
<th>SLR Scenario</th>
<th>LOWER KEYS</th>
<th>MIDDLE KEYS</th>
<th>UPPER KEYS</th>
<th>FLORIDA KEYS</th>
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<tbody>
<tr>
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<td>PROPERTY VALUE AT RISK</td>
<td>ACRES</td>
<td>PROPERTY VALUE AT RISK</td>
<td>ACRES</td>
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<tr>
<td>IPCC 18cm</td>
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</table>

Note: Figures are rounded to 3 significant digits. Entries may not sum to totals due to rounding.
SE FL Regional Climate Change
Compact Vulnerability Assessment

2-Foot Sea Level Rise Scenario

Long Key -- Duck Key
By mitigating the root causes of global climate change at international through local scales
  – Atmospheric pollution from greenhouse gases
  – Deforestation and forest degradation

By preparing our local natural areas, native species populations and the built environment
  – Enhancing their resilience to undesirable change
  – Then enabling them to adapt to unavoidable change

And Now is the Time to Start
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