

Sea Level Rise (SLR) Projection

A Platform for Discussion with the Science and Technical Committee

Presented by:

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February 24, 2009



Presentation Outline

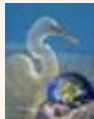
1. Existing recommendations
2. Current rise rates
3. Future projections
4. Modeling issues
5. Uncertainties



Existing Recommendations

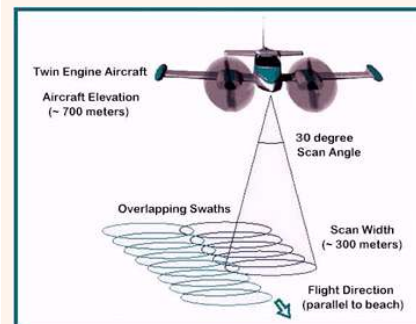
Miami-Dade CCATF Science and Technical Committee Apr 2008

1. 2050 1.5 feet (0.45 meters) SLR
2. 2100 3-5 feet (1-1.5 meters) SLR
3. Model SLR scenarios by one foot intervals up to 5 feet - LiDAR



LiDAR (Light Detection and Ranging)

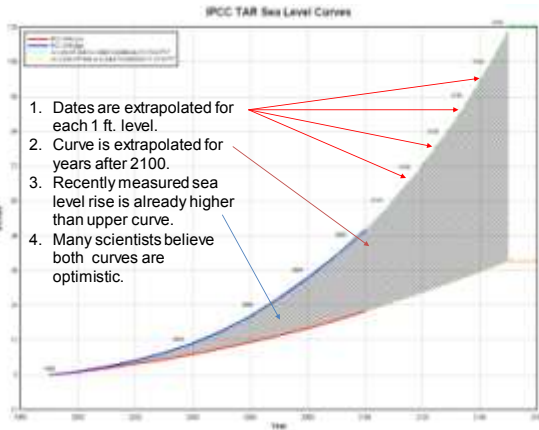
a critical tool in projecting climate change impacts



<http://www.csc.noaa.gov/products/scoasts/html/tulid.html>



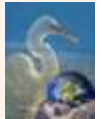
- 1) a remote sensing system used to collect topographic data
- 2) collected with aircraft-mounted lasers
- 3) records elevation to a vertical precision of **approx 6 inches**



Slide # 6 from "Sea Level Rise in Miami-Dade County Florida-Implications for Management of Coastal Wetlands and the Everglades. Peter W. Harlem and Dr. John F. Meeder, Florida International University Southeast Environmental Research Center"

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Current Sea Level Rise Rates

A. Global

- a. 1.3-2.3 mm/yr (1961-2005, IPCC 2007)
- b. 2.4-3.8 mm/yr (1993-2003, CCSP, 2009*)
- c. 3.0-3.2 mm/yr (1993-2008, Cazenave et al., 2008**)

B. Regional

- a. Atlantic Coast
 - i. 2-4 mm/yr (CCSP, 2009)
- b. Gulf of Mexico
 - i. 2-10 mm/yr (CCSP, 2009)

* Tide gauge and altimetry – Bindoff et al., 2007
 ** Altimetry



Current Sea Level Rise Rates (cont)

C. Local

- a. Miami Beach
 - a. 2.2 - 2.6 mm/yr (1931-1999, Zervas, 2001)
- b. Key West
 - a. 2.2 - 2.4 mm/yr (1913-1999, Zervas, 2001)



Current Sea Level Rise Rates (Projected)

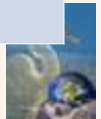
- Some projections assumes all conditions are static
 - SLR rate does not change
 - No increase in GHG production
 - No change in glacial melt rate
- Others (IPCC - BAU scenarios) use current trends when adequate data is available



Current Sea Level Rise Rates (Projected)

Location and Rate	In 41 years, 2050	In 91 years 2100
Global max SLR @ 3.8 mm/yr	0.156 m	0.346 m
Regional max SLR in Gulf of Mexico @ 10 mm/yr	0.41 m	0.91 m
Local max SLR in Miami Beach @ 2.6 mm/yr	0.107 m	0.237 m
Miami-Dade CCATF Science and Technical Committee Recommendations	0.45 m	1.5 m
Jevrejava et al., 2008. Recent global Sea level acceleration started over 200 years ago. Geophys. Res. Letts. 35:L08715.		0.34 m

1 ft = 30 cm



Globally, Sea Level is rising AND falling

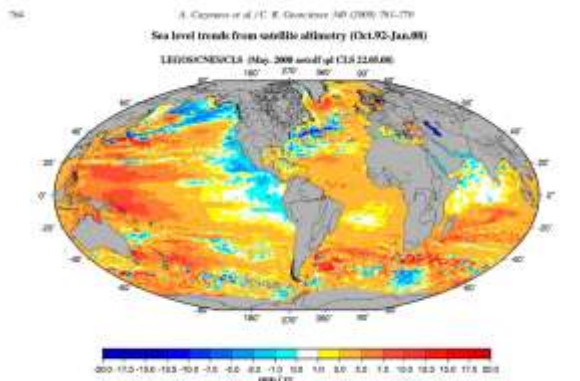


Fig. 3. Geographical distribution of linear sea level trends computed over 1993-2000 from multi-satellite altimetry. Distribution géographique des vitesses de variation de niveau de la mer entre 1993 et 2000 basées sur les données altimétriques multi-satellites.

Factors Affecting Sea Level Change

A. Components of Change

- Water-related
 - Thermal Expansion of sea water
 - Volume increase via
 - ice sheet melting and
 - land water storage change e.g. glaciers
- Land-related
 - Erosion
 - Land subsidence and uplift
 - Glacial rebound
 - Tectonics



Continued on next page

Factors Affecting Sea Level Change

A. Components of Change (cont)

- c. Earth-related
 - a. Albedo flip
 - b. Gravity*
 - c. Rotational effects*

*Result in non-uniform distribution of sea-level rise



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A. Cazenave et al./C. R. Geoscience 340 (2008) 761-770

Table 1

Sea level budget for 1993-2003 and 2003-2008

Bilan des différentes contributions au niveau de la mer pour les périodes 1993-2003 et 2003-2008

Rate of sea level rise	1993-2003 mm/yr	2003-2008 mm/yr
1. Thermal expansion	1.6 ± 0.3 [4,26]	0.37 ± 0.1 Argo ^a
2. Glaciers	0.8 ± 0.1 [21]	1.1 ± 0.25 [31]
Greenland	0.2 ± 0.04	0.4 ± 0.05
Antarctica	0.2 ± 0.17	0.55 ± 0.06
3. Total ice sheets	0.4 ± 0.2 [23]	0.95 ± 0.1 ^a
Land waters		0.2 ± 0.1 [36]
Sum of 1 + 2 + 3 + 4	3 ± 0.5	2.6 ± 0.3
Observed (satellite altimetry GLA applied)	3.1 ± 0.4 [4,6]	2.5 ± 0.4 ¹

Synthesis from text.

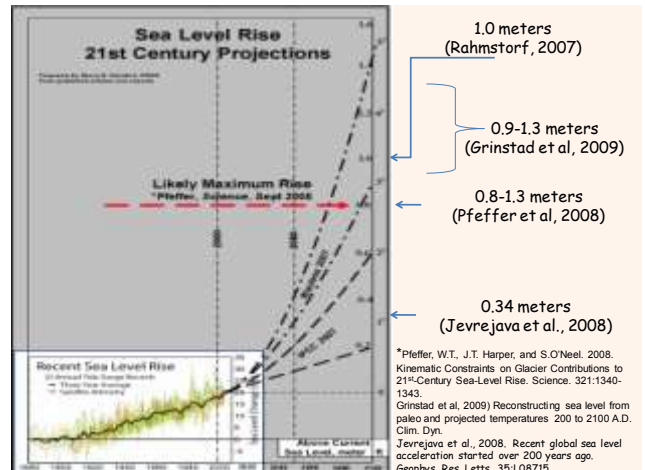
Synthèse à partir du texte.

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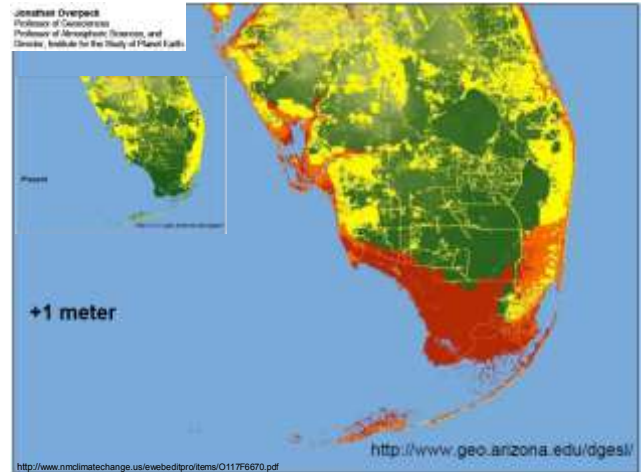
Future projections for 2100

- A. 0.3 m to 0.91 m (IPCC, 2000)
- B. 0.18 m to 0.59 m (IPCC, 2007)
- C. 0.5 to 1.4 m (Rahmstorf, 2007)
- D. ~5 m (Hansen, 2007)
- E. 6.3 m (Mitrovica et al, 2009)
- F. ?? (Broward CCTF Science and Technical Subcommittee)

A range of 60-90 cm (high end of IPCC projections) appears to be a general consensus value for 2100 among many authors.



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Projection Concerns

1. Positive environmental feedbacks
2. Greater pace of ice melting than previously predicted
3. Drawbacks in the current models
4. Global scale models which cannot reflect local impacts
5. Assumptions of eustatic change
6. Predictions if no change in global warming occurs - Unclear if current impact is reversible within generational time-scales



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Model concerns

- Inadequately addresses climate decadal variability
- Non-rotating earth*
- No marine ice*
- Shoreline and land in fixed geometry*
- Sea level responding more quickly than models predict **
- Non-linearity of the factors



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*Mitrovica et al. Science Feb 2009.
**Rahmstorf et al. Science May 2007.

Conclusions

- Great uncertainty remains
- New research and data are being developed daily.
- This committee must make a recommendation to the Full Task Force on potential scenarios to test.



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