# Climate Change Impacts in the Caribbean

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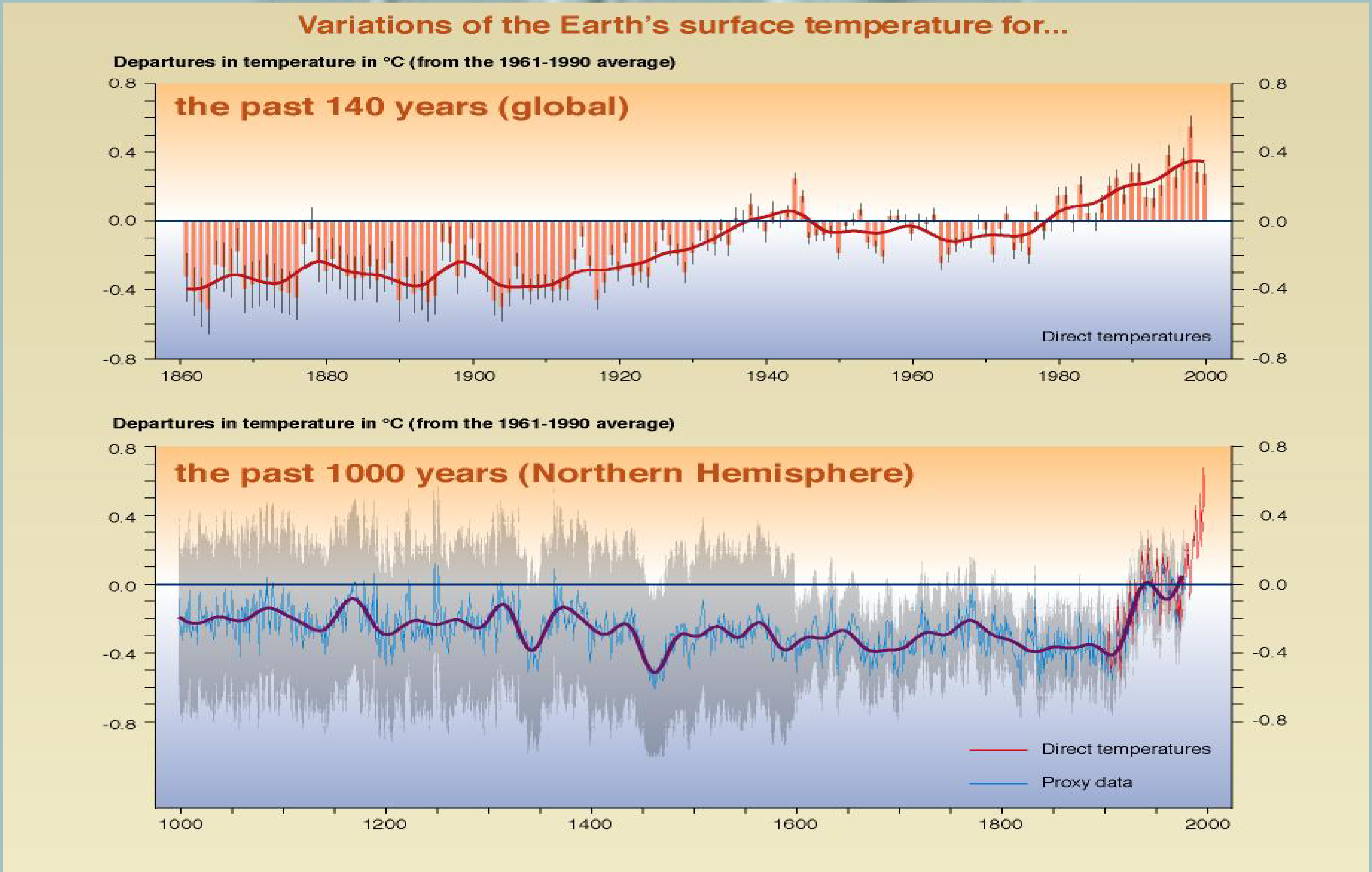
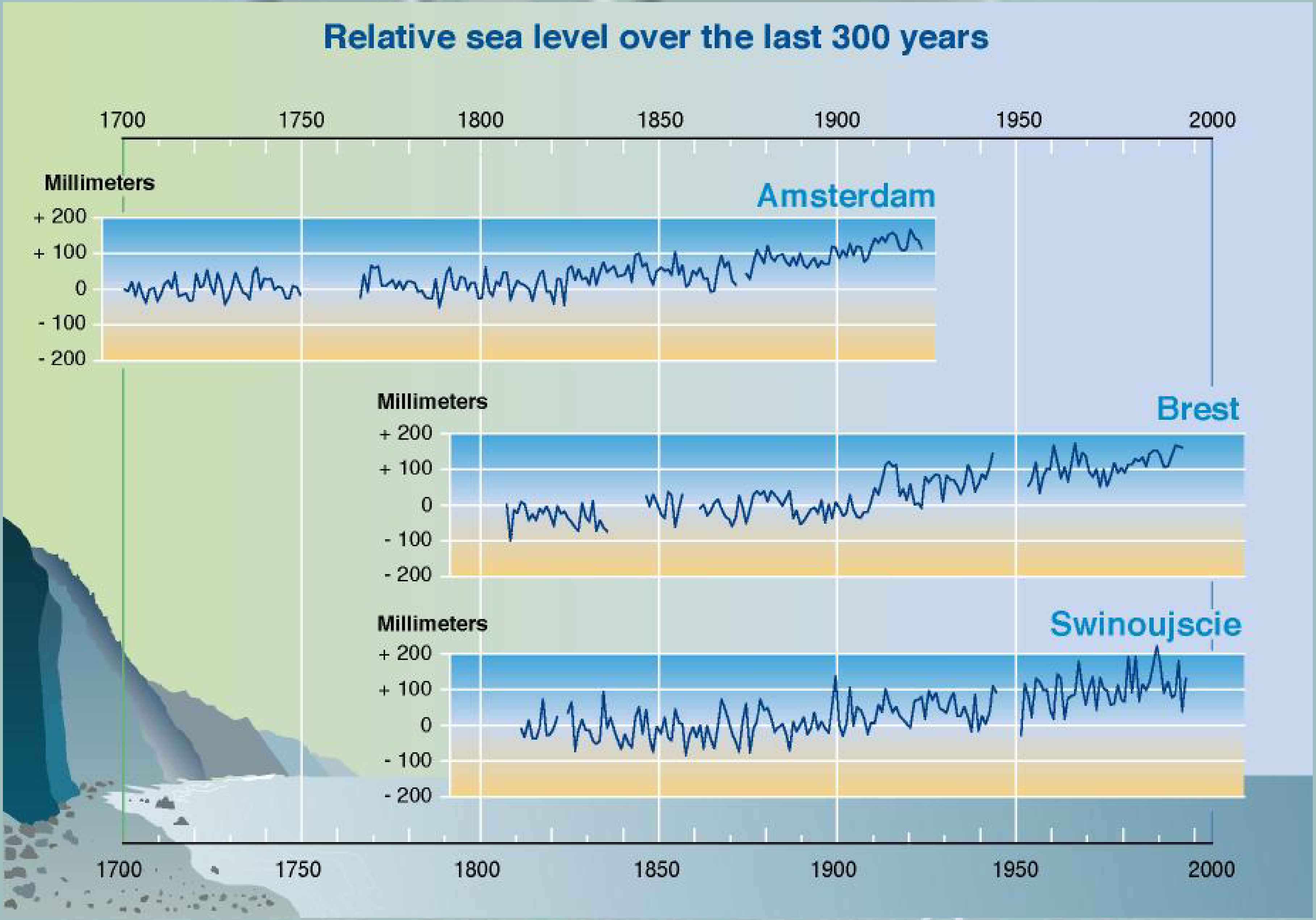
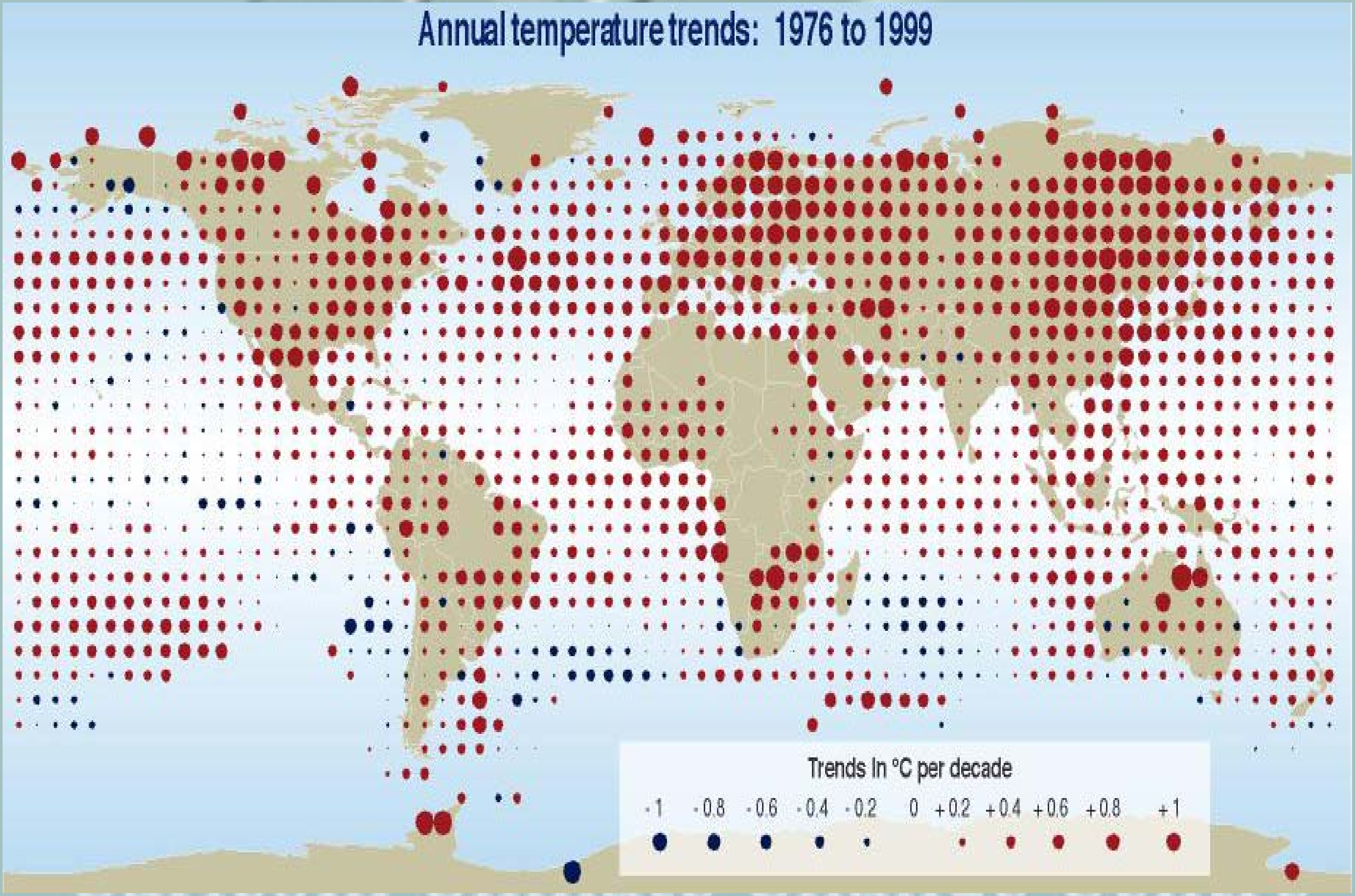
# Global mean surface temperatures have increased



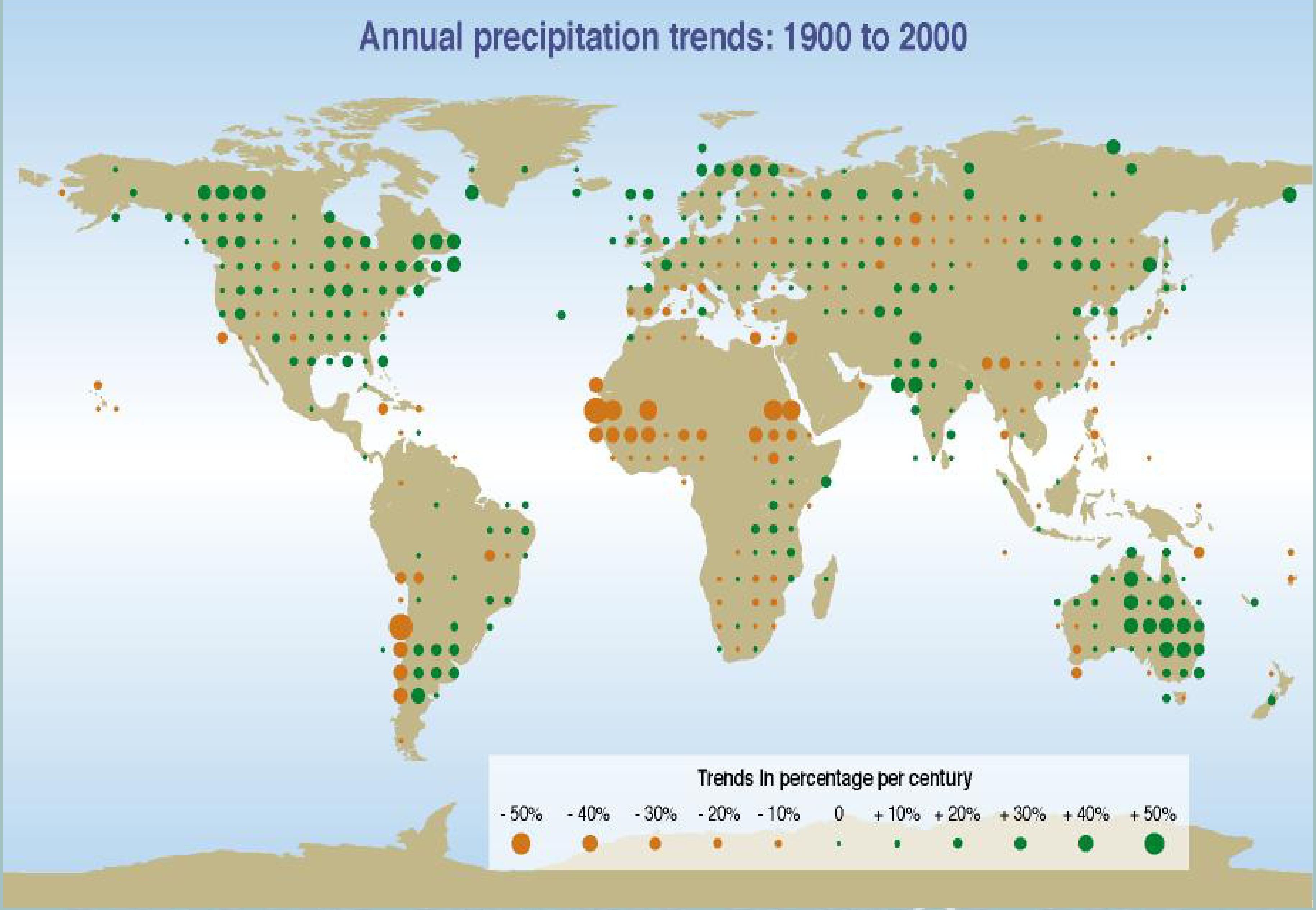
# Sea Levels have risen



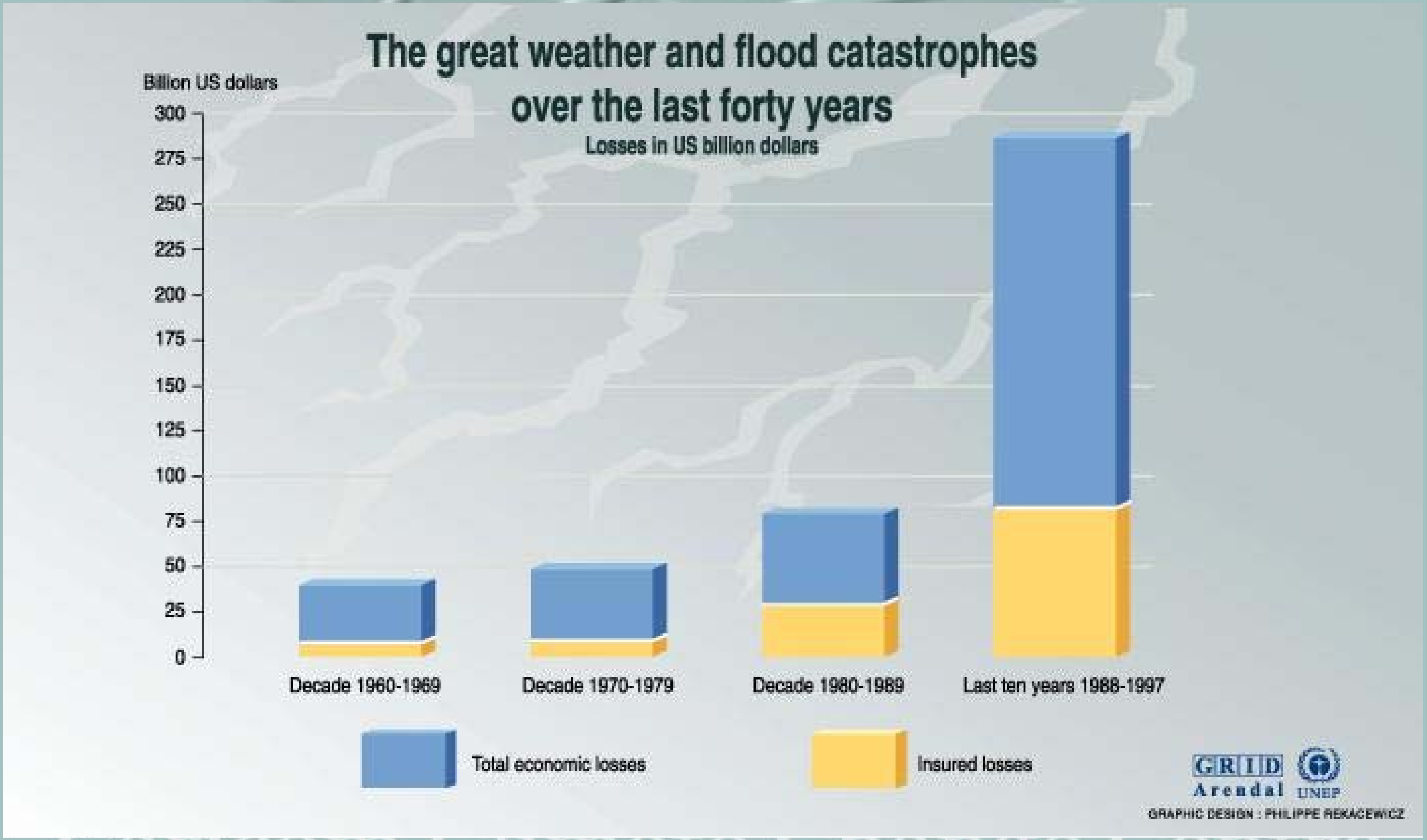
# The Land and Oceans have warmed



# Precipitation patterns have changed



# Weather-related economic damages have increased

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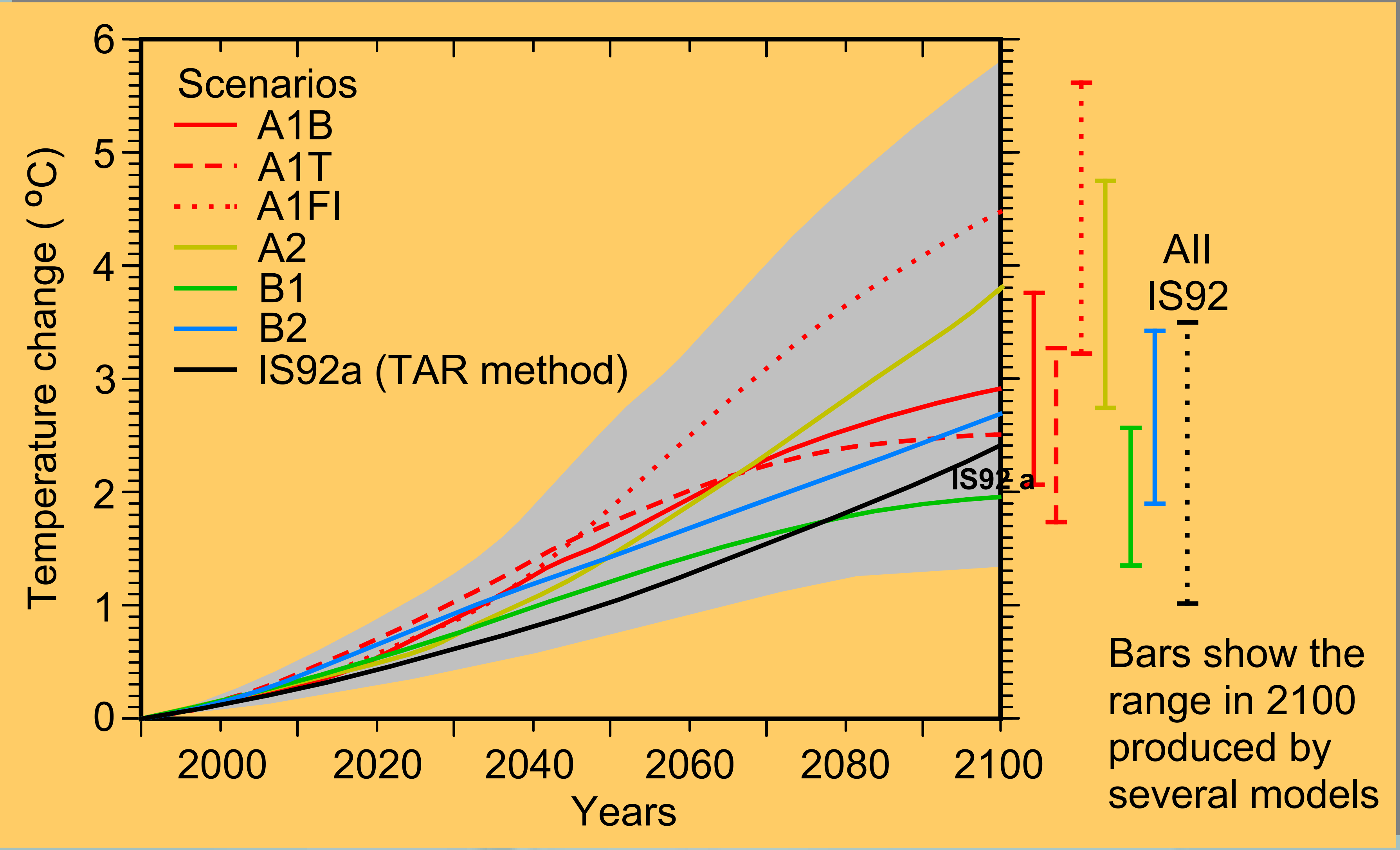


The change in temperature resulting from the SRES emission scenarios

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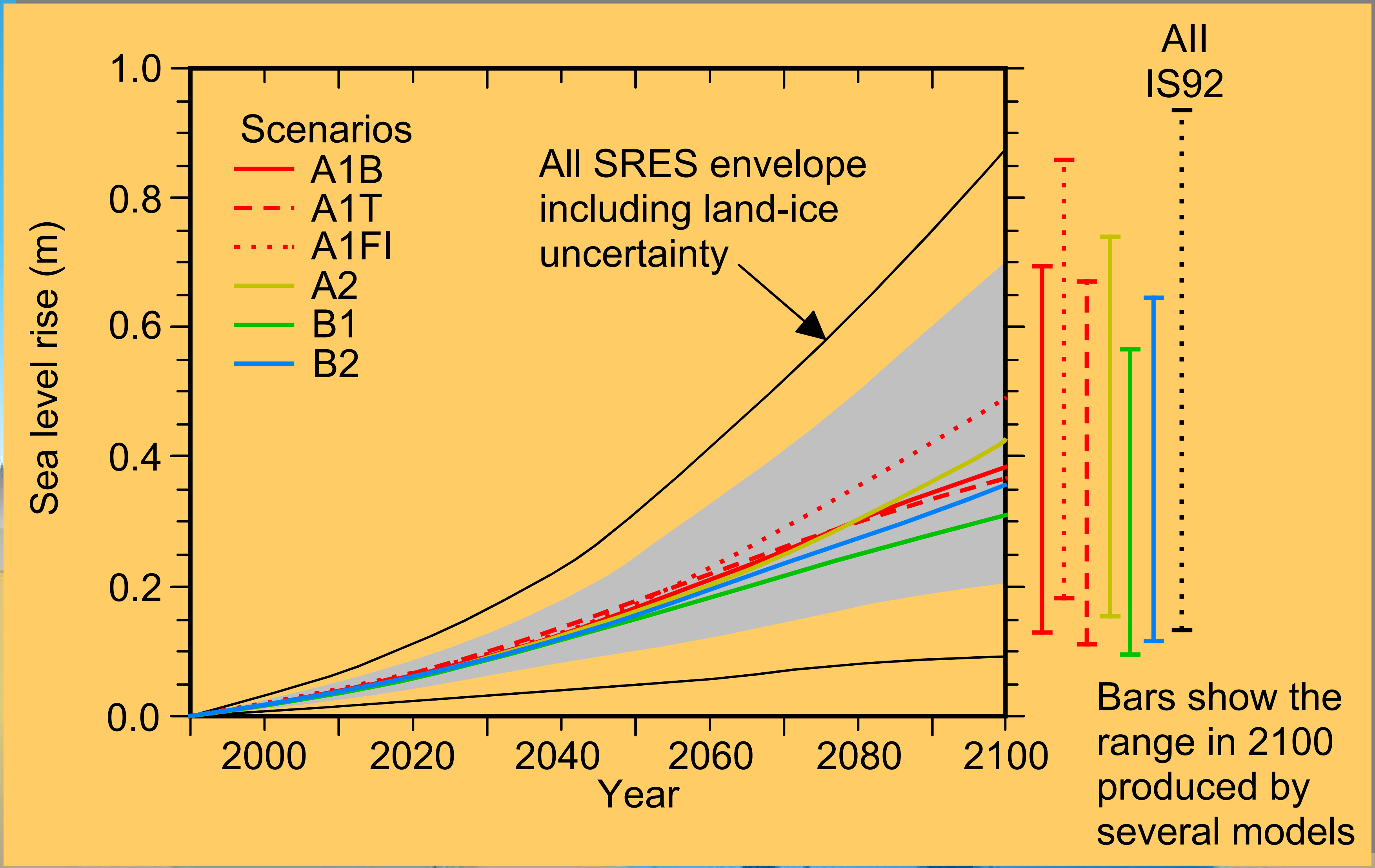
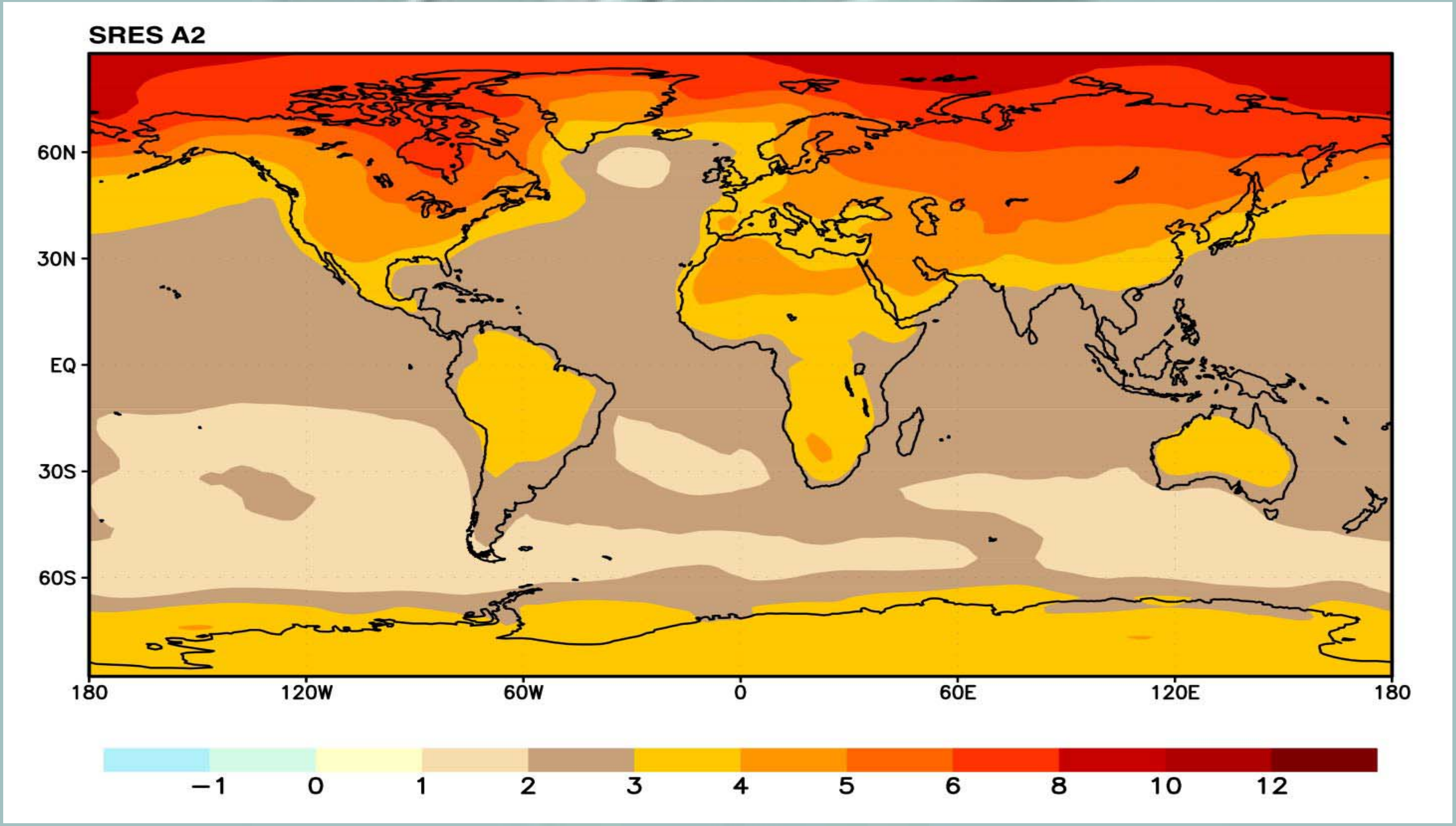



# The projected sea level change

## Land areas are projected to warm more than the oceans with the greatest warming at high latitudes




**Annual mean temperature change, 2071 to 2100 relative to 1990: Global Average in 2085 = 3.1$^{o}$C**

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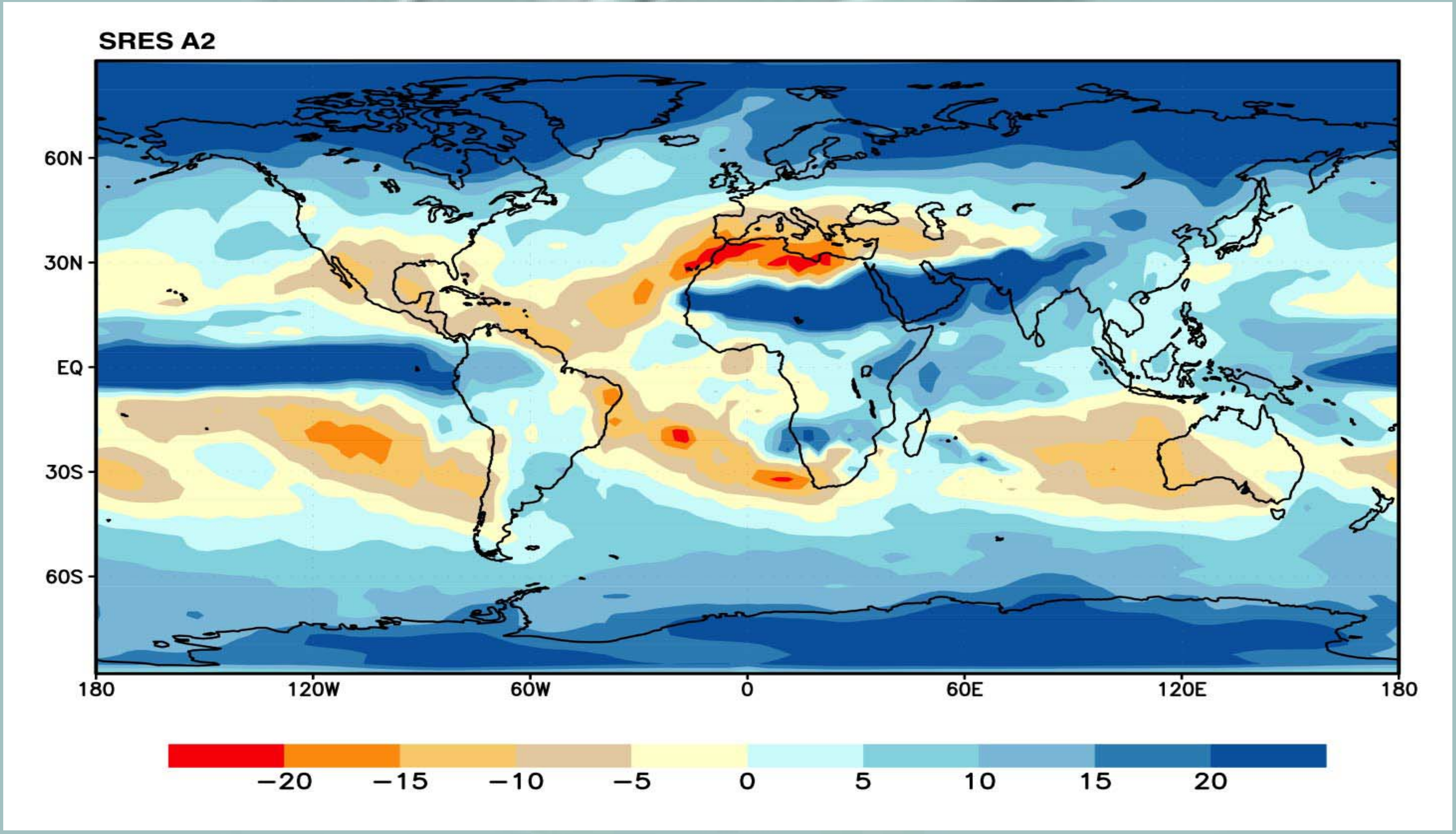
# Some areas are projected to become wetter, others drier with an overall increase projected




**Annual mean precipitation change: 2071 to 2100 Relative to 1990**

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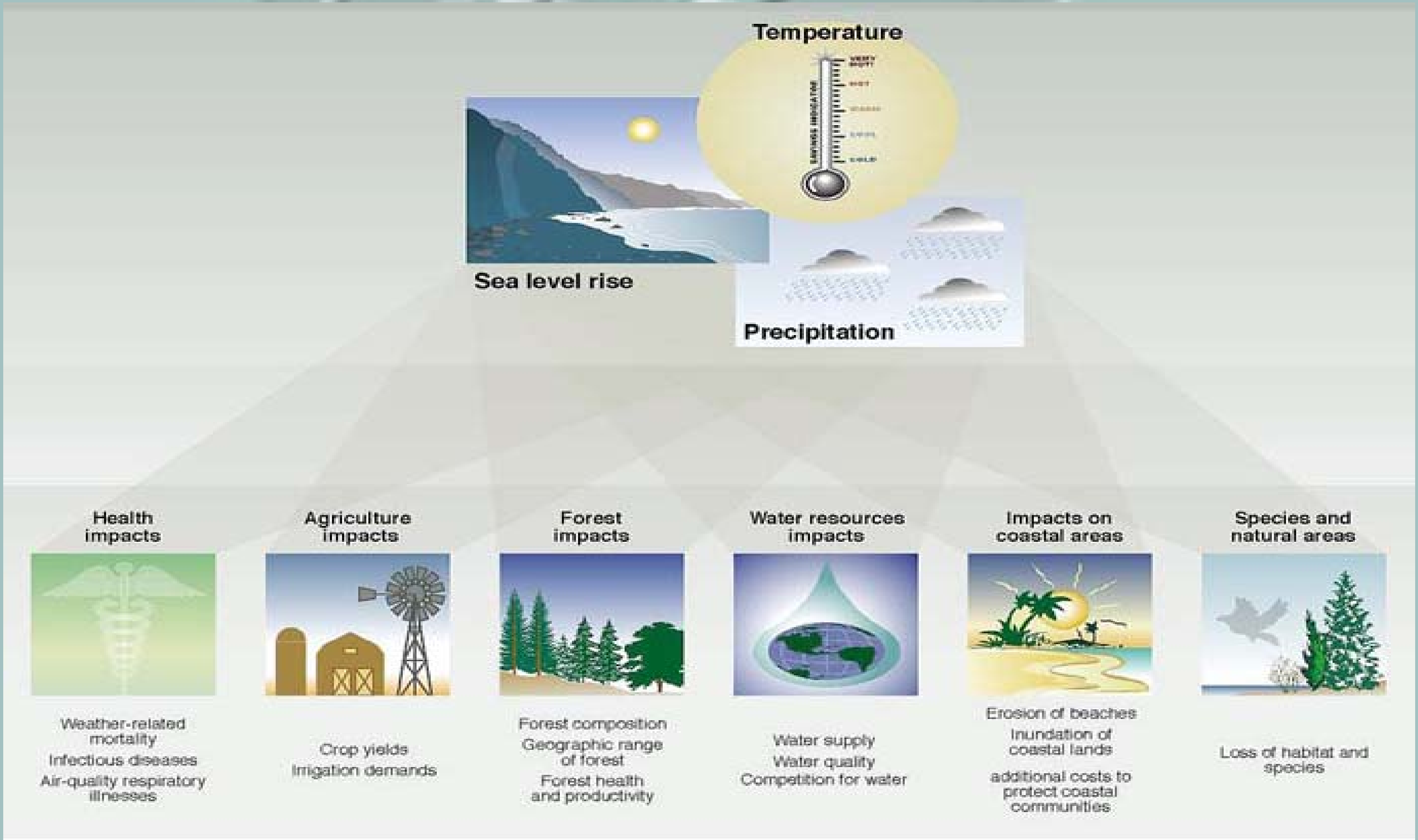
# More adverse than beneficial impacts on biological and socioeconomic systems are projected



# Climate in the 20th Century

- Average temperature increased by 1 degree Celsius
- Mean sea level increased by 2 mm per year

# Projections in 21st Century

| | 2010 - 2039 | 2040 - 2069 | 2070 - 2099 |
|---|---|---|---|
| Temp increase (degrees Celsius) | 0.48 – 1.06 | 0.79 – 2.45 | 0.94 – 4.18 |
| Change in precipitation ( %) | -14.2 to +13.7 | -36.3 to +34.2 | -49.3 to +28.9 |

Max & Min temps increasing, cold nights decreasing

Consecutive dry days inc. while no. of heavy rainfall events inc.

Sea level will rise by 5 mm per year

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# Impacts

- A 0.5 m rise in sea level will result in 38% of beach loss
- 1/3 of turtle nesting habitat will be lost
- Coral bleaching could become annual or bi-annual without an increase in coral tolerance of 0.2 to 1.0 degrees Celsius
- Sea surface temp – increased incidences of ciguatera in fish
- Forest mortality of 5.2% per annum
  - 7 times higher than non hurricane periods

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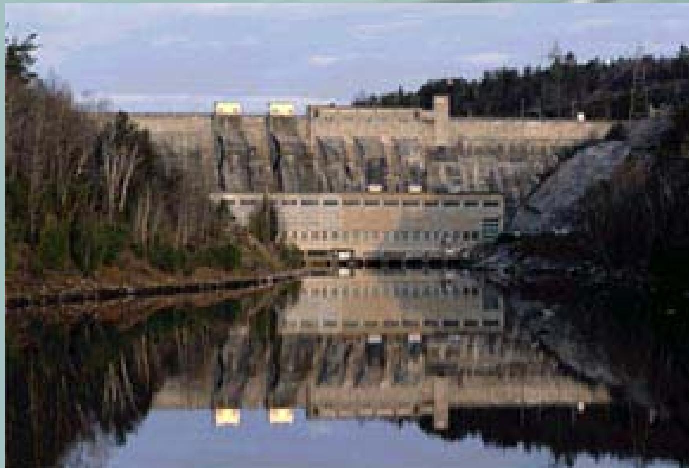

**Water Security:**

–**Salt water intrusion**

–**Less rainfall**

–**More evaporation**

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# Water Supply

- San Pedro
  - Desalination plant
- Placencia
  - Piped across lagoon
- Belize City
  - Supply located 17 miles inland
  - During drought, pumping limited to high tide
  - Salt water intrusion?

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# Sea Level Rise

- Erosion
- Coastal flooding
- Inundation
- Saltwater intrusion
- Mangroves

- Tourist destinations
- Human settlements
- Water supply
- Agriculture
- Aquaculture
- Fisheries

# AVVA Vulnerability Analysis

- Entire coastline videotaped and analyzed in 1995
- Sea level rise of 4, 30 and 50 cm.
- Time periods of 25, 50 and 100 yrs.
- Little impact in 25 yrs
- 50-100% of beaches lost in 100 yrs

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Branching coral

Brain coral

**coral bleaching events are expected to increase**

**Fisheries**

**Threatened:**

**-Loss of habitats**

**mangroves, reefs**

**-Species migrate**

**-Water quality changes**

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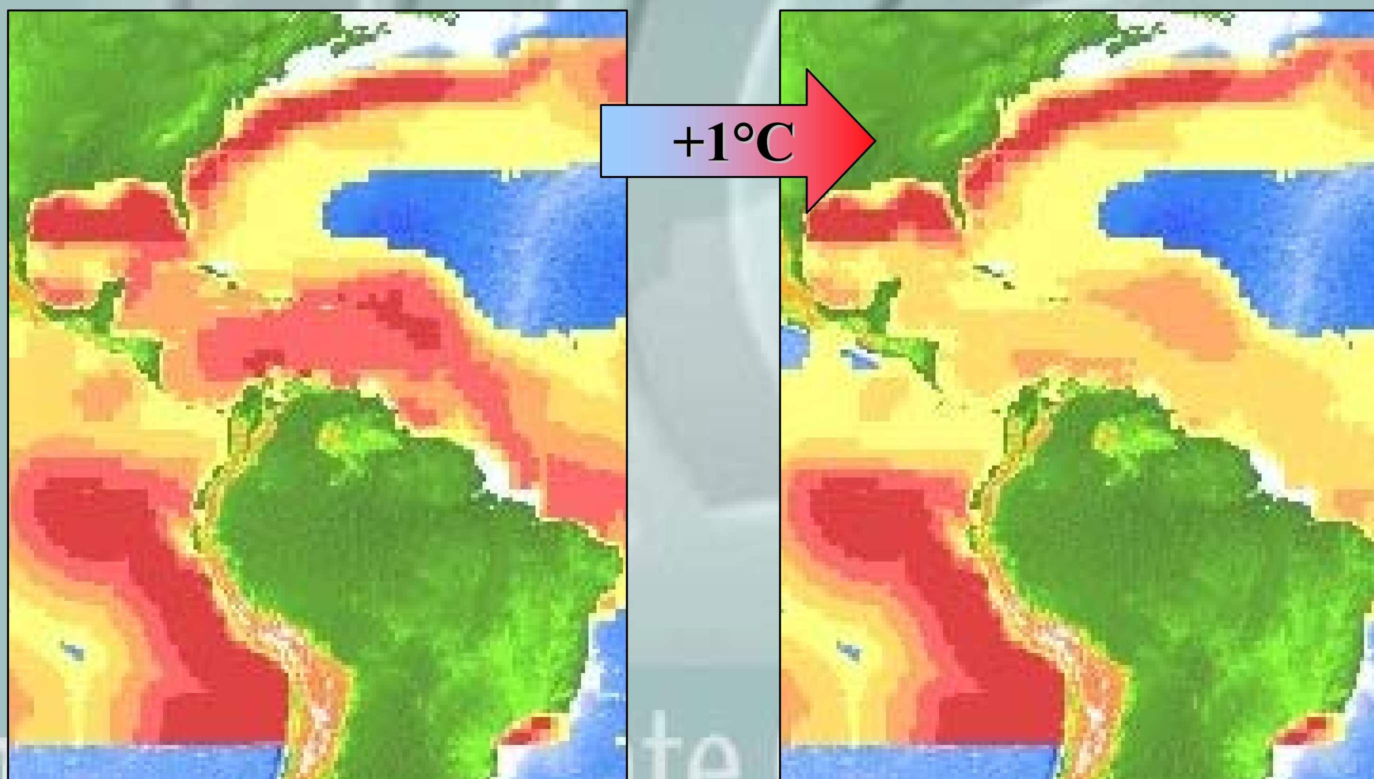
*Thunnus albacares*

Habitat becomes less favourable

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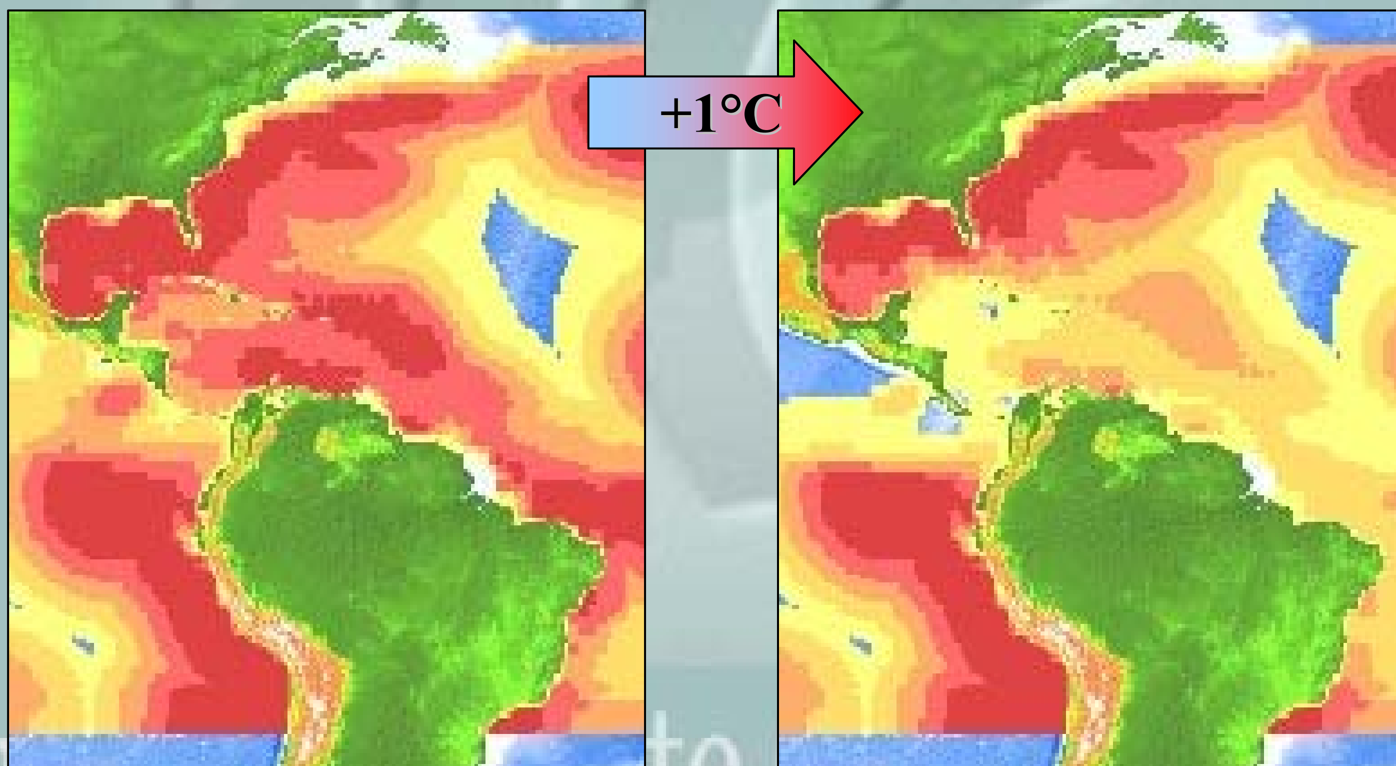
Dolphin fish

*Coryphaena hippurus*

Habitat becomes less favourable

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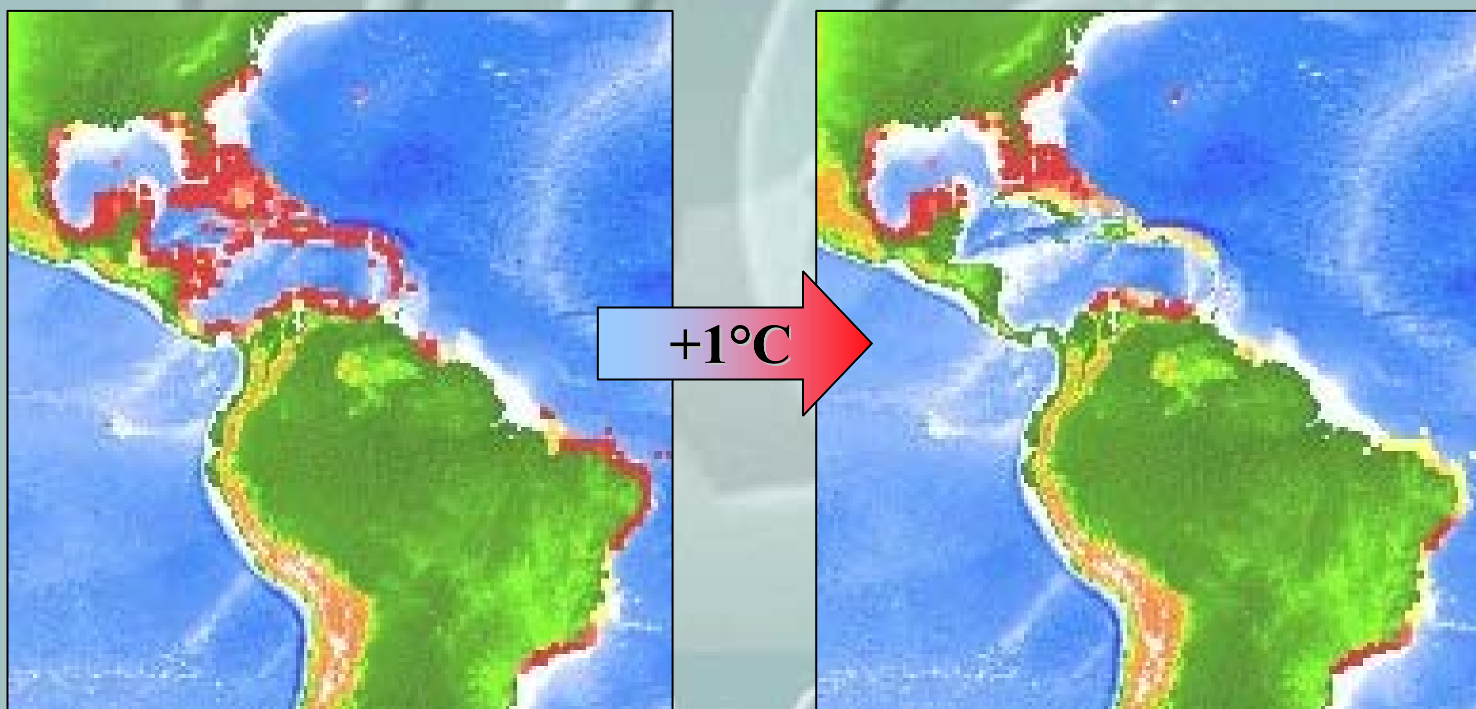
*Sparisoma chrysopterum*

Habitat becomes less favourable

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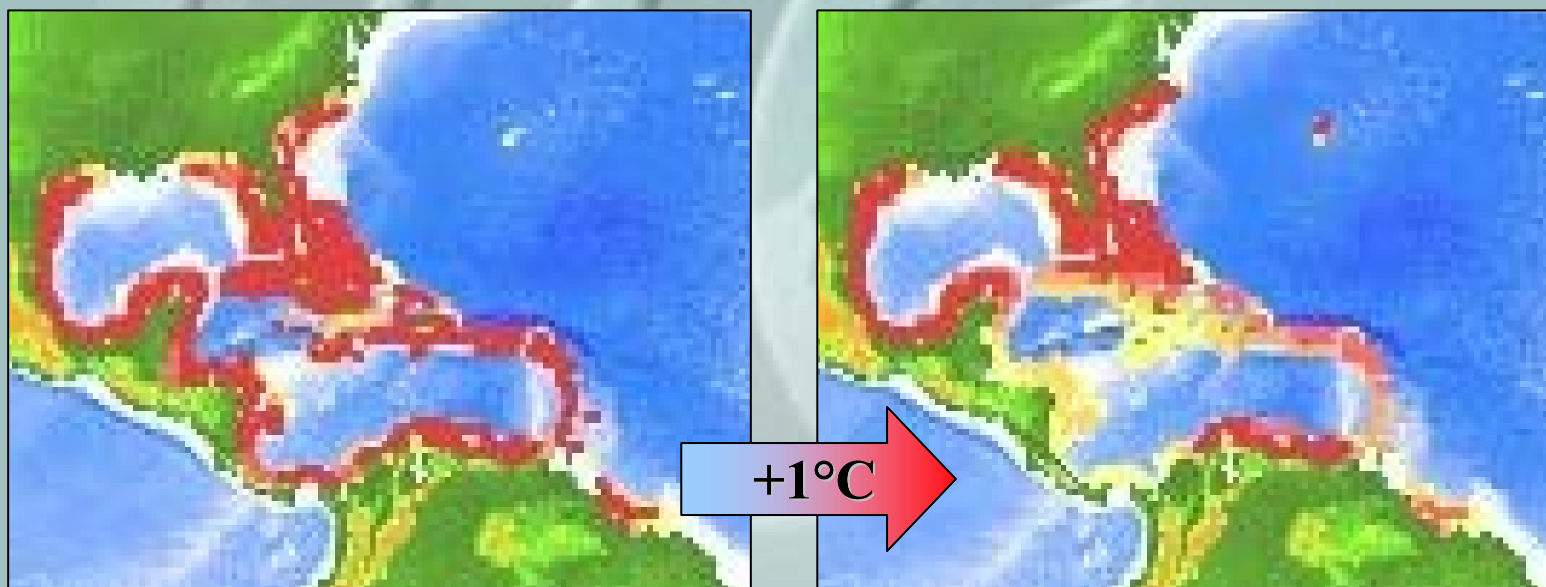
Yellow tail

*Ocyurus chrysurus*

Habitat becomes less favourable

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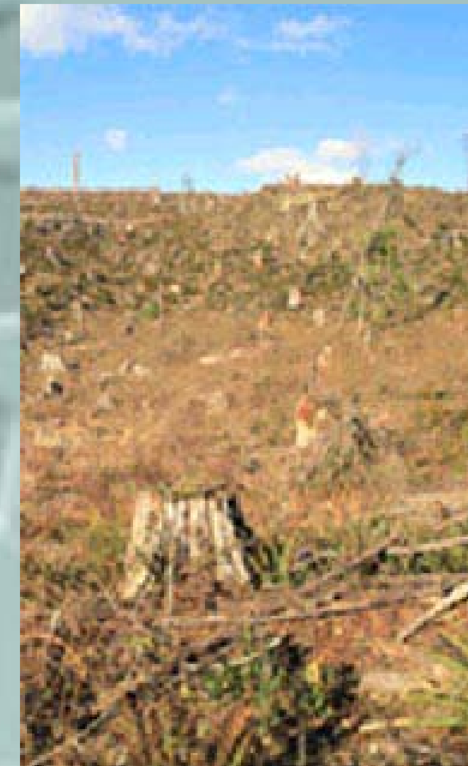


**Food Security**

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# Vulnerability Studies in Agriculture

- 1995
- DSSAT
- Beans, corn and rice
- 1-2°C rise in temp
- ± 10-20% change in precipitation
- Result: 10-20% decline in yields

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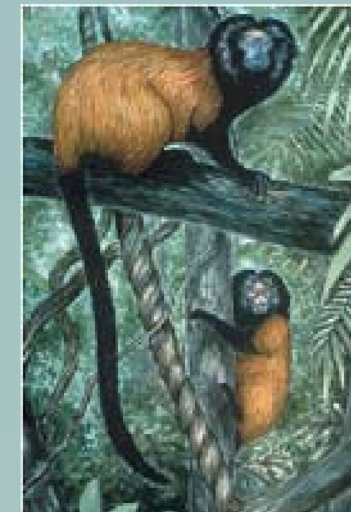

**Forestry Threatened:**

**Higher temperatures**

**Lower humidity**

**More forest fires**

**More pests and diseases**

# Forestry

- 1999-2000
- Pine bark beetle infestation
- 75% of pine forest destroyed
- High temperatures & high humidity
- Poor management
- Climate change signal?
- Impacts on timber industry and biodiversity
- Contributes to emissions

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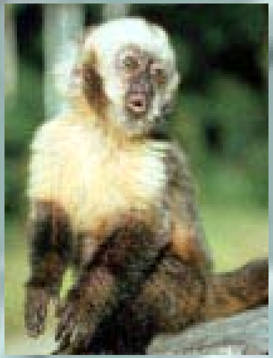


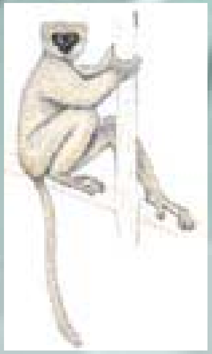


## Loss of Biodiversity

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# The high priority diseases identified in the small island states.

- Disease Identified: malaria, dengue, diarrhea disease/typhoid, heat stress, skin diseases, acute respiratory infections, viral hepatitis, varicella (Chicken pox), meningococcal disease and asthma, toxins in fish and malnutrition.

- The possibility of dust-associated diseases with the annual atmospheric transport of African dust across the Atlantic, is unique to the Caribbean islands.

- In addition to weather and climate factors, social aspects such as culture and traditions are important in disease prevalence.

Ebi, et al., 2005 and Ortíz, 2004, 2006

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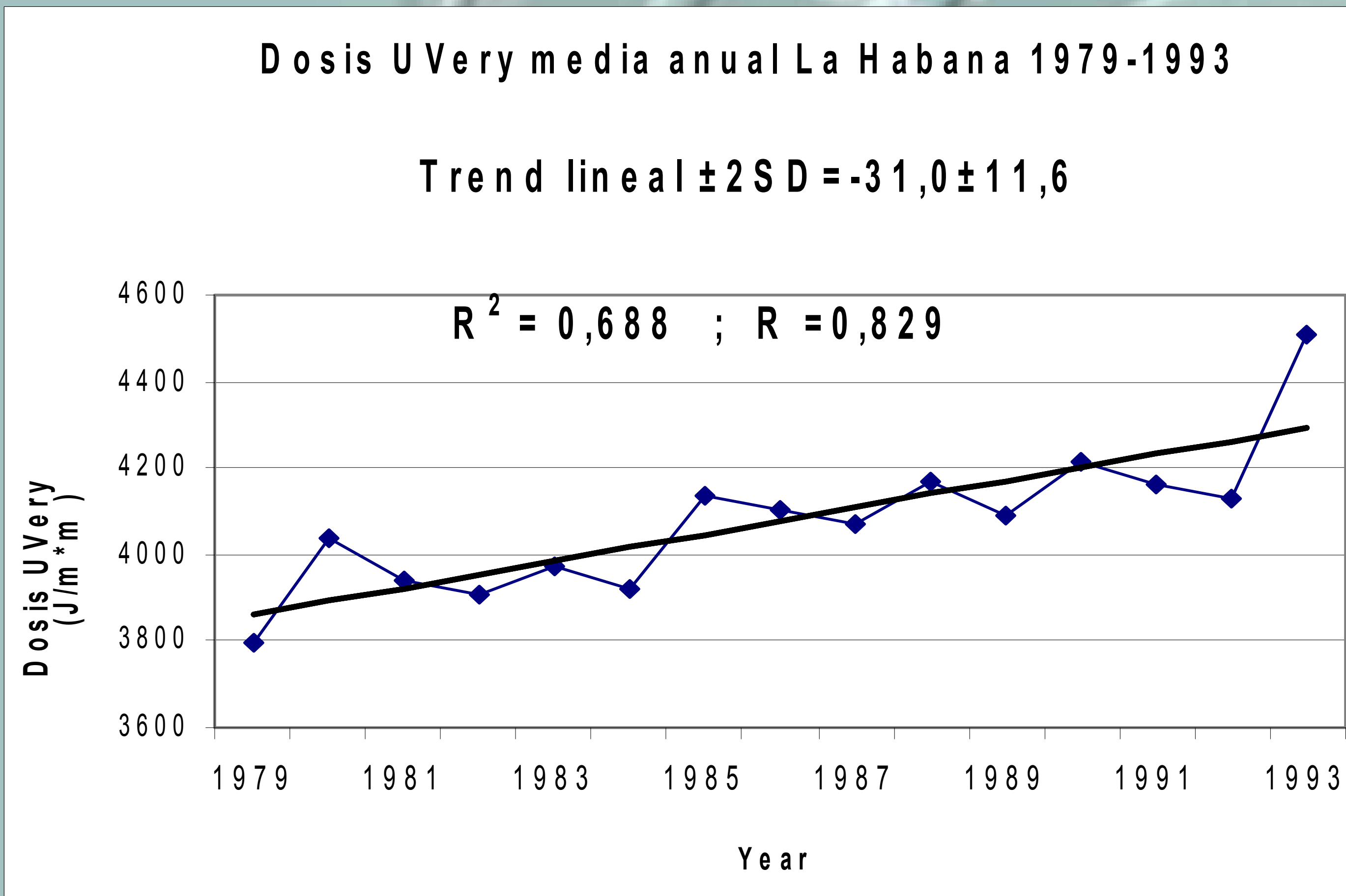
## Variability and trend of average yearly UV incidence due to cloud cover and total ozone changes in Havana during the period 1979-1993




Average annual UV increased significantly in agreement with the trend of decrease in cloud cover. This results are consistent with the observed trends by satellite in the region during 1979-1998

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# Limitations

- Resolution of models: 400 – 125 km.
- Small islands do not appear
- Projections are over water not land
- Very little work in downscaling
- Some climatic processes are not well understood (eg. mid-summer drought)
- Insufficient information on sea surface temperature
- Less scientific literature available to IPCC to prepare 4th Assessment Report than the 3rd Assessment Report

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# Challenges

- Limited size, prone to natural hazards and external shocks enhance vulnerability
- Low adaptive capacity and high costs
- 50% of population live within 1.5 km of coastline
- International airports, roads, capitals on coast
- Stresses: terms of trade, impacts of globalization, financial crises, international conflicts, rising external debts, rapid population growth, rising poverty, political instability, unemployment, reduced social cohesion, widening gap between rich and poor

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# Requirements

- Downscaling of global climate models
- Vulnerability assessments using objective techniques
- Integrated assessment models required
  - Fisheries: spawning sites, migratory patterns, habitats at various life cycles, changes in sea temperature and water quality
- Scientific work published in peer reviewed literature
- National Climate Change Policies and Action Plans

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