



CLIMATE CHANGE – A THREAT TO THE FUTURE SUSTAINABLE DEVELOPMENT IN THE CARIBBEAN

Key Observations from the IPCC IV Assessment

- **Temperature trend from actual observations**
 - "Warming of the climate system is unequivocal."
- **Changing rainfall patterns**
 - increases of both drought and heavy precipitation events.
- **Sea level rise**
 - Sea level rose at an average rate of about 1.8mm/year during the years 1961-2003. The rise in sea level during 1993-2003 was at an average rate of 3.1mm/year.
- **Hurricanes**
 - There has been an increase in hurricane intensity in the North Atlantic since the 1970s, and that increase correlates with increases in sea surface temperature.
 - The observed increase in hurricane intensity is larger than climate models predict for the sea surface temperature changes we have experienced.

The Global Climate Projections

- **Unequivocal evidence that the earth's temperature is rising and attributable to anthropogenic activities – Green House Gases**
- **Projected trends through 2100**
 - **rise in global temperatures of between 2 – 4.5°C**
 - **Sea level rise of between 11 -77 cm**
 - **Changed weather patterns**
 - **More intense extremes –drought ,floods**
 - **More intense hurricanes**

Direct Regional Evidence

- **Temperature trend**

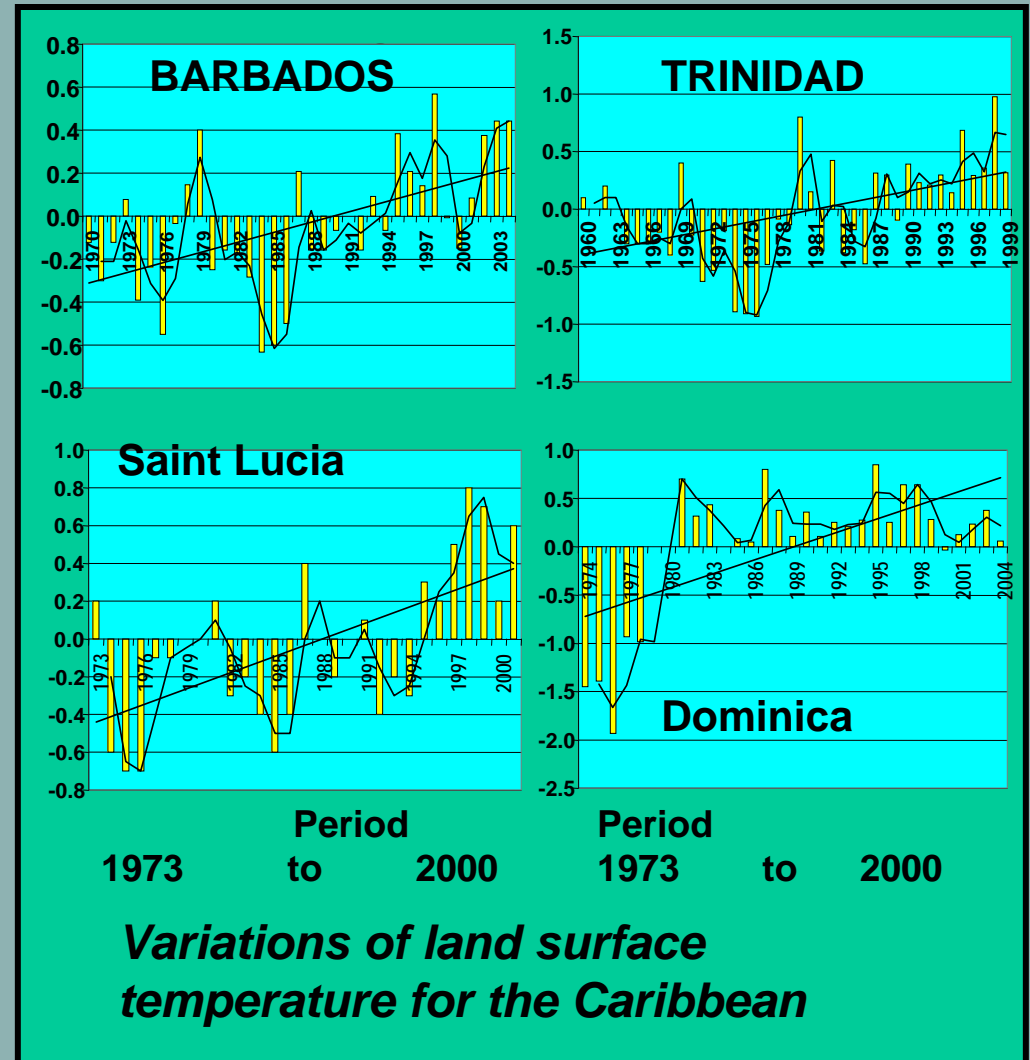
- Temperature records have shown an increase in the last century, with the 1990s being the warmest decade since the beginning of the 20th century.

- 1998 also appears as the warmest year on record.

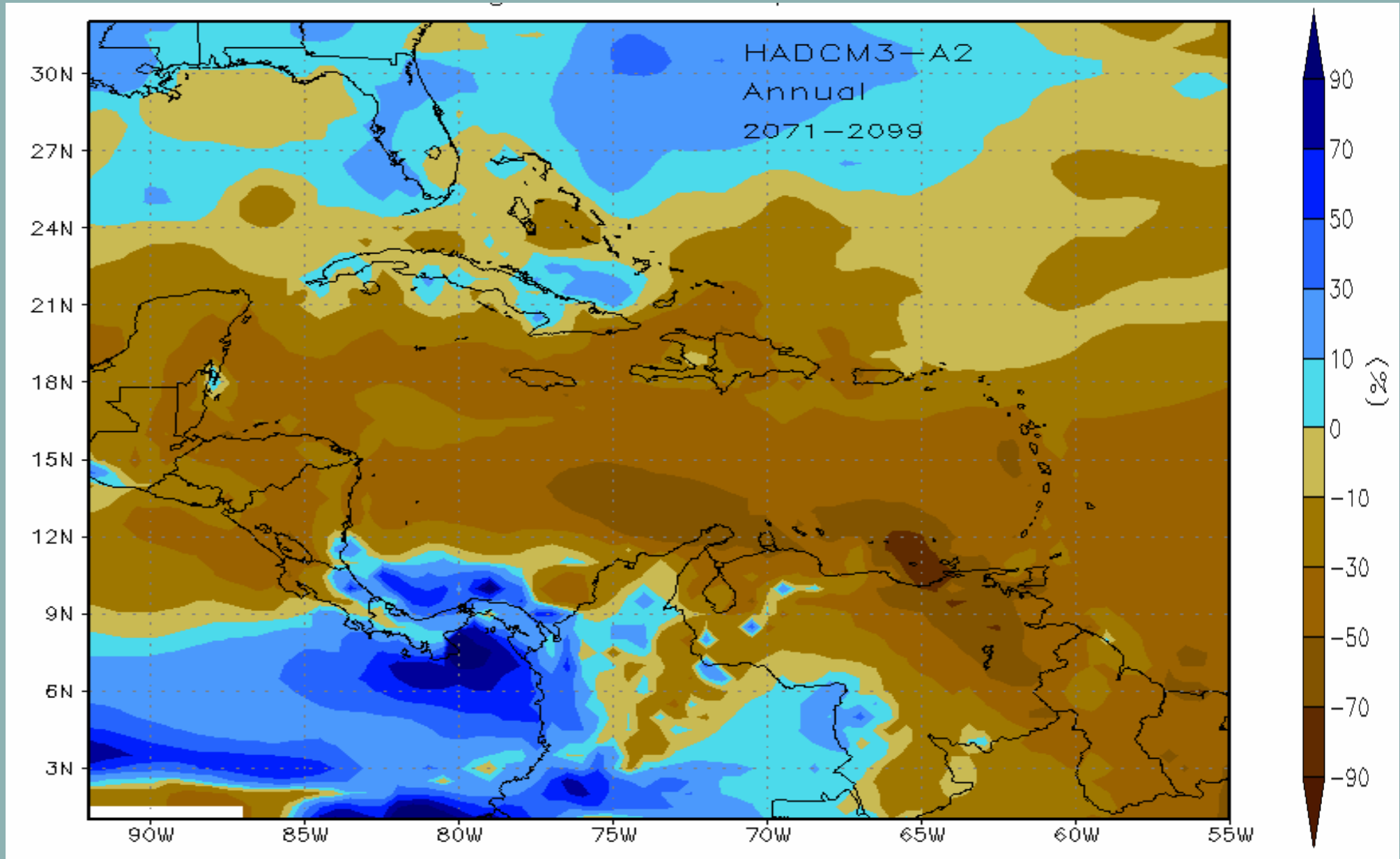
- **Rainfall trend**

- Records have shown changing patterns.

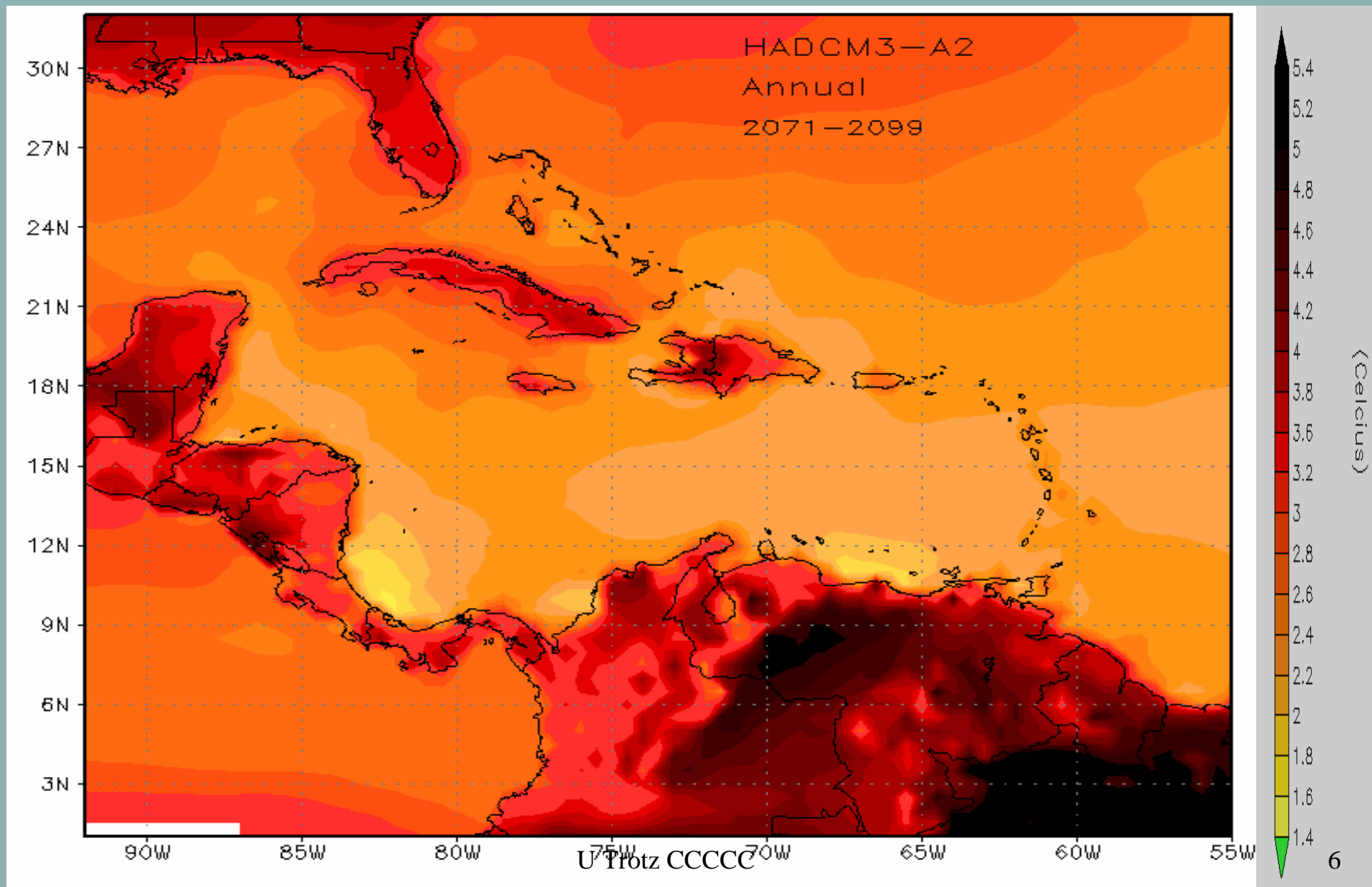
- Floods in some areas and droughts in other areas



FUTURE PROJECTED % CHANGES IN PRECIPITATION



MODEL PROJECTION OF FUTURE INCREASES IN THE REGIONAL TEMPERATURES



Caribbean Sea Temperature Much Warmer

- **Warmer sea temperatures support:**
 - Development of stronger hurricanes at lower latitudes
 - More rapid transition to category 4 and 5
 - Increases the likelihood of coral bleaching



**April sea temperature near
80°F/27°C**

Consequences Of Climate Change.

- Change in rainfall regimes
- Increased evaporation with higher temperature
- Increased evapo-transpiration (soil moisture)
- >> SLR – salt water intrusion (estuarine, aquifers)
- Decreased precipitation
- Increase in extreme events – droughts, floods
- Increased intensity of heavy rain events – rapid run off / flash floods, >> soil erosion, >> run off of contaminants
- >> intensity of hurricanes
- Adverse effects on coastal water

IMPACTS

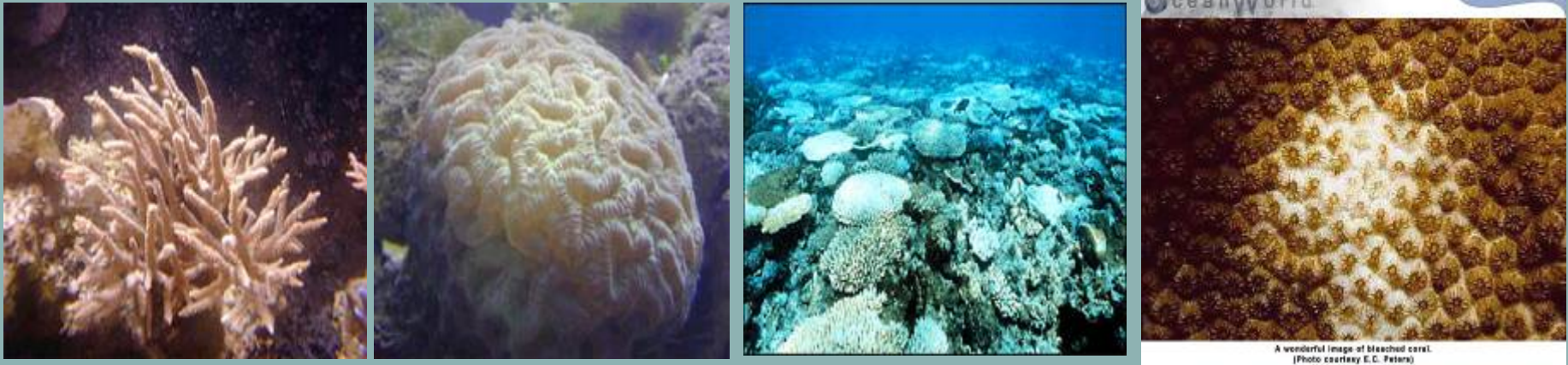
- Impact studies on vulnerable elements – some indications :
 - Less precipitation - less available water;
 - Changing weather patterns – agriculture adversely affected.
 - Increased frequency of extreme events
 - Sea level rise – coastal inundation, storm surge exaggeration (tourism, aquifers, agriculture, infrastructure, human settlement)
 - Increased intensity of hurricanes (human settlements, tourism, infrastructure, livelihoods.
 - Increased temperature (agriculture, health, coral reefs)

IMPACTS

Dire consequences for

- Economic activities
 - Tourism
 - Agriculture
 - Financial sector
- Property and infrastructure
- Human welfare
- Livelihoods
- Regional natural resource base
- Attainment of MDGs in prescribed time frame.
- Indeed for realization of sustainable development goals.

WARMER SEA TEMPERATURES RESULT IN CORAL BLEACHING AND MORTALITY

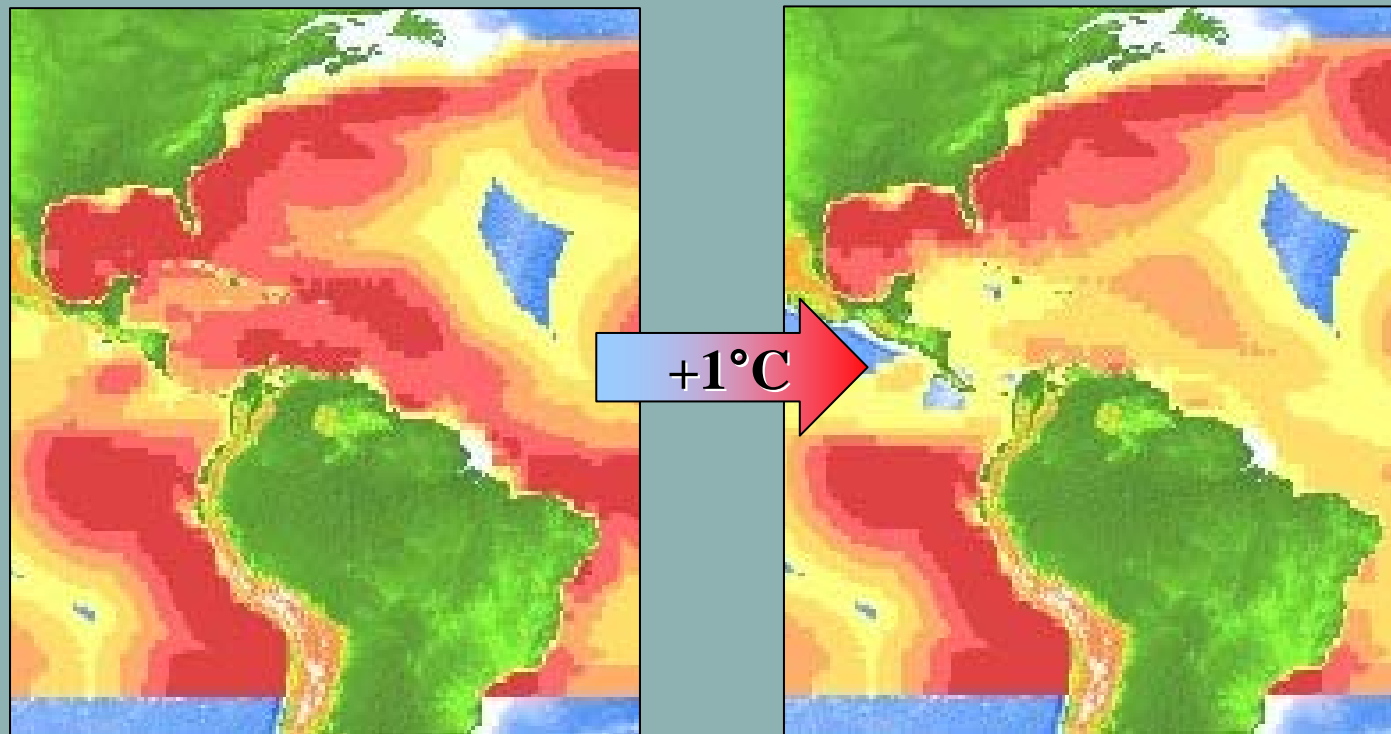


- In 1998 coral reefs around the world suffered the most extensive and severe bleaching and subsequent mortality in modern record.
- In the same year, tropical sea surface temperatures were the highest in modern record, topping off a fifty year trend for some tropical oceans.
- The repercussions of the 1998 mass bleaching and mortality events will continue to be far reaching in time and space.

Impact of 1°C further rise in sea temperature on the Dolphin fish



Habitat becomes less favourable

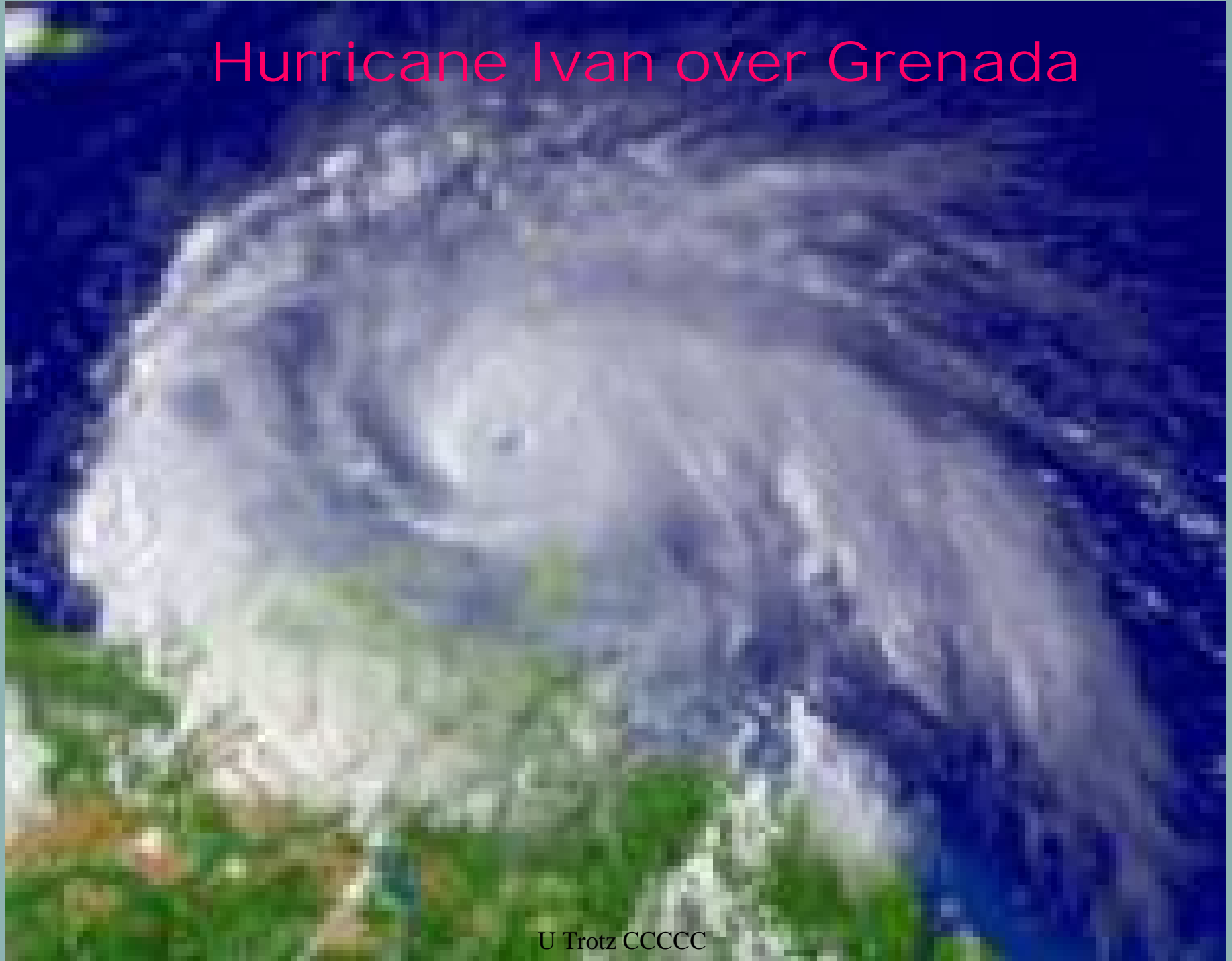


Likely Impact of a 2°C rise on Agriculture

Preliminary studies on the impact on the staples -corn, beans and rice for 2°C warmer and +/- 20% change in precipitation

Crop	Scenario Name	Season Length (days)	Temperature Change (°C)	% Change in precipitation	Yield (kg/ha)	% change in Yield
Dry beans C3	Baseline	87	0	0	1353.6	
	Carib A	85	+2	+20	1163.7	-14%
		85	+2	-20	1092.6	-19%
Rice C3	Baseline	124	0	0	3355.5	
	Carib A	113	+2	+20	3014.4	-10%
		113	+2	-20	2887.5	-14%
Maize C4	Baseline	104	0	0	4510.6	
	Carib A	97	+2	+20	3736.6	-22%
		97	+2	-20	3759.4	-17%

Hurricane Ivan over Grenada



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2008 Atlantic hurricane season

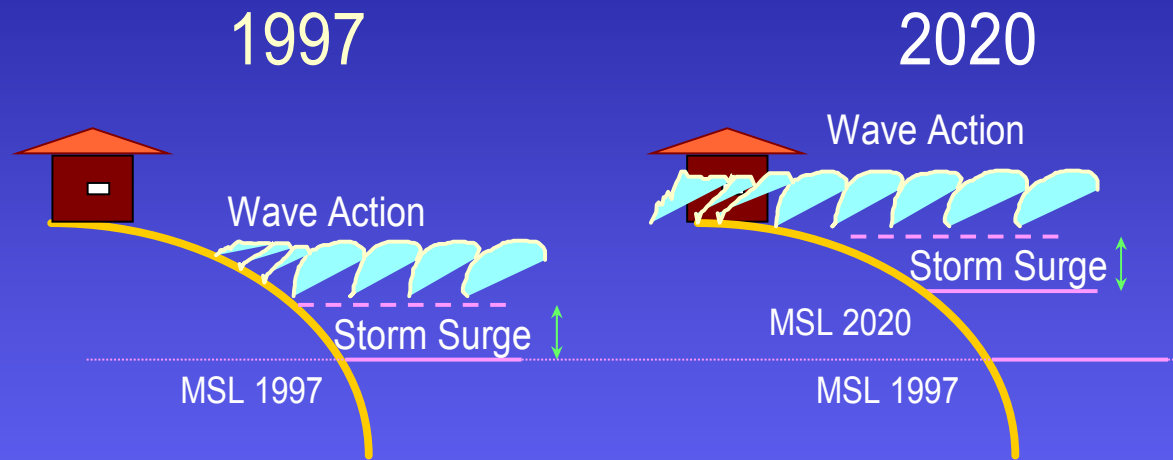
- [Tropical Storm Arthur](#) caused the season to start two days early. – 9 deaths , \$78M US damage in Belize.
- Third most costly season on record, behind only the [2004](#) and [2005](#) seasons, with up to \$45 billion in damage (2008 [USD](#)).
- the only year on record in which a major hurricane existed in every month from July through November in the North Atlantic.^[1]
- particularly devastating for [Haiti](#), where over 800 people were killed by four consecutive tropical cyclones (Fay, Gustav, Hanna, and Ike) in August and September.^[1]

INSURED LOSSES

Storm	Class	Year	Estimated 1990 Insured Losses (000's)	Estimated 1990 Insured Losses if Maximum Wind Speed Increases by		
				5%	10%	15%
Hugo	4	1989	\$3,658,887	\$4,902,705 34%	\$6,514,172 78%	\$8,542,428 133%
Alicia	3	1983	\$2,435,589	\$3,382,775 39%	\$4,312,884 77%	\$5,685,853 133%
Camille	5	1969	\$3,086,201	\$4,120,733 34%	\$5,438,332 76%	\$7,095,008 130%
Source: Clark, 1997.						

SLR & Storm Surge

Coastal Impact of Storm Surge and Wave Action under a Sea Level Rise Scenario



Response Strategies:

- Retreat
- Accommodation
- Protection

One of many flood events Georgetown, Guyana



STERN REPORT -

- Climate change presents very serious global risks and demands an urgent global response.
- Response demands int'l cooperation notably in following areas:
 - Creating price signals and markets for Carbon.
 - Spurring technological research, development and deployment.
 - Promoting adaptation particularly for developing countries

STERN REPORT

- Evidence shows that ignoring climate change will eventually damage economic growth.
- Our actions over the coming few decades could create risks of major disruption to economic and social activity later this century and the next, on a scale similar to the great wars and the economic depression of the 1st half of the 20th century.
- The earlier effective action is taken, the less costly it will be.

Costs of no action: % GDP

Country	2050	2100
Haiti	61	123
Grenada	46	111
St. Kitts & Nevis	36	89
Puerto Rico	2.8	6

Source: © EcoAméricas - <http://www.ecoamericas.com/>

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ENERGY – CARIBBEAN CONTEXT

- All CARICOM countries except T&T net energy importers.
- Strong dependence on fossil fuel – potential to reverse developmental gains achieved over the last 2-3 decades.
- Regional scenario of limited resources & >> cost of energy putting a severe drain on limited financial resources
 - 116 Mb in 1985 costing US \$ 530 m
 - 160 Mb in 2004 costing US \$6.5 B
 - At 2008 prices US \$15b – in some cases requiring countries to devote 50% of foreign exchange earnings to purchase fuel
- wrt to CC mitigation region contributes << 1% to global GHG budget however opportunity to place the regional energy sector on a more sustainable footing

ENERGY

- Region economy highly Carbon intensive & not as competitive as it can be.
- Heavy outflow of foreign ex. to meet escalating energy bill.
- Endogenisation of regional energy sources coupled with effective demand and supply side management practices regarded as essential part of region's adaptive strategy.

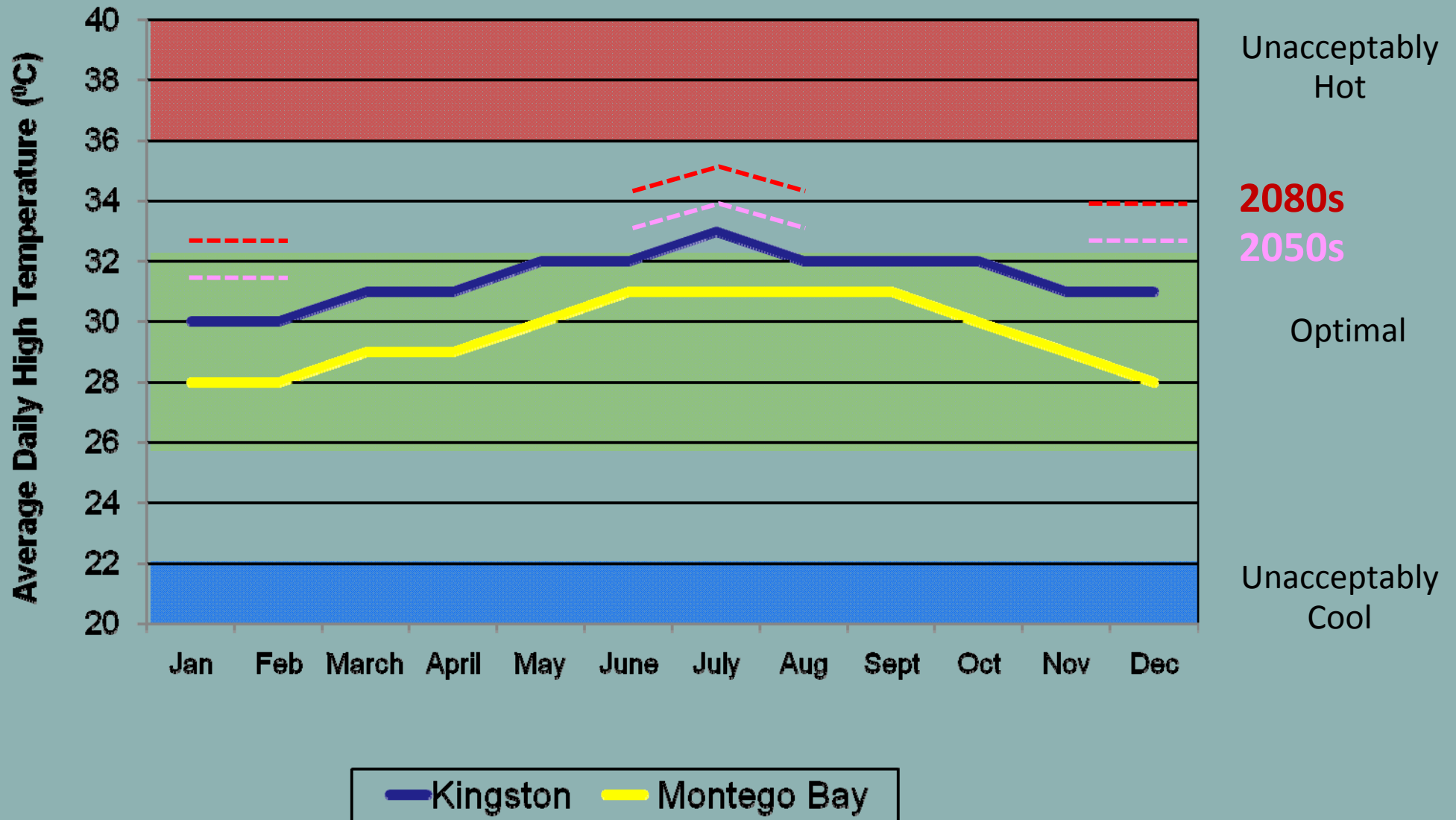
Will the Caribbean be 'Too Hot' for Tourism?

If the Caribbean becomes too warm,
or if the Northern countries experience
milder winters, this may result in a shift
in tourist destinations



Preferred Climate for Beach Holidays

Based on 2009 Survey of Tourists in 8 European Cities

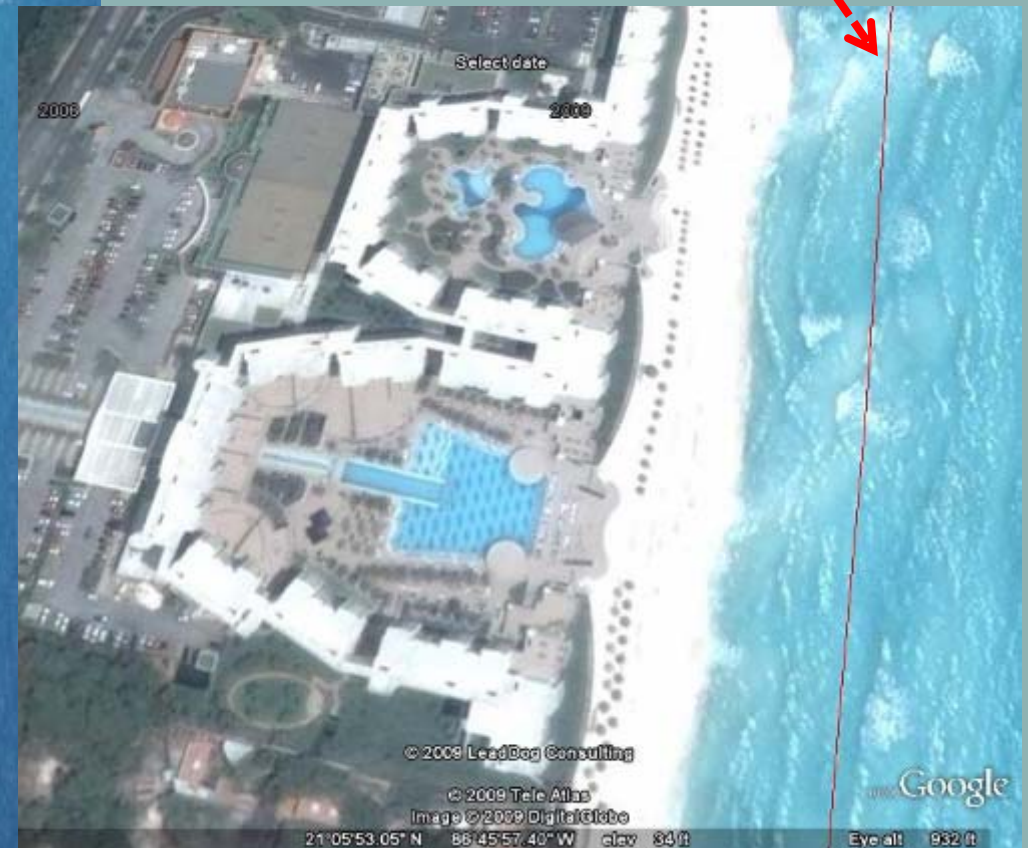


Beach Loss to Sea Level Rise and Storms

Cancun
Mexico
(2009)



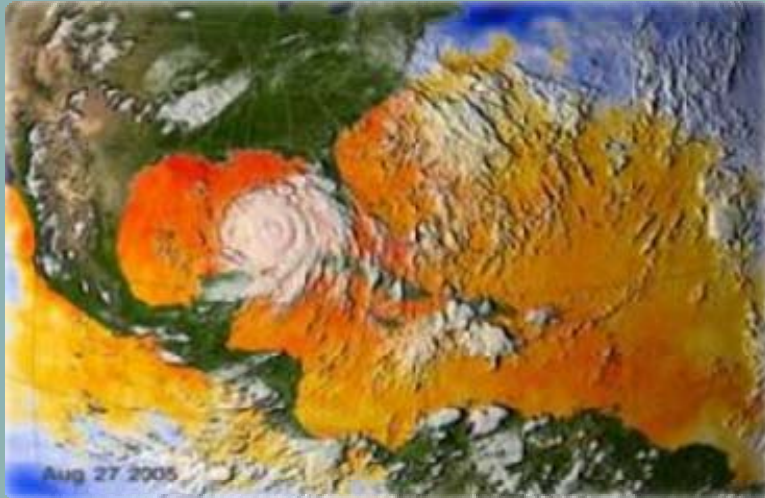
2006 Beach Extent



Extreme Events and Insurability

'Hurricane Katrina Blows Away
'Big Easy' Tourism'

31 Aug 2005 - USA Today



US Gulf Coast & Caribbean Region (Mid to Late-21st Century)

- Estimated premium increase 20-80%
- Increase deductibles (order of magnitude)
- Drop coverage in high risk areas



Association of British Insurers

Impact of Climate Policy on Tourist Arrivals to the Caribbean



“The immediate current threats are emerging as our major tourism markets seek to take urgent and decisive action to curb their own contributions to climate change. In so doing these developed nations risk curtailing the Caribbean region’s efforts to develop its societies and economies through its participation in the global tourism industry”

The CARICOM Climate Change Centre

- Recognizing the vulnerability to the impacts of climate change and climate variability on the economic development and social needs of the region:

- The Heads of Governments of CARICOM in July 2002, endorsed the creation of a permanent capacity in the region to address climate change issues.
- The Centre is mandated to coordinate the regional response to climate change and its efforts to manage and adapt to its projected impacts.



- ◆ Operational since January 2004
- ◆ Located in Belmopan, Belize