

Global Climate Change: Implications for South Florida

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INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE



Climate Change 2007: The Physical Science Basis

Summary for Policymakers

Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

This Summary for Policymakers was formally approved at the 10th Session of Working Group I of the IPCC, Paris, February 2007.

Note:

Text, tables and figures given here are final but subject to checking and copy-editing and editorial adjustments to figures.

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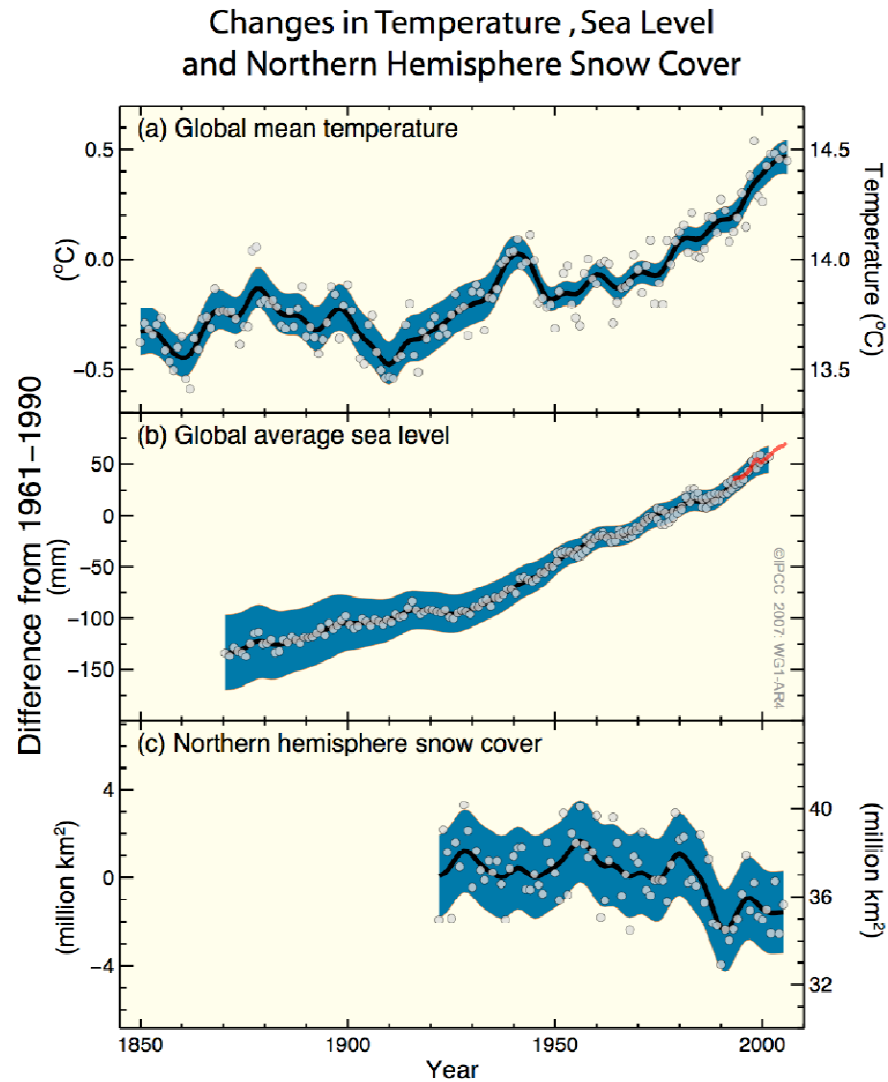
IPCC 2007

+ findings since the report
+ discussion of uncertainty

The physical science basis

- Detection
- Attribution
- Projections

Detection: Global warming in 3 parameters

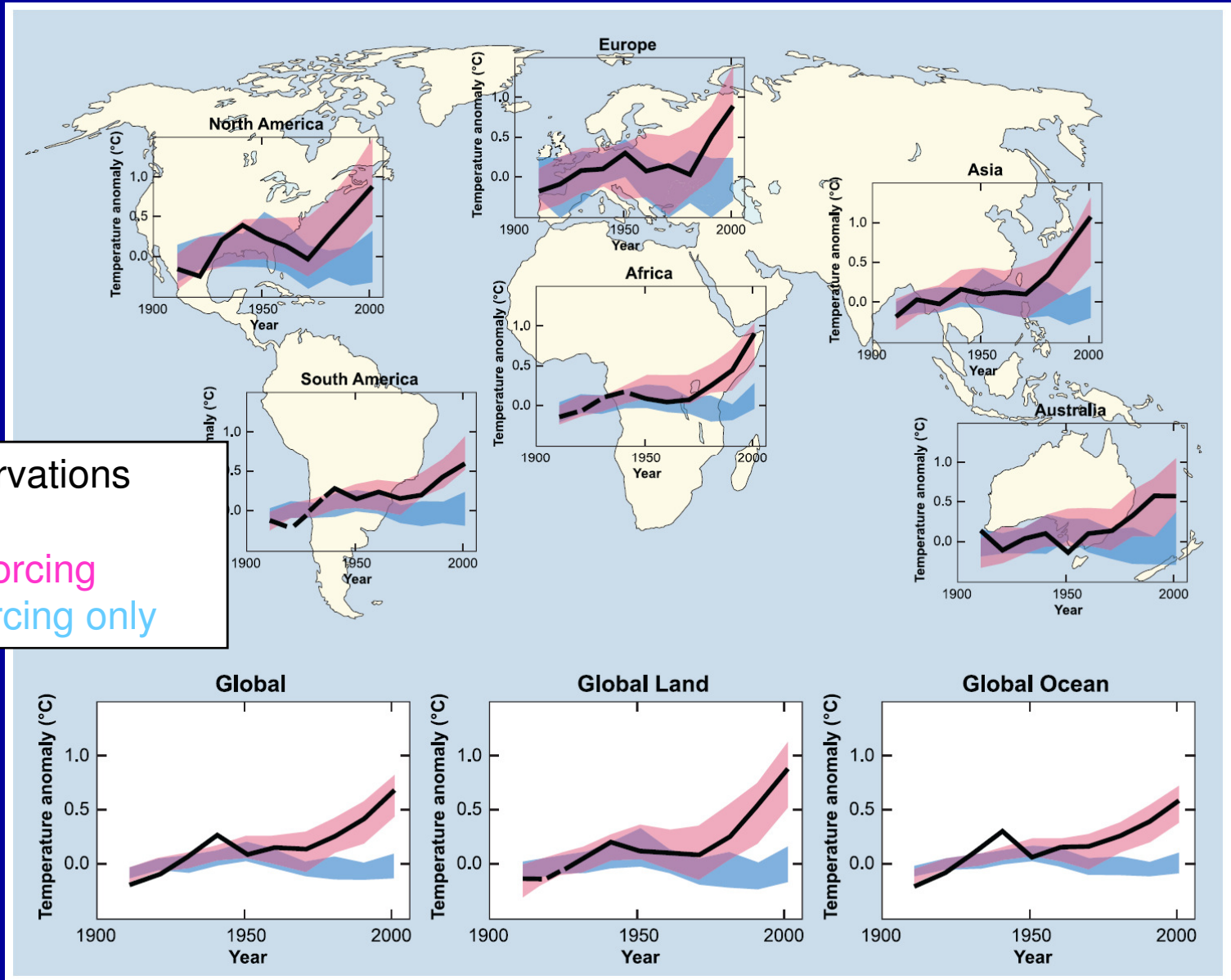


Blue shading
represents
error in
estimates

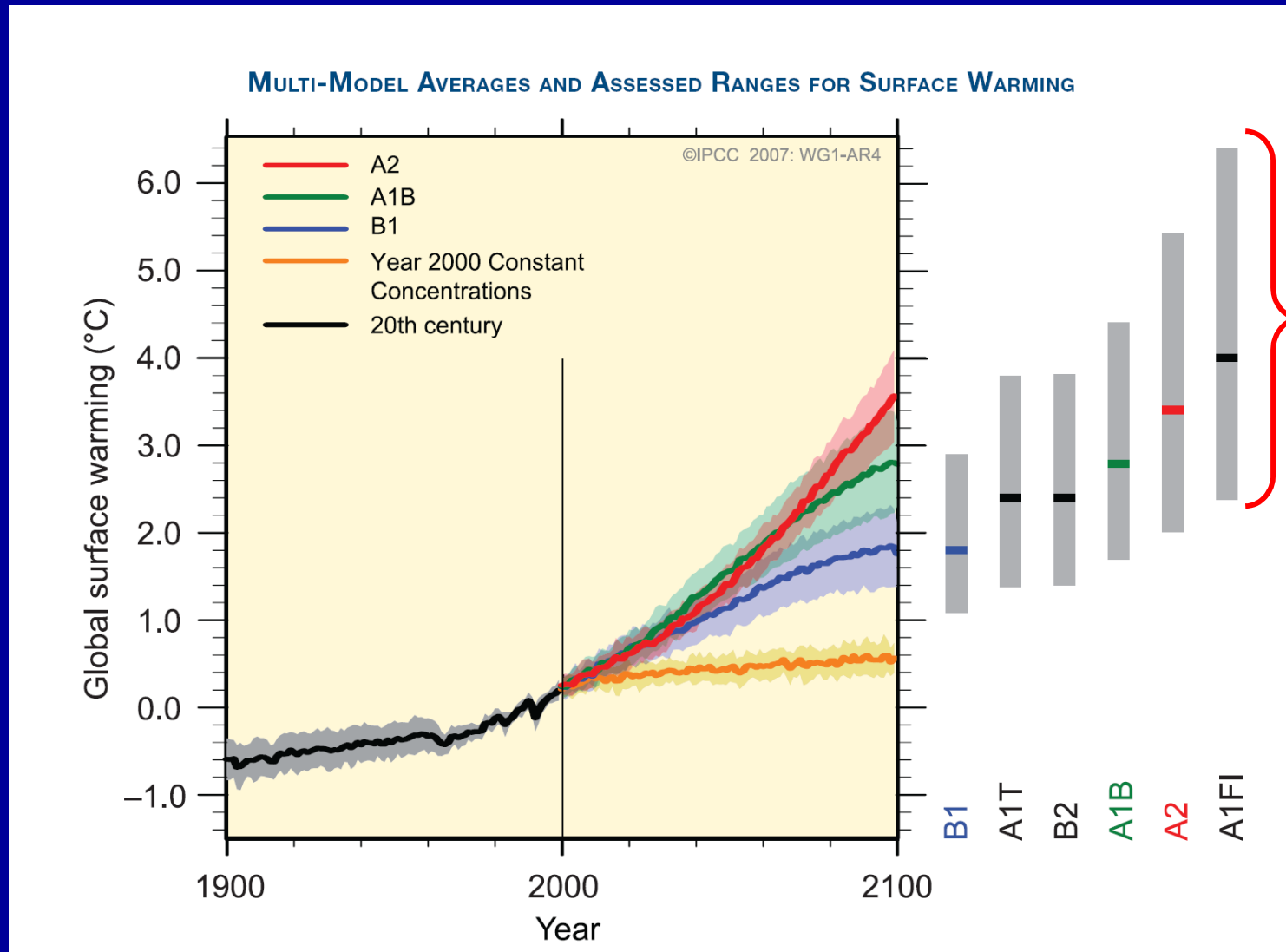
Attribution: Global Climate Models

- 23 coupled ocean-atmosphere models
 - General circulation described by equations of motion
 - Radiation, thermodynamics, convection... parameterizations
- 20th century forcing (CO₂ + aerosols + volcanoes + solar variability)
- 21st century CO₂ forcing (Projections)
- Multi-model average + statistics

Attribution: 20th century simulations



Temperature Projection

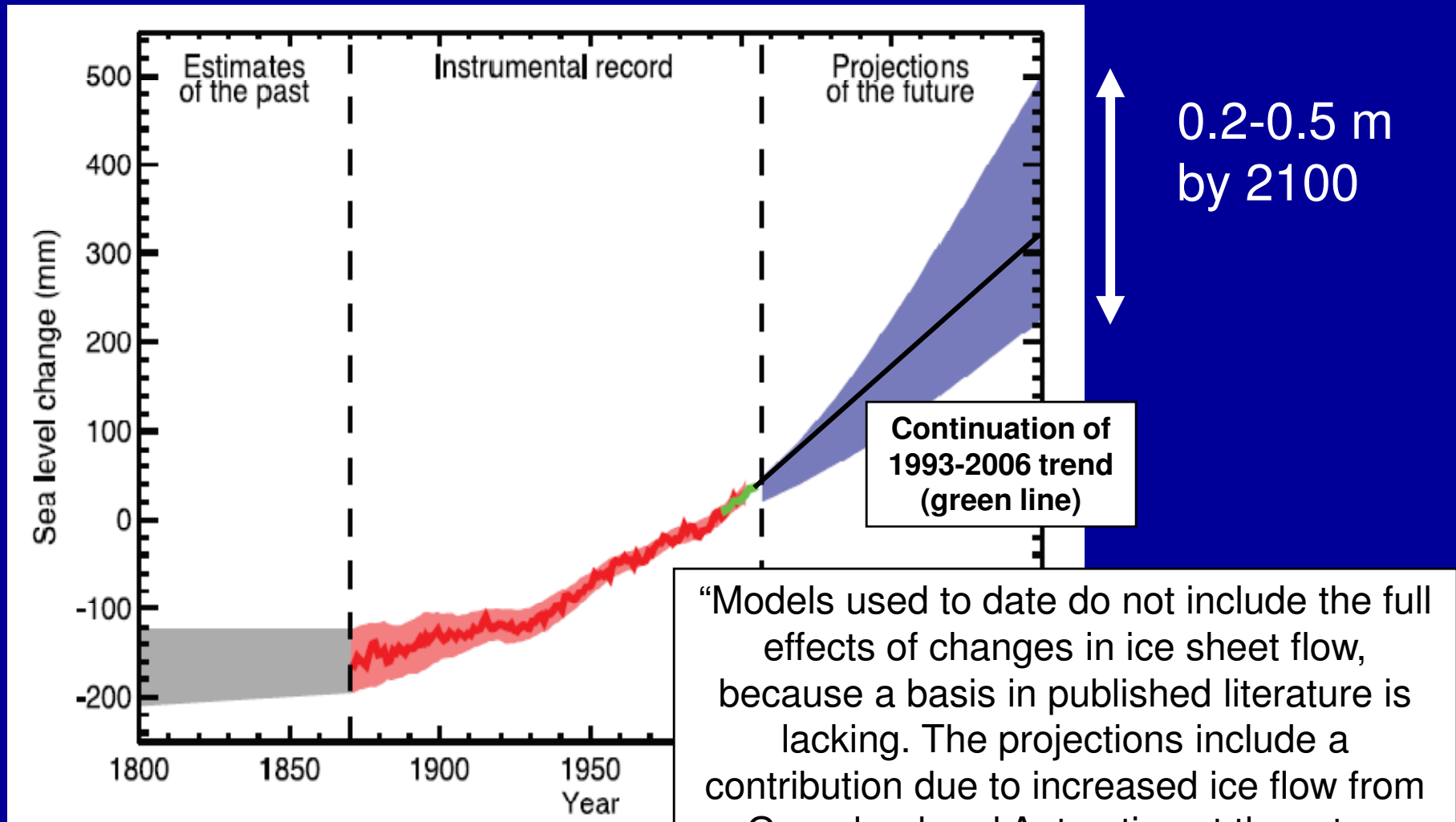


Range is primarily due to clouds

Solid lines are multi-model average and shading is +/- 1 σ

Best estimate and likely range for different scenarios

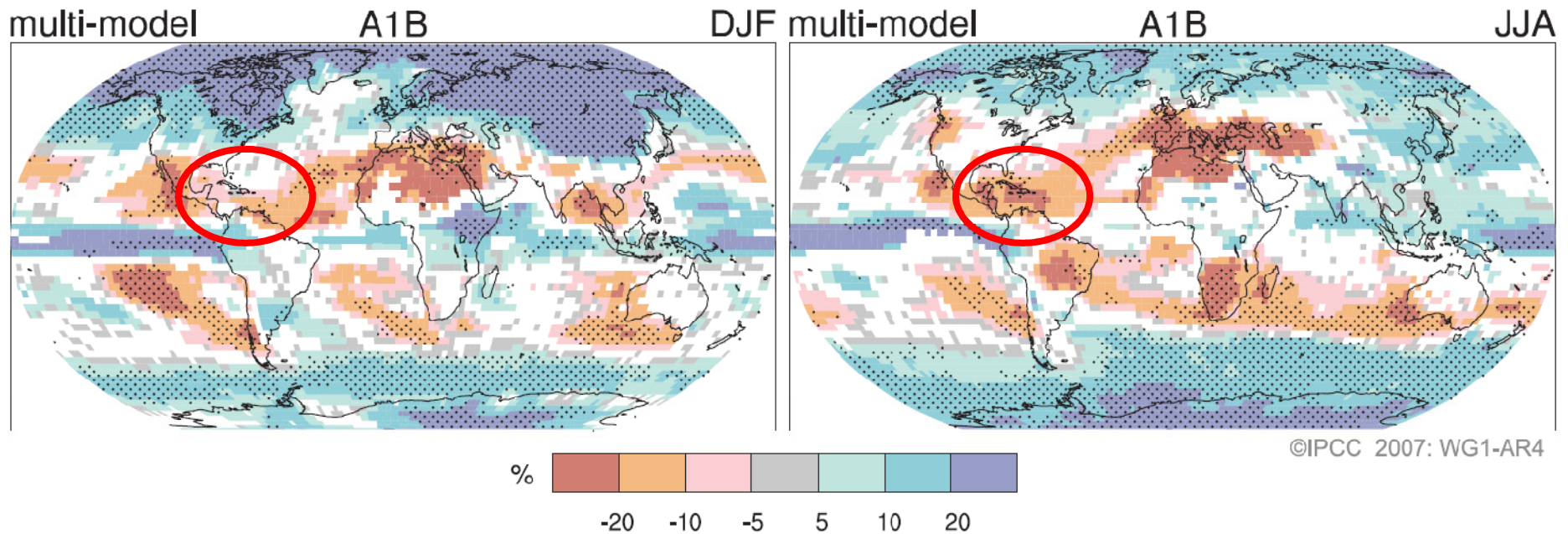
Sea Level Rise Projection



1900-2000: ~1.7 mm/yr

1993-2006: 3.1 mm/yr = 30cm/100yr

Precipitation Projection



WINTER

SUMMER

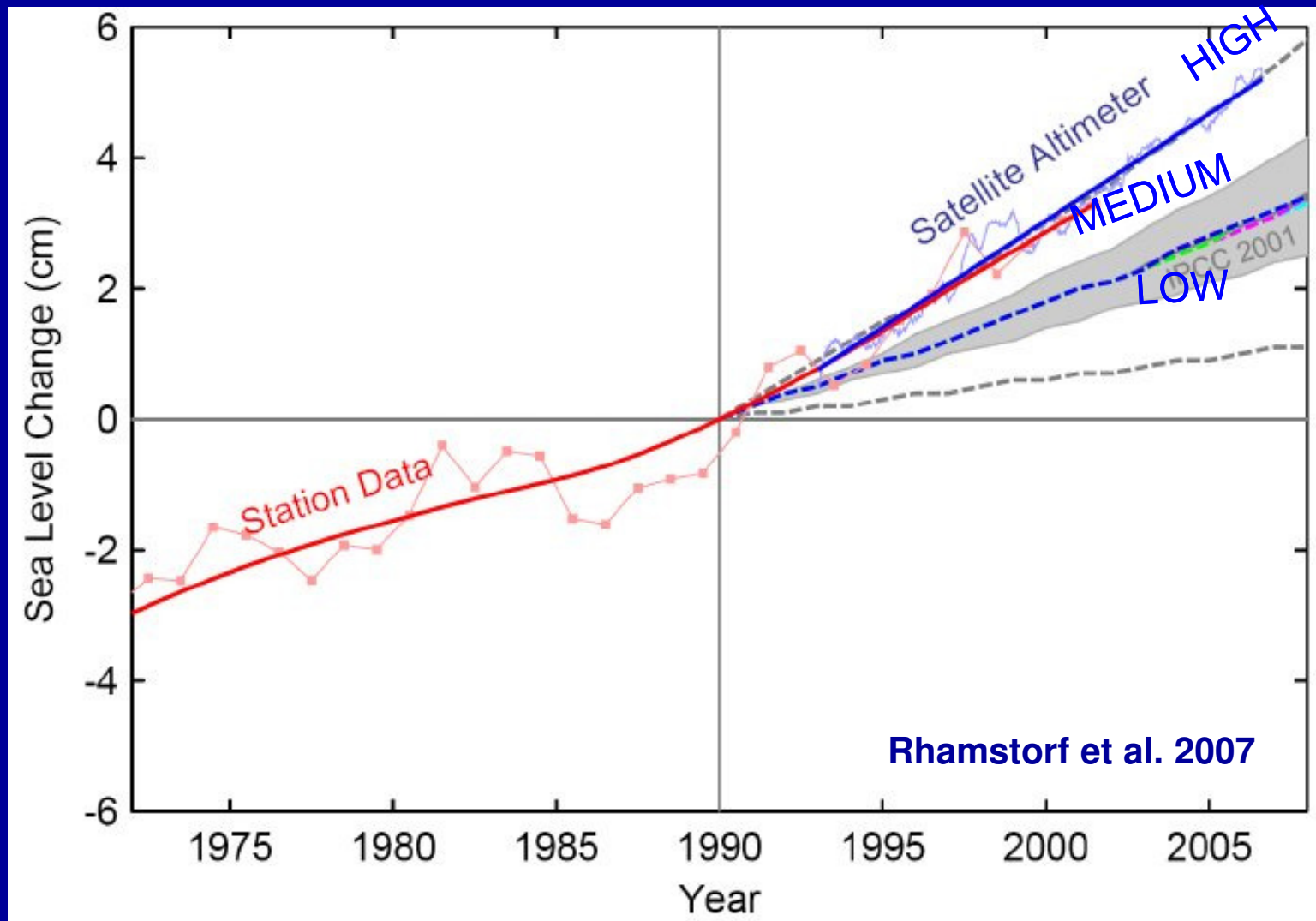
White areas are where less than 60% of models agree in sign of the change. Stippled areas are where more than 90% of models agree in sign.

Phenomenon ^a and direction of trend	Likelihood that trend occurred in late 20th century (typically post 1960)	Likelihood of a human contribution to observed trend ^b	Likelihood of future trends based on projections for 21st century using SRES scenarios
Warmer and fewer cold days and nights over most land areas	<i>Very likely^c</i>	<i>Likely^d</i>	<i>Virtually certain^d</i>
Warmer and more frequent hot days and nights over most land areas	<i>Very likely^e</i>	<i>Likely (nights)^d</i>	<i>Virtually certain^d</i>
Warm spells/heat waves. Frequency increases over most land areas	<i>Likely</i>	<i>More likely than not^f</i>	<i>Very likely</i>
Heavy precipitation events. Frequency (or proportion of total rainfall from heavy falls) increases over most areas	<i>Likely</i>	<i>More likely than not^f</i>	<i>Very likely</i>
Area affected by droughts increases	<i>Likely in many regions since 1970s</i>	<i>More likely than not</i>	<i>Likely</i>
Intense tropical cyclone activity increases	<i>Likely in some regions since 1970</i>	<i>More likely than not^f</i>	<i>Likely</i>
Increased incidence of extreme high sea level (excludes tsunamis) ^g	<i>Likely</i>	<i>More likely than not^{f,h}</i>	<i>Likelyⁱ</i>

More recent findings

1. Sea level rise may be faster than reported in IPCC 2007
2. Precipitation projected to decrease & evaporation increase in the subtropics
3. The jury is out on Atlantic storm activity

IPCC 2001 Sea Level Rise Projections vs. Observed



Observed sea level rise has been following the upper end of the 2001 IPCC sea level projection.

“Statement on Sea Level Rise in the Coming Century”
Miami-Dade Climate Change Task Force
Science and Technology Committee
January 2008

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Dr. John Van Leer University of Miami, physical oceanography

Mr. Doug Yoder Miami- Dade County

Key points from report

“With what is happening in the Arctic and Greenland, [there will be] a likely sea level rise of **at least** 1.5 feet in the coming 50 years and a total of **at least** 3-5 feet by the end of the century, possibly significantly more. “

- Relative sea level in S. Florida has been rising at a rate of 1.5 inch/century for the last 2500 years.
- Since 1932, sea level has risen by 9 inches.
- IPCC 2007 projects 1-3 feet by 2100, but this does not include contribution from recent rates of melt
- Key uncertainties: high latitude ice cover (Greenland, Antarctic & Arctic sea ice)
- Committee recommends detailed documentation of elevation of infrastructure and natural resources at 1, 2, 3... feet of sea level rise.

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Robust signals:

- Hadley cell expands
- Subtropics dry

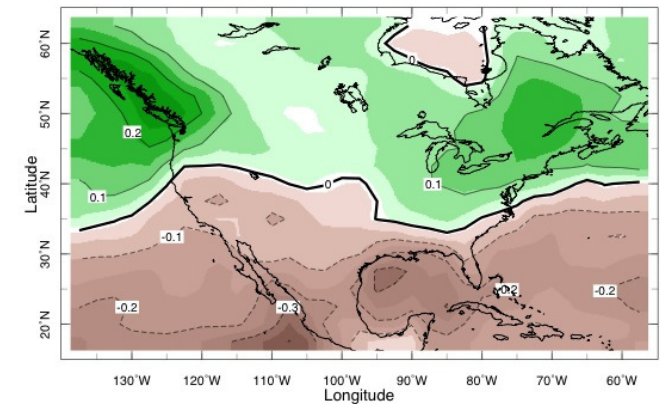
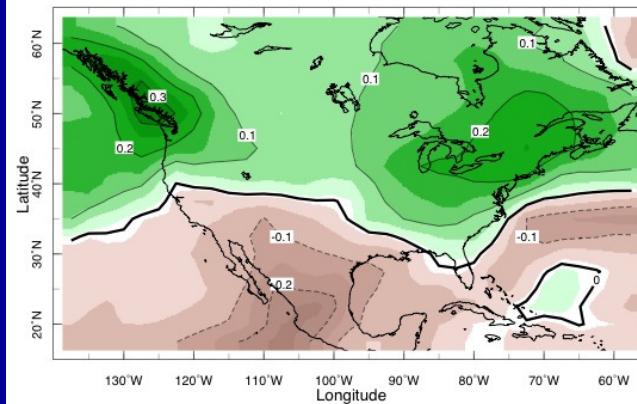
Held and Soden
(2006); Seager et al.
(2007, 2008)

24 Model IPCC Mean (2021-2040) - (1950-1999)

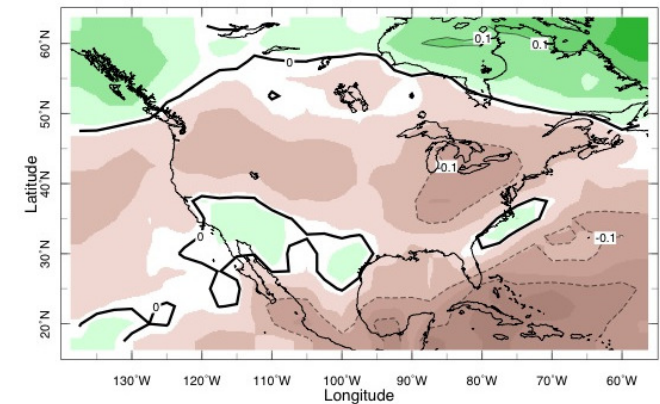
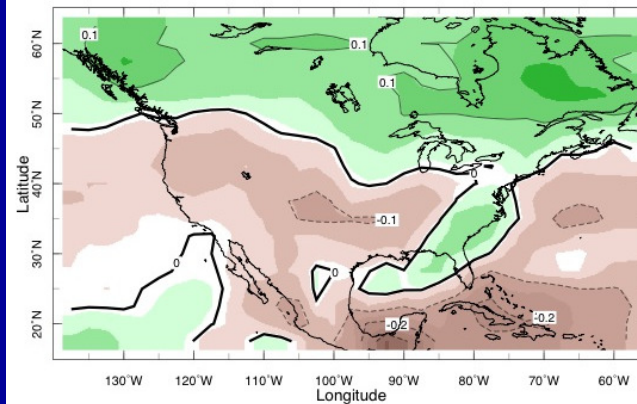
Precipitation

Precipitation - Evaporation

Nov-Apr

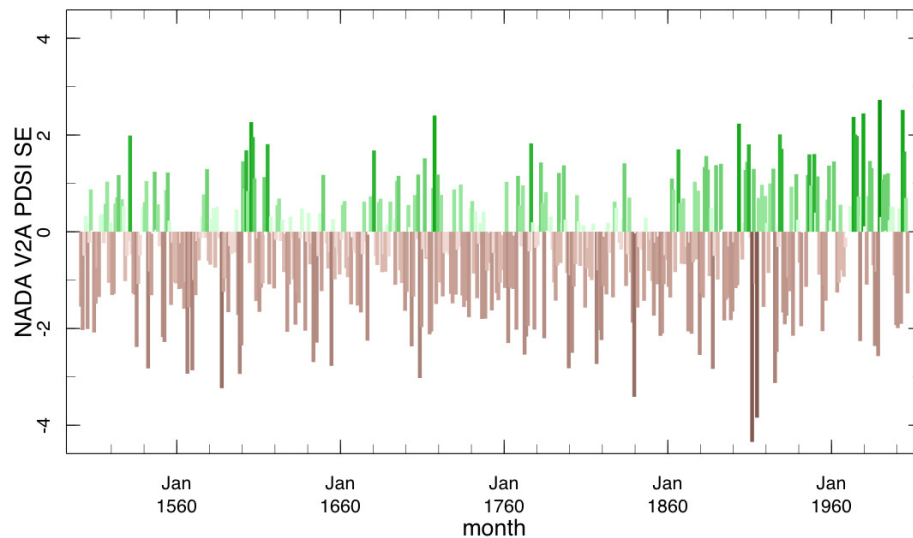
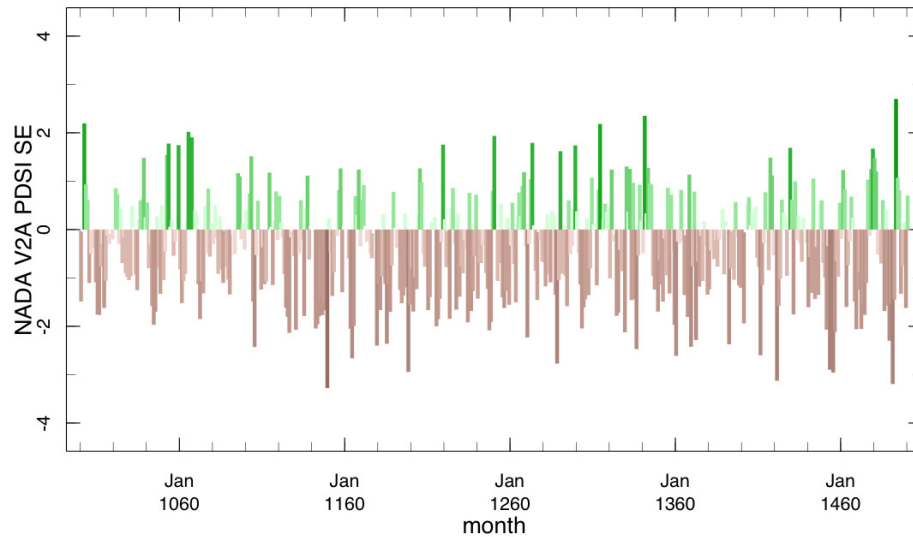


May-Oct



A Paleo-perspective

Tree-ring based estimate of PDSI for SE US (1000 AD to 2006)



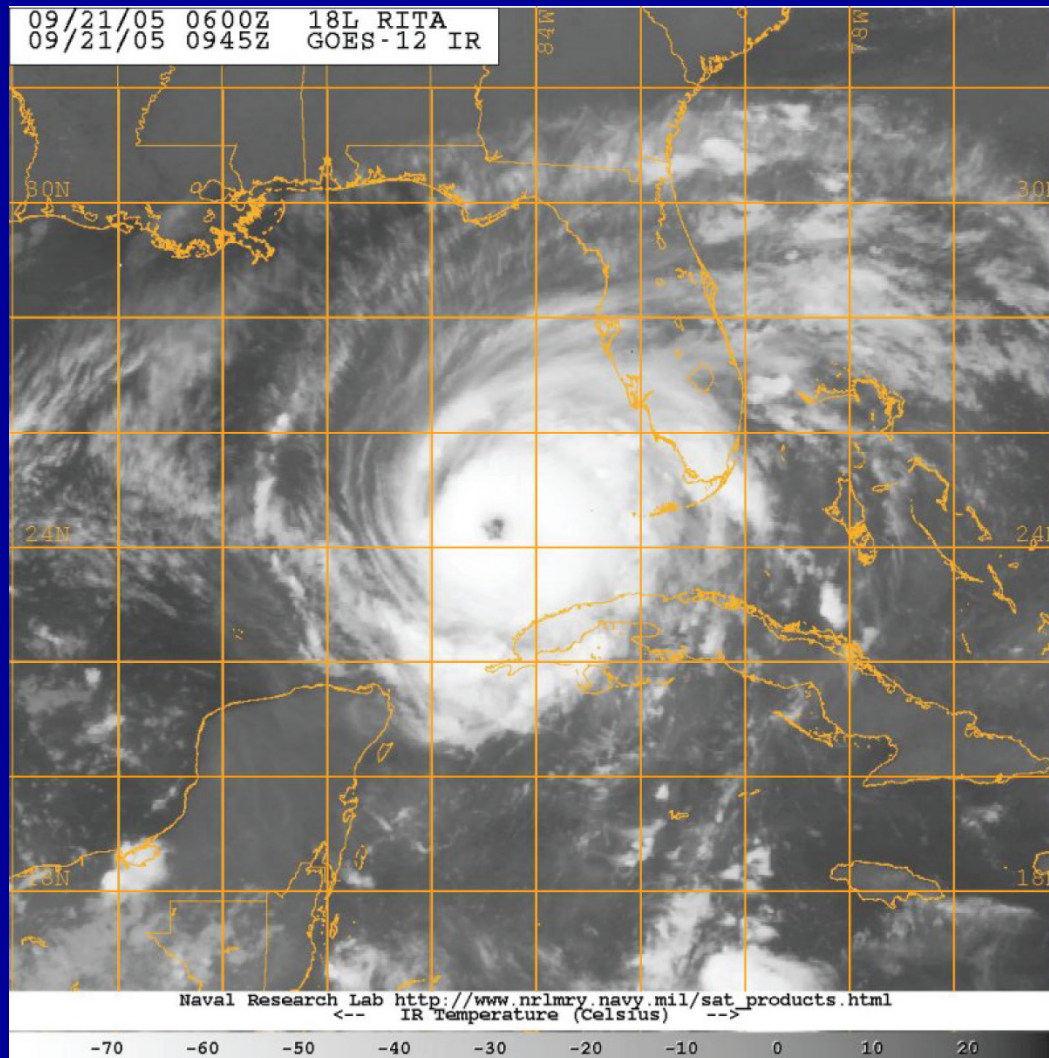
Tree ring records show that much longer droughts of equal severity in any one year have occurred in the southeast and that the twentieth century appears to have been unusually wet by the standard of the last one thousand years.

Seager et al. (2008)

More recent findings

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Current computing power limits ability of global climate models to represent hurricanes



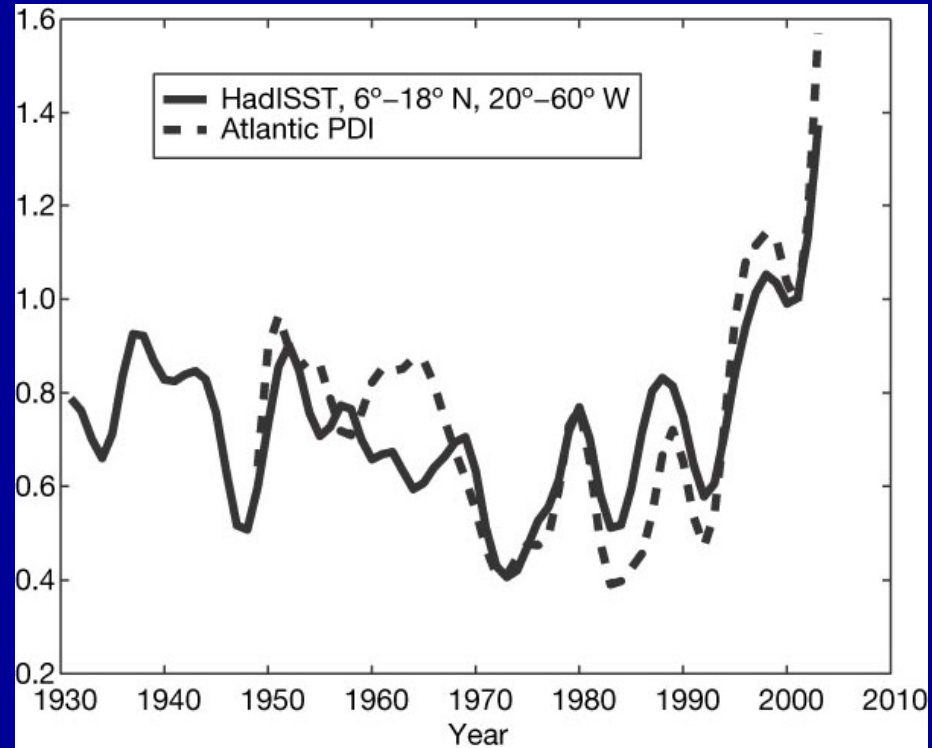
Hurricane Rita (2005): orange grid is representative of current *global* climate model resolution.

Size of grid limited by power of computers.

Nonetheless, tropical storms are affected by *large-scale* conditions that today's climate models *can* represent.

Factors that influence storm development and intensification:

- Warm ocean surface



Emanuel, *Nature* (2005)

Nonetheless, tropical storms are affected by *large-scale* conditions that today's climate models *can* represent.

Factors that influence storm development and intensification:

- Warm ocean surface
- Cool upper atmosphere
- Vertical wind shear

Climate model projections for Atlantic development:

- Favor
- Inhibit (Vecchi and Soden 2007)
- Inhibit (Vecchi and Soden 2007)

Net effect? Unknown

Next step: embedding regional models within global models (Knutson et al. 1998; Knutson and Tuleya 2004; Knutson 2007; Emanuel et al. 2008)

Florida: Public Opinion on Climate Change



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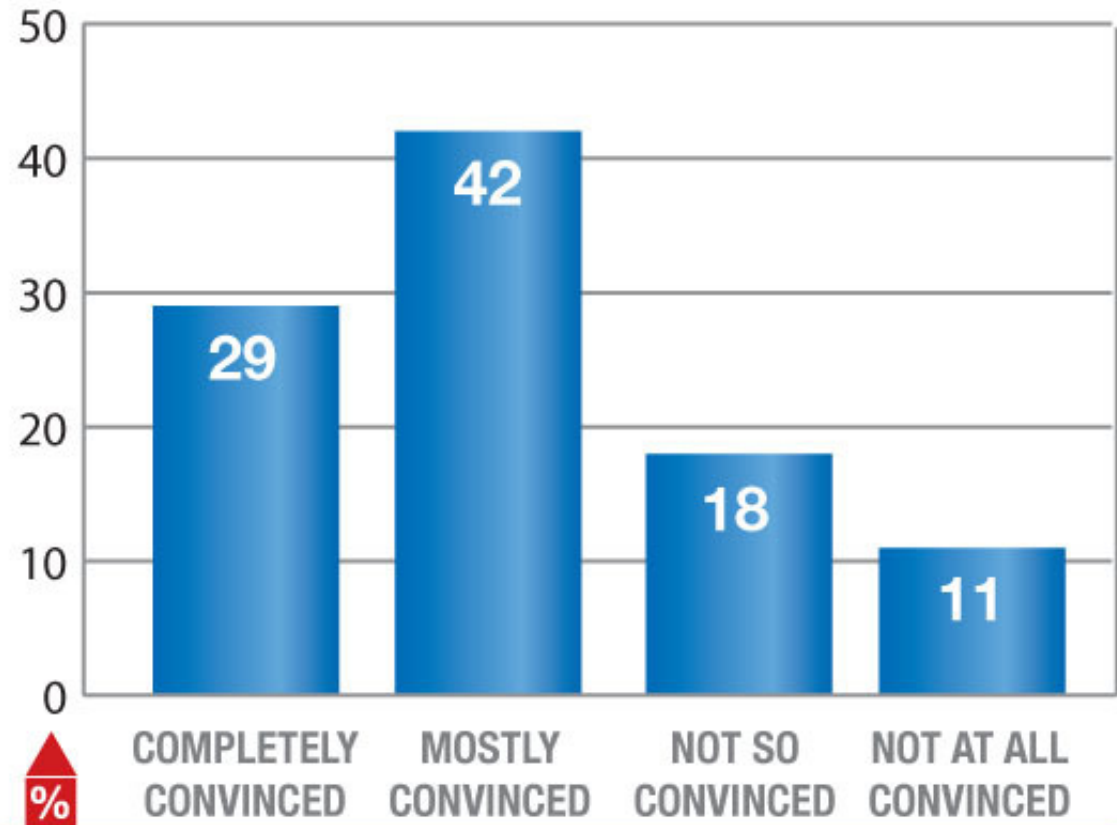
Does a problem exist?

Florida Statewide Survey

- May 2008
- (n = 1,077)
- +/- 2.9%

FIGURE 1: PERSONALLY CONVINCED

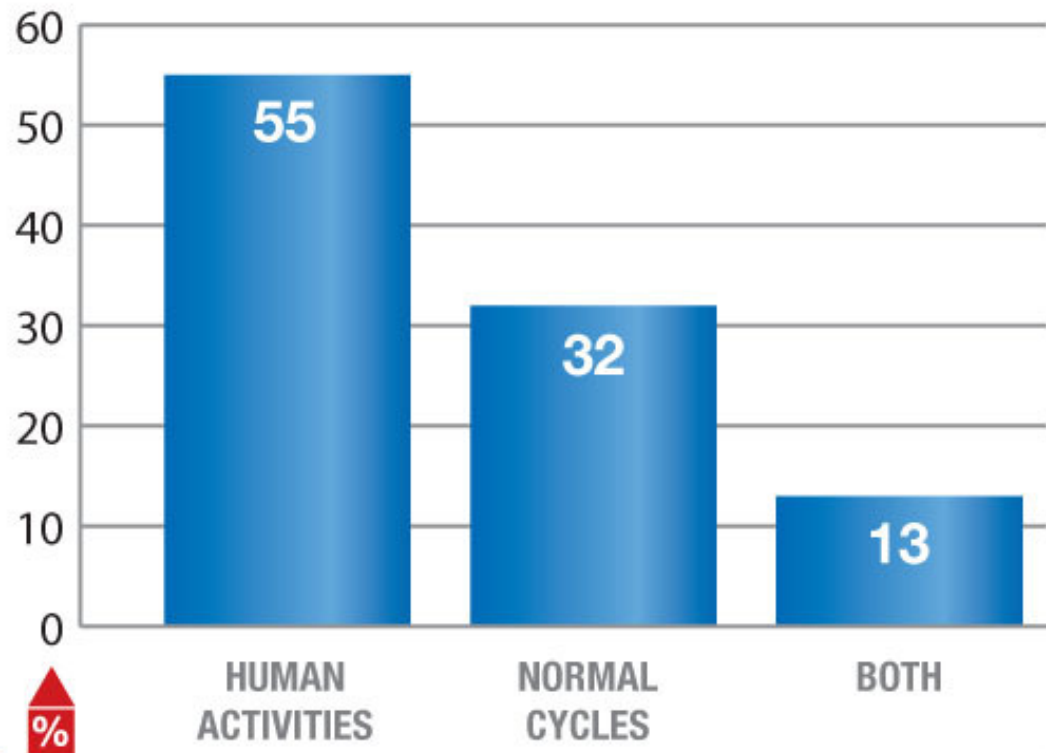
“How convinced are you that global warming is happening?”



Attribution

FIGURE 2: CAUSE OF GLOBAL WARMING

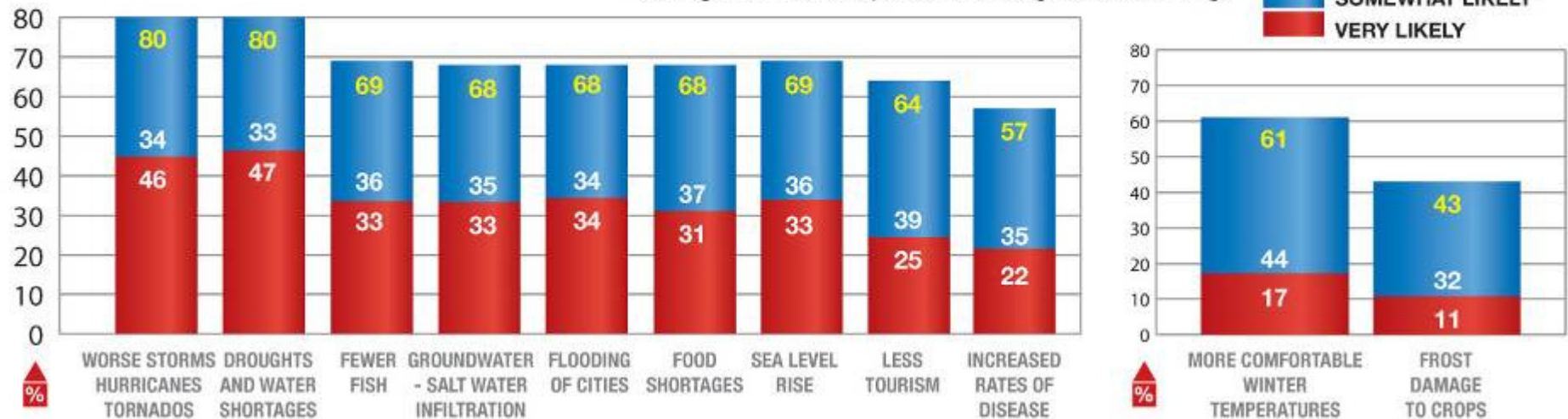
“If global warming is happening, do you think it is due more to normal cycles in the Earth’s environment, more to human activity such as burning fossil fuels, or by both equally?”



Impacts

FIGURE 7: LIKELIHOOD OF IMPACTS ON FLORIDA

"In Florida, how likely do you think it is that each of the following will occur during the next 50 years due to global warming?"



A majority of Floridians support climate change policies at both state and federal levels

More recent findings

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