



THE UNIVERSITY OF THE WEST INDIES
AT MONA, JAMAICA

GLOBAL WARMING & GLOBAL ENVIRONMENTAL CHANGE

CONTENT

- Pop Quiz
 - Test your knowledge

- Global Warming Review

- Global Environment Change
 - Temperature
 - Hydrology – Precipitation, Snow Cover
 - Sea Level
 - Extremes

GLOBAL WARMING REVIEW

○ Earth System

- Early Greeks
 - 4 Fundamental Components – Air, Water ,Earth and Fire
- Scientist
 - Atmosphere is comprised of several chemically distinct gases,

Nitrogen (N ₂)	78.08%
Oxygen (O ₂)	20.95%
Argon (Ar)	0.93%
Neon, Helium, Krypton	0.0001%

- The concentrations of these gases are constant over time and location.
- Both nitrogen and oxygen are essential to human life on the planet, but have little effect on weather and other atmospheric processes.

GLOBAL WARMING REVIEW

○ Earth System

- The atmosphere is also comprised of variable gases

Carbon dioxide (CO ₂)	0.038%
Water vapour (H ₂ O)	0-4%
Methane (CH ₄)	<i>trace</i>
Sulfur dioxide (SO ₂)	<i>trace</i>
Ozone (O ₃)	<i>trace</i>
Nitrogen oxides (NO, NO ₂ , N ₂ O)	<i>trace</i>

- Even though these gases make up less than 1% of the atmosphere they greatly influence the short and long term weather making the Earth much like a greenhouse and warm enough to support life.
- Without the greenhouse effect the earth would be a frigid -18°C.
- Global warming results due to changes in the concentrations of these gases.

GLOBAL WARMING REVIEW

○ Global Warming

- Definition
 - An abnormal and sustained increase in the average temperature at or near the earth's surface.
- Human activity has been increasing the concentration of greenhouse gases in the atmosphere.
- Prior to industrialization levels of carbon dioxide were ~ 280 ppmv, and current levels are greater than 380 ppmv.

POP QUIZ – GLOBAL WARMING

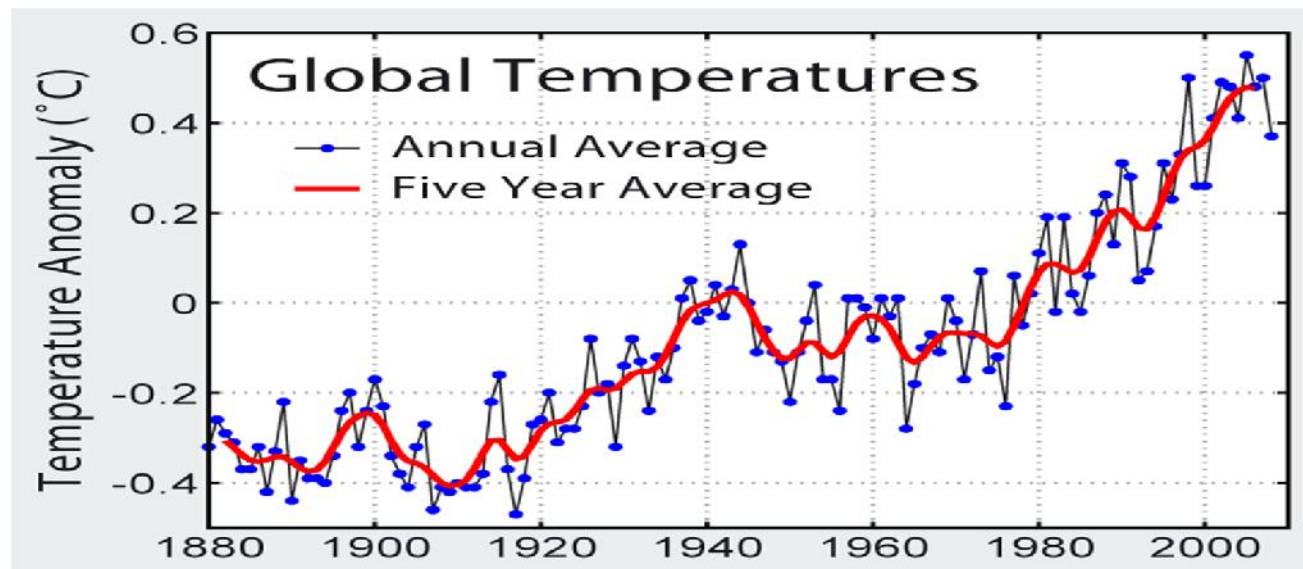
Global Warming

1. What is the most abundant greenhouse gas?
 - **Water Vapour**
2. Without a natural greenhouse effect, the temperature of the Earth would be?
 - **-18°C**
3. The global concentration of CO₂ in our atmosphere today is approximately?
 - **380 ppm**
4. Global warming is an average and abnormal increase in atmospheric temperatures in / at:
 - **Near the Earth Surface**
5. The term global environmental change refers to :
 - **All of a, b, & c.**

ENVIRONMENTAL CHANGE

○ Temperature

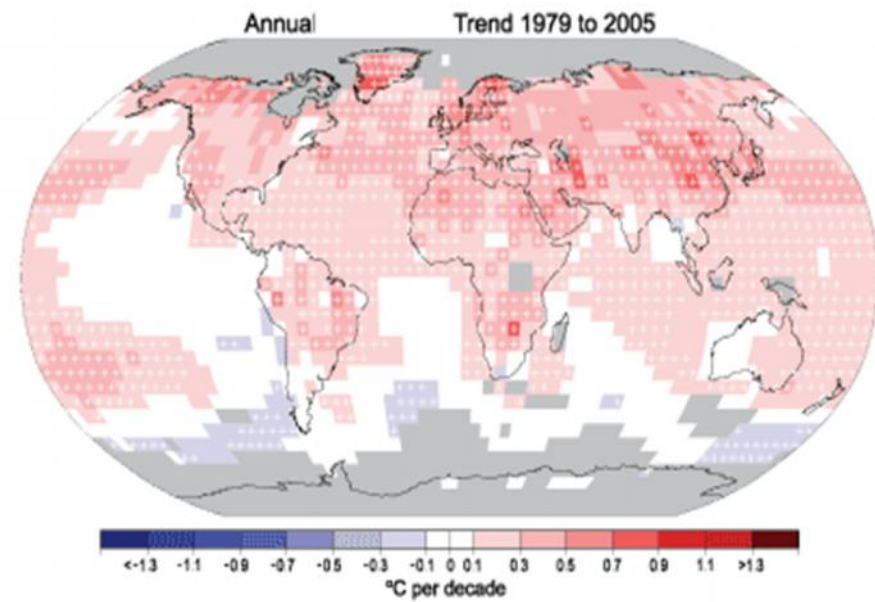
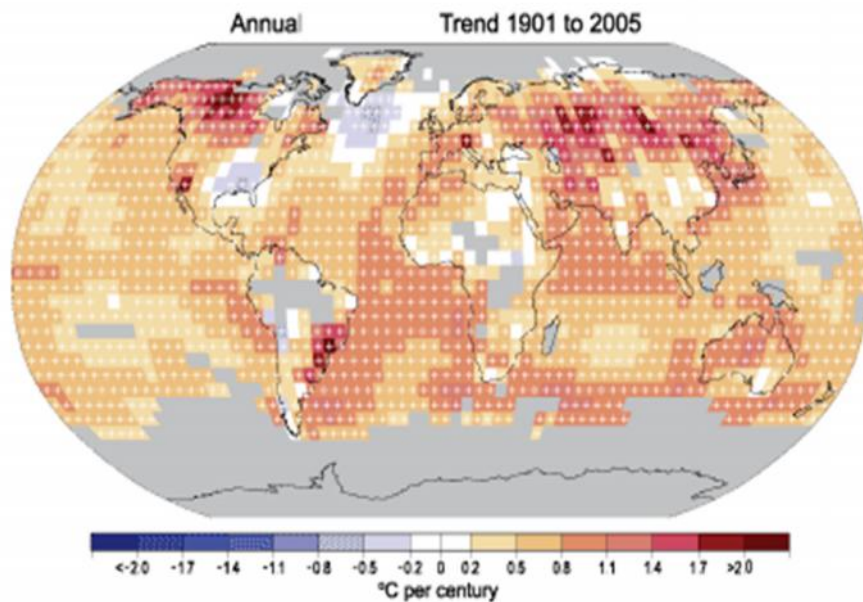
- Rise of $0.74^{\circ}\text{C} \pm 0.18^{\circ}\text{C}$ during the period 1906 – 2005
- The warming over the the past 50 years of $0.13^{\circ}\text{C} \pm 0.03^{\circ}\text{C}$ per decade is nearly twice that for the past 100 years
- More warm days, fewer cold nights
 - > Lower diurnal temperature range



ENVIRONMENTAL CHANGE

○ Temperature

- Mid Latitude Northern and Southern land masses have areas of greatest historical warming
- Parts of the southeastern U.S. and parts of the North Atlantic have cooled slightly over the last century



POP QUIZ – ENVIRONMENTAL CHANGE

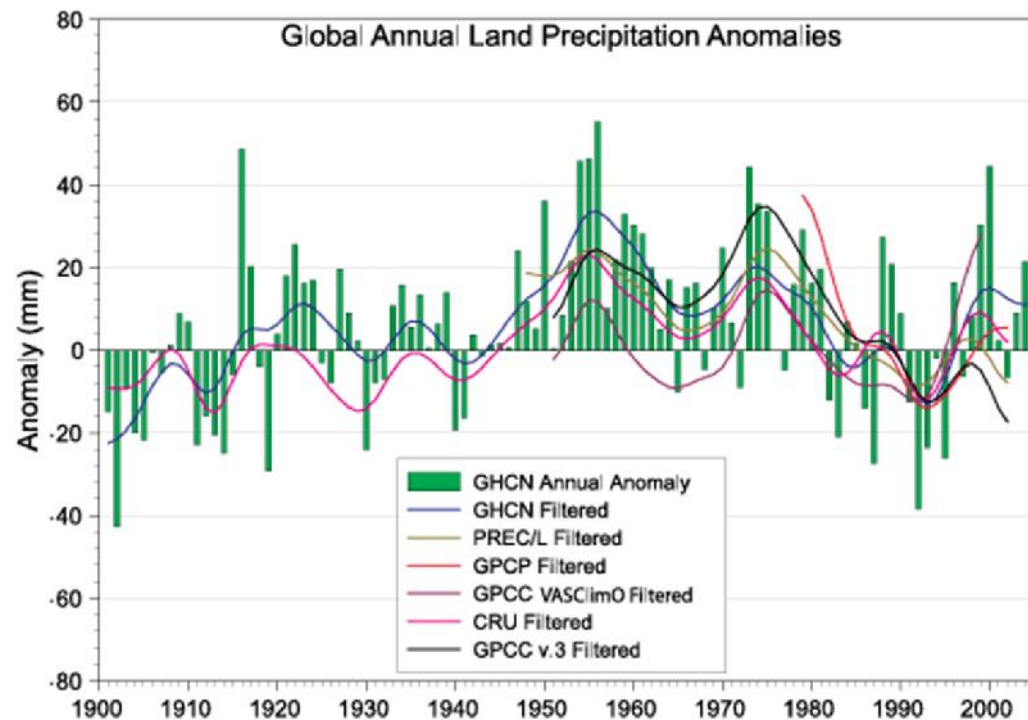
Temperature

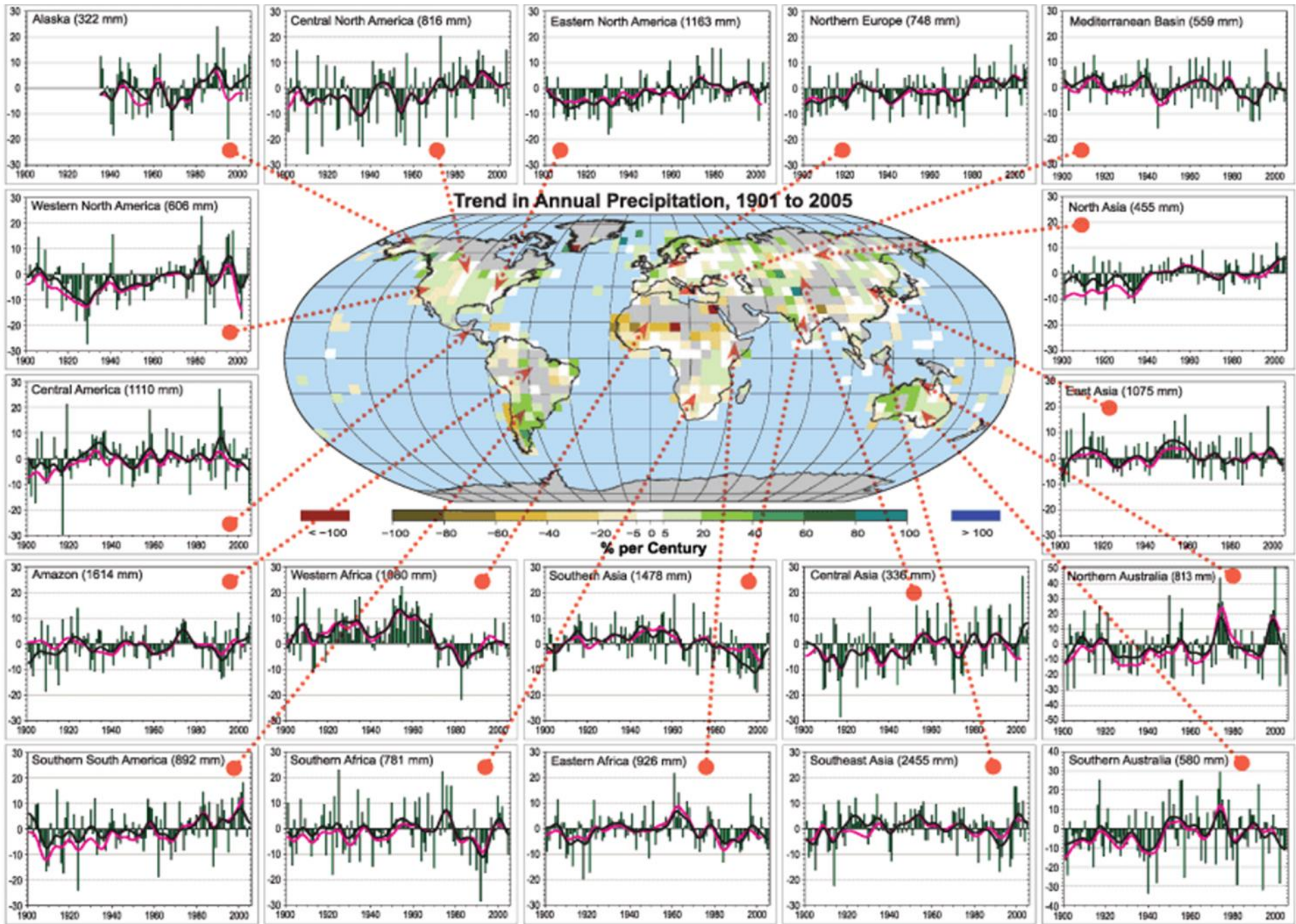
1. Between 1906 and 2005 the Earth's temperature increased by approximately ____ $\pm 0.18^{\circ}\text{C}$.
 - **0.80°C**
2. What is the warming trend per decade – globally - over the past 50 years?
 - **0.13°C**
3. Although the Earth over the last century has shown an average increase in temperatures, a few areas have been found to be relatively cooler. Which of the following areas (or parts of thereof) has been found to be relatively cooler?
 - **Northern Atlantic**
4. El Nino is as a result of global warming?
 - **False**

ENVIRONMENTAL CHANGE

○ Hydrology

- Globally-averaged land-based precipitation shows a statistically insignificant upward trend





ENVIRONMENTAL CHANGE

○ Hydrology

- Increases in annual precipitation have occurred in the higher latitudes of the Northern Hemisphere and southern South America and northern Australia.
- Decreases have occurred in the tropical region of Africa, and southern Asia
- Agreement between measured changes in precipitation and observed changes in stream flow, lake levels, and soil moisture.
- Decreases in the North Hemisphere's snow cover

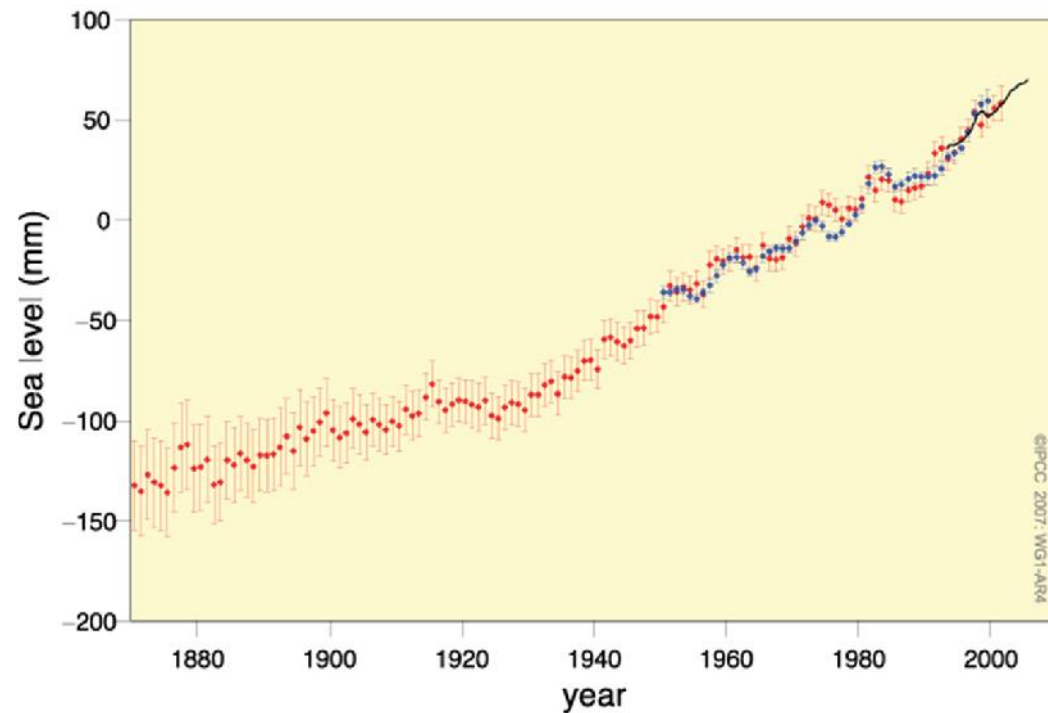
POP QUIZ – ENVIRONMENTAL CHANGE

1. The areas of greatest precipitation decreases have been:
 - **Tropics**
2. These areas have noted an annual increase in precipitation:
 - **Northern Australia, Southern Africa**
3. Global Warming has resulted in decreases in the Southern Hemisphere's snow cover
 - **False**

ENVIRONMENTAL CHANGE

○ Sea Level Rise

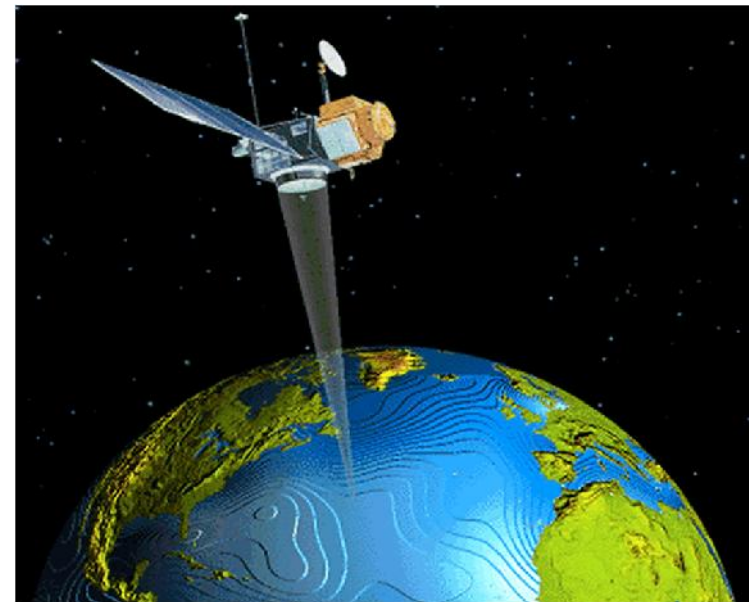
- Global mean sea level has rising at an average rate of 1.7 ± 0.5 mm/yr over the past 100 years.
- Increases are mainly due to thermal expansion and contributions from melting alpine glaciers.



ENVIRONMENTAL CHANGE

○ Sea Level Rise

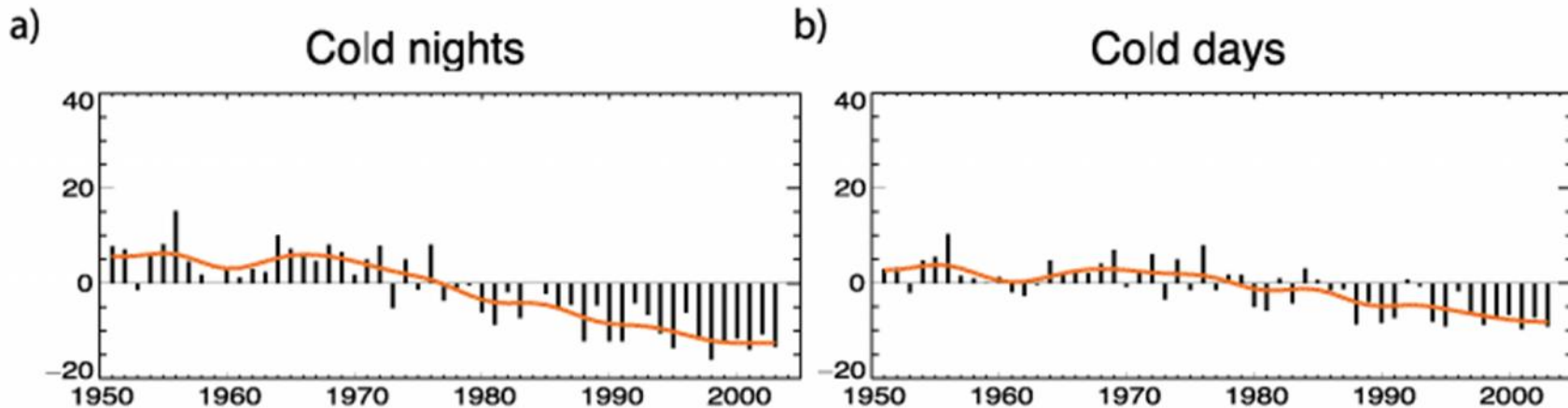
- Updated measurements using only the period when satellite measurements have been available indicate the rate of SLR has now reached $3.4 \pm 0.7 \text{ mm/year}$.



ENVIRONMENTAL CHANGE

○ Extremes

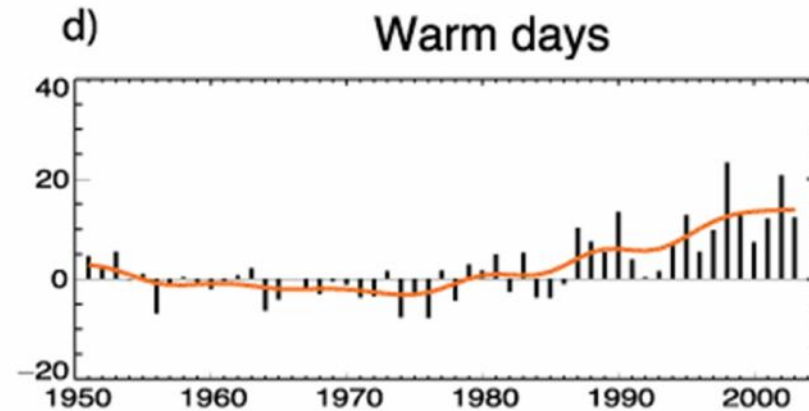
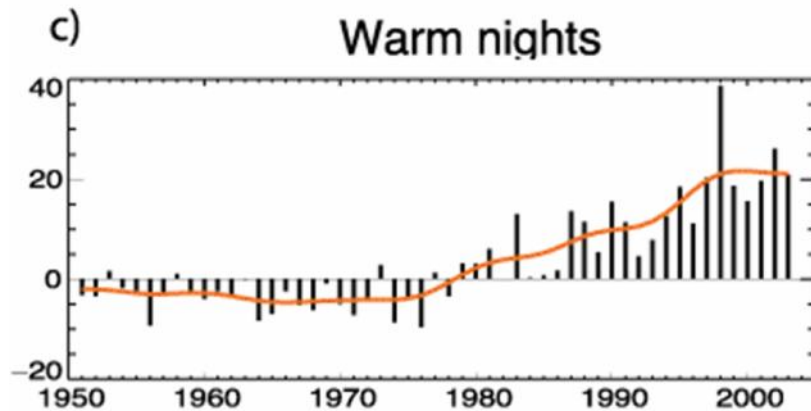
- Decreases in the number of unusually cold days and nights
- Similarly decreases in the number of frost days in the northern hemisphere

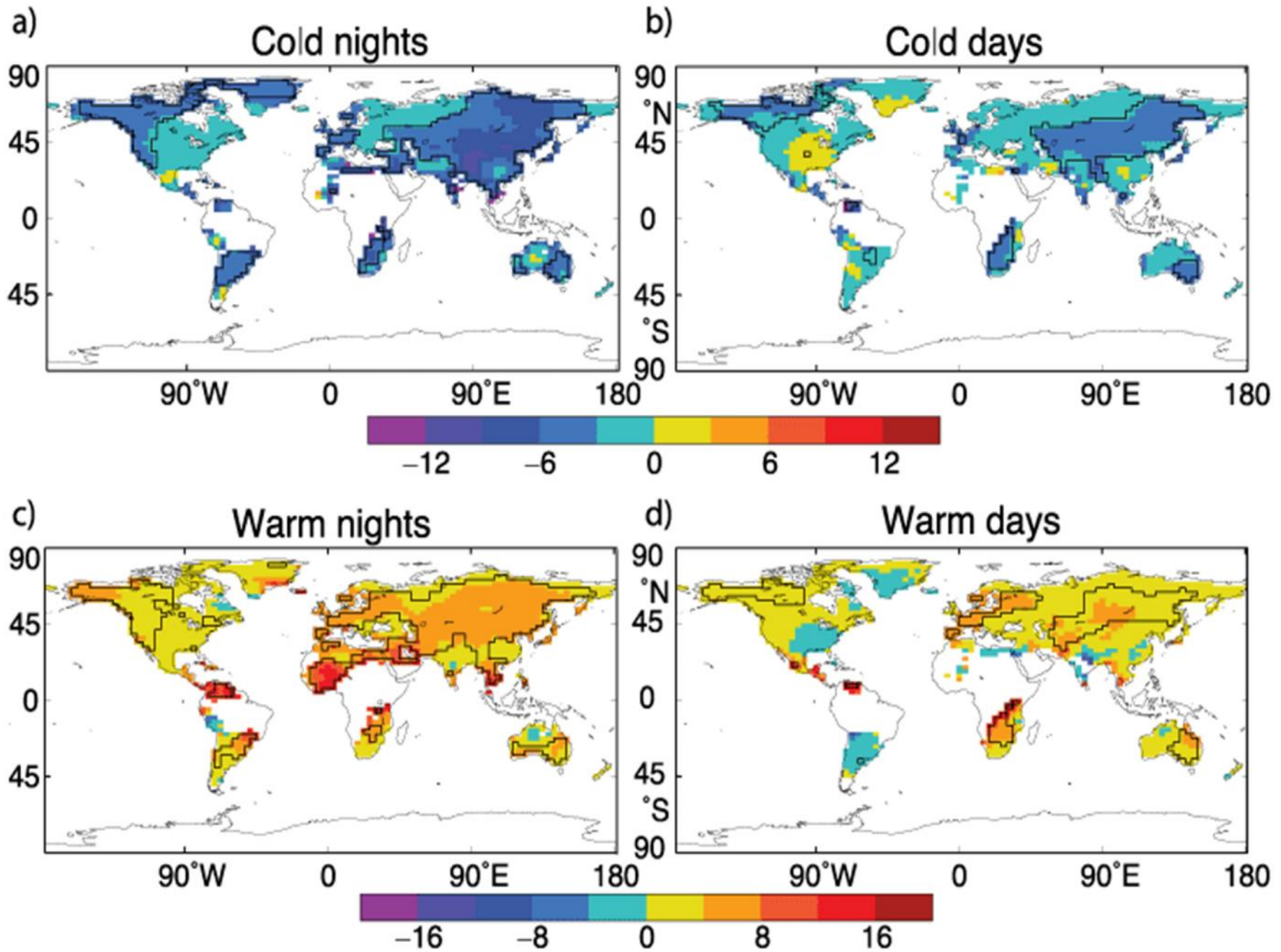


ENVIRONMENTAL CHANGE

○ Extremes

- Increases in the number of unusually warm days and nights.
- Similarly changes in lengthening of the growing season

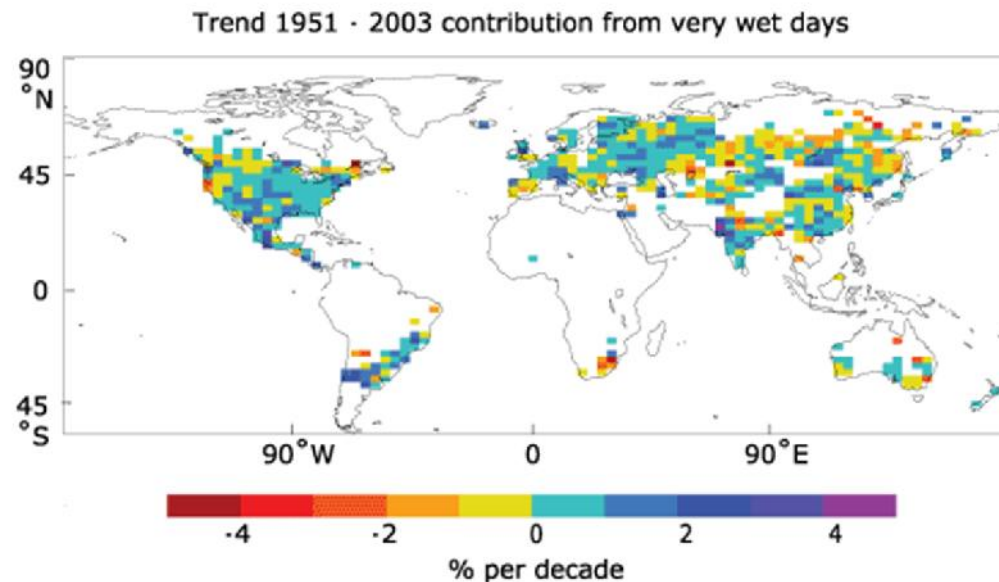




ENVIRONMENTAL CHANGE

○ Extremes

- The extent of regions affected by droughts has increased as precipitation over land has marginally decreased.
- Generally, numbers of heavy daily precipitation events that lead to flooding have increased, but not everywhere.



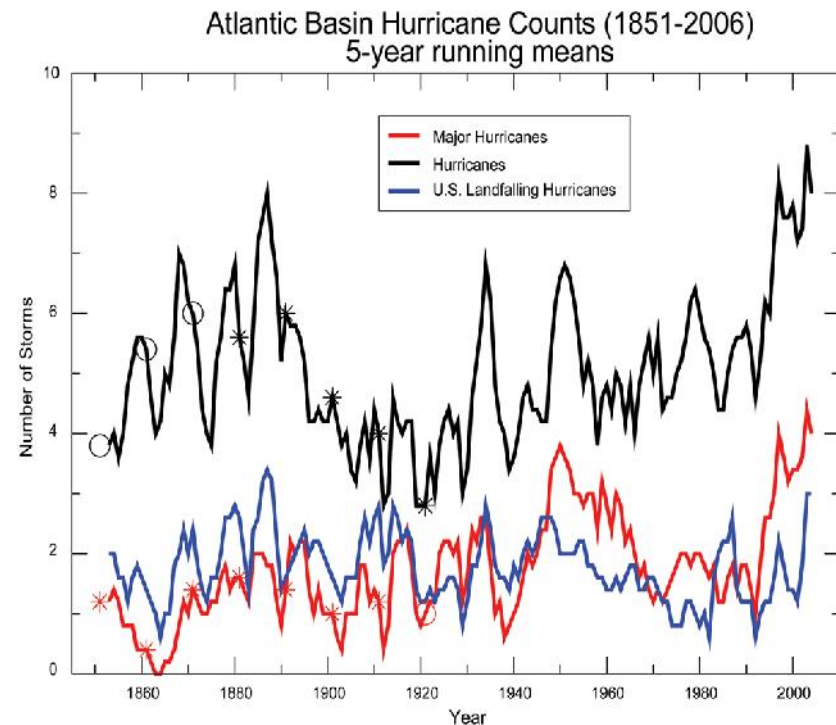
In areas such as eastern Asia, extreme precipitation events have increased despite total precipitation remaining constant or even decreasing somewhat.



ENVIRONMENTAL CHANGE

○ Hurricanes

- Tropical cyclone activity seems to have generally increased over the last half of the 20th century in the northern hemisphere, but decreased in the southern hemisphere.
- Hurricane activity in the Atlantic has shown an increase in number since 1970 with a peak in 2005.



POP QUIZ – ENVIRONMENTAL CHANGE

Extremes

1. Sea Level rise due to global warming is largely due to:
 - **Thermal expansion of water**
2. Changes in the number of warm days and warm nights in the northern hemisphere has resulted in
 - **Lengthening of the growing season**
3. Globally the number of tropical cyclones has
 - **Increase in one hemisphere whilst decreasing in the next**