

**National Seminar on “Issues of Global Warming and Climate Change”  
Christ University Nodal Office, Thiruvananthapuram  
October 08 – 09, 2010.**

# **Atmospheric Impacts and Environmental Changes**



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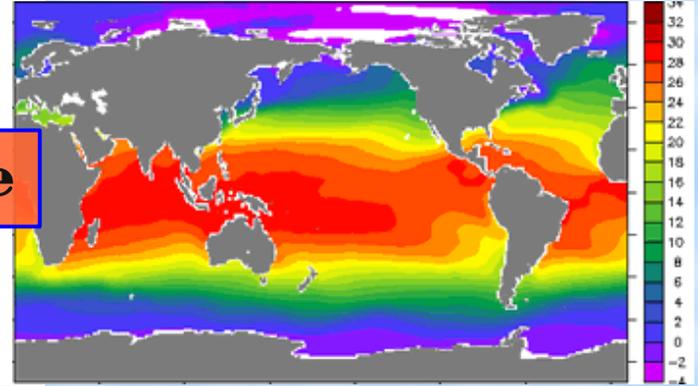
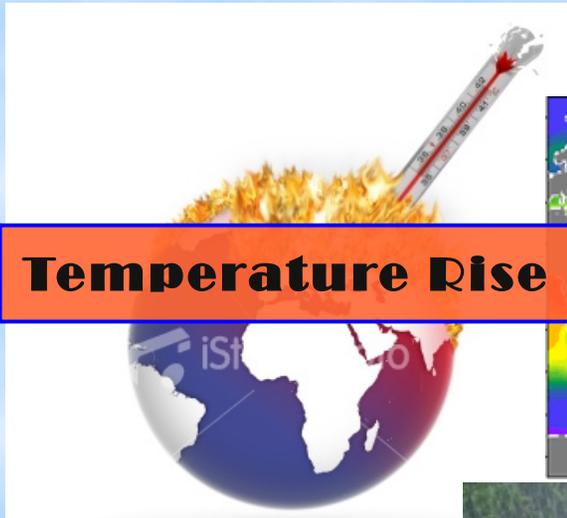
**Indian Space Research Organization, Thiruvananthapuram – 695 022**

# Organization of Presentation

- **Climate Change: Environmental Impacts**  
(INTRODUCTION)
- **Natural and Human Influences on Global Climate**  
(HOW DO THEY INFLUENCE THE GLOBAL CLIMATE)
- **Greenhouse Gases: Global Scenario**  
(SOME BASICS AND THEIR PERCENTAGE SHARE)
- **Climate Change: Future Trends**  
(FUTURE PROJECTIONS: CLIMATE MODELS)
- **Global Warming and Climate Change: Road Ahead**  
(HOW CAN WE CONTRIBUTE EFFECTIVELY?)

# Climate Change: Environmental Impacts

**Temperature Rise**



**Precipitation**



**Sea-level Rise**



# Climate Change (Temperature Rise)

**Coastal Glaciers are retreating !!!**

**Muir Glacier, Alaska**

**August 1941**

**August 2004**



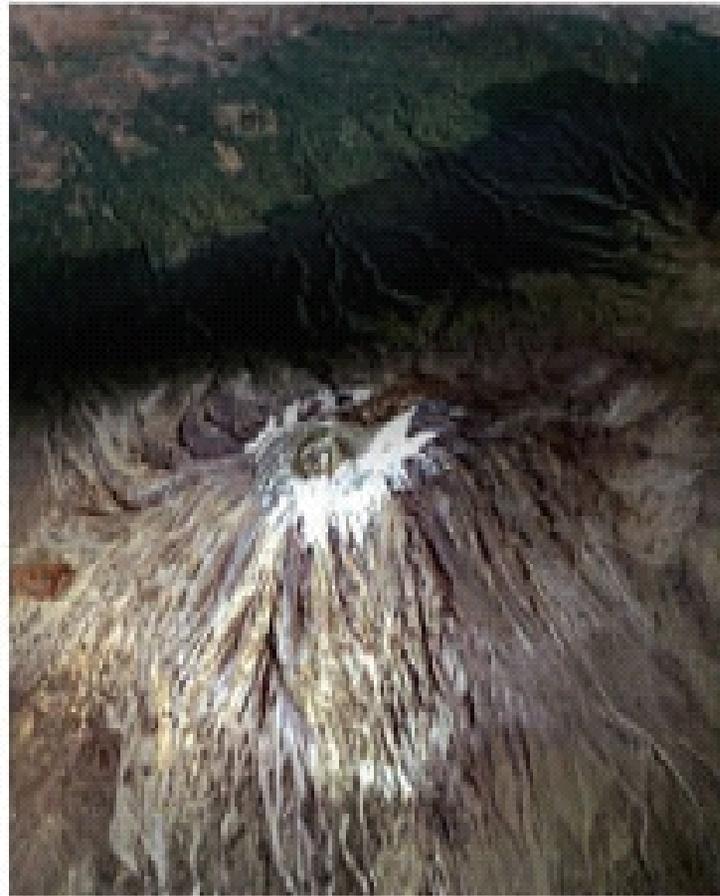
**(Image Courtesy: Online Glacier Photography Database)**

## Climate Change (Temperature Rise...)

**Mountain Glaciers are disappearing !!!**

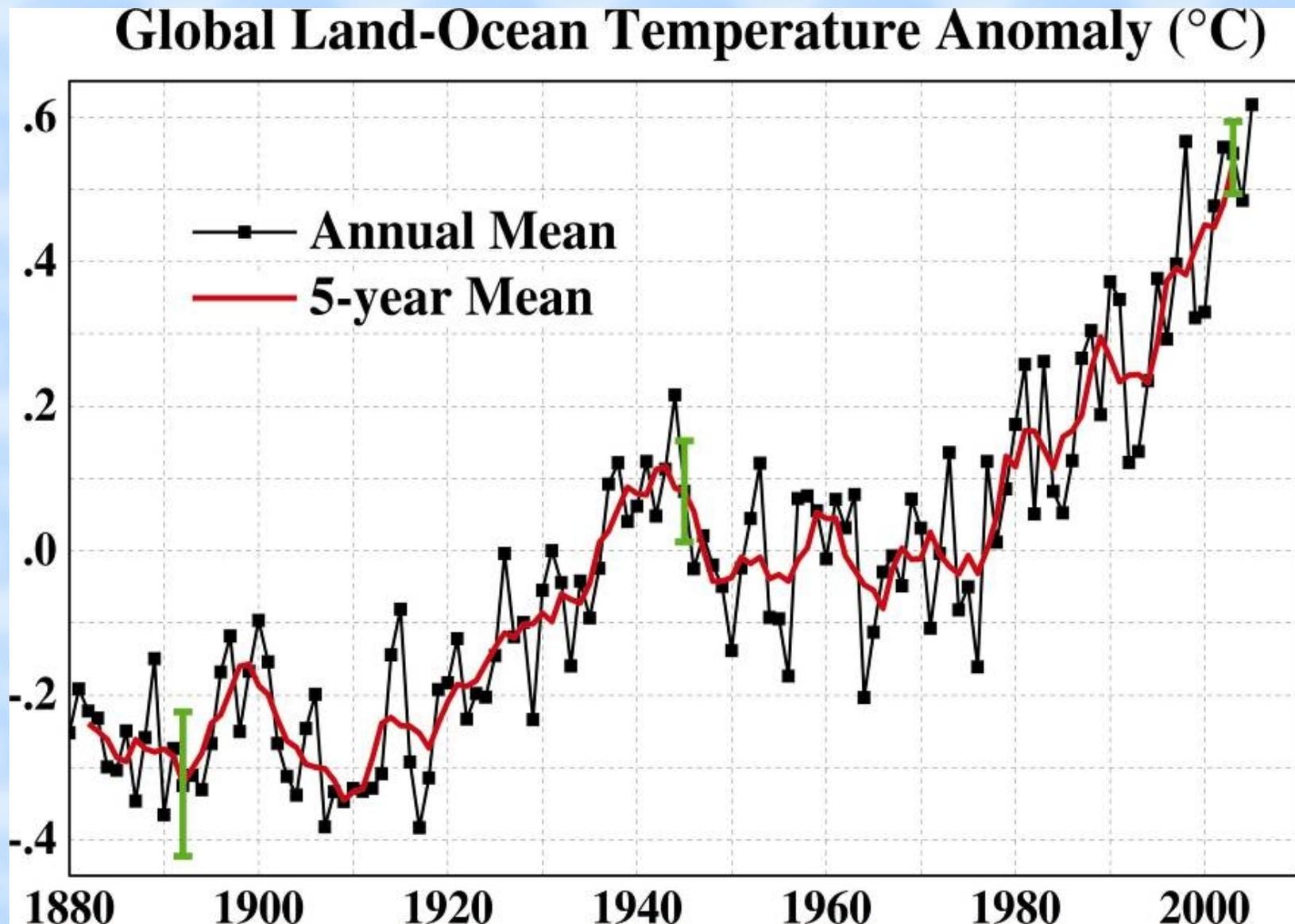


Mt. Kilimanjaro-- February 17, 1993



Mt. Kilimanjaro-- February 21, 2000

**Global Temperatures have risen by about 0.8°C in the past 125 years (IPCC) !!!**

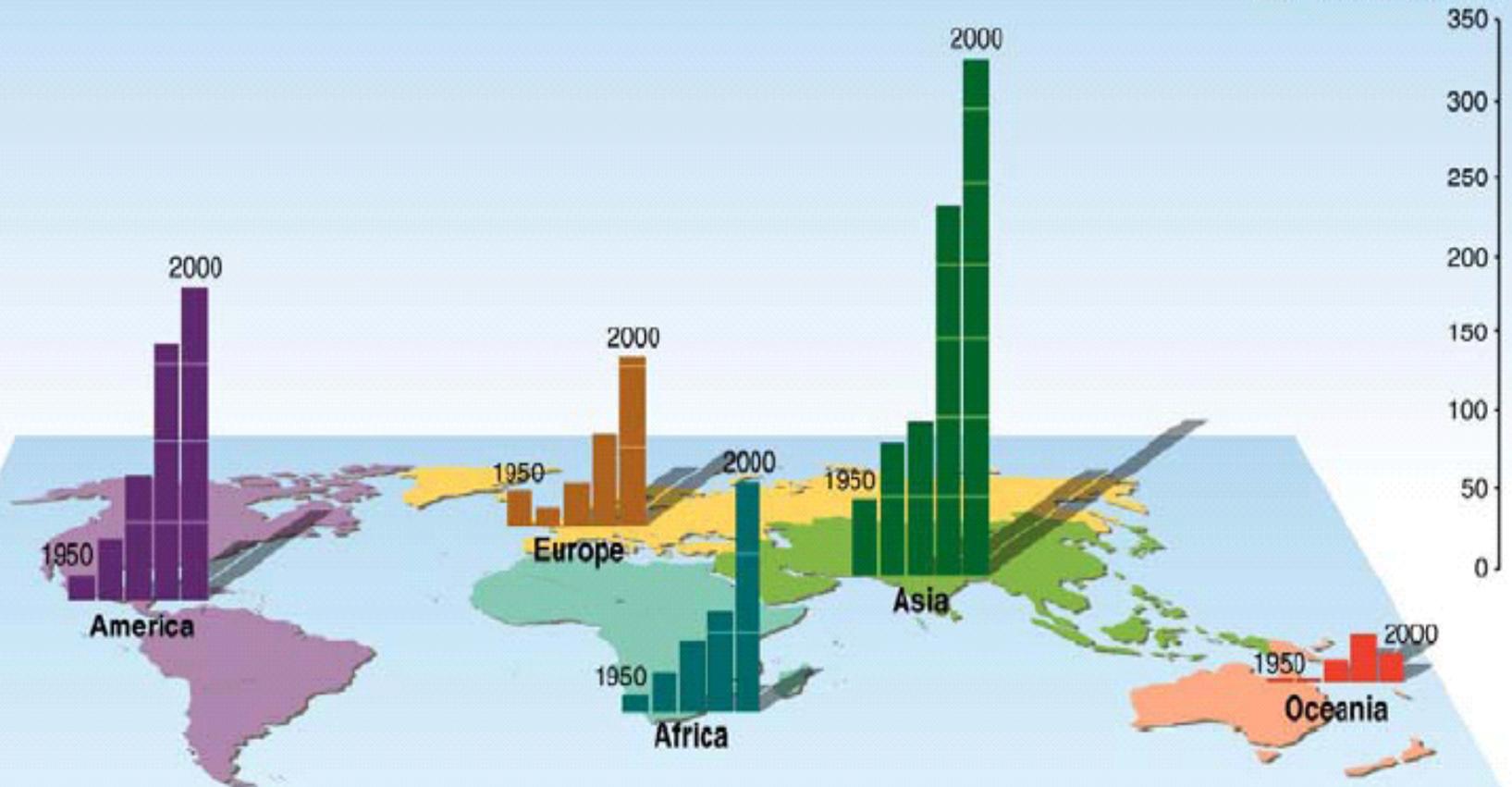


# Climate Change (Precipitation)

## Floods by Continent and Decade since 1950

### Floods

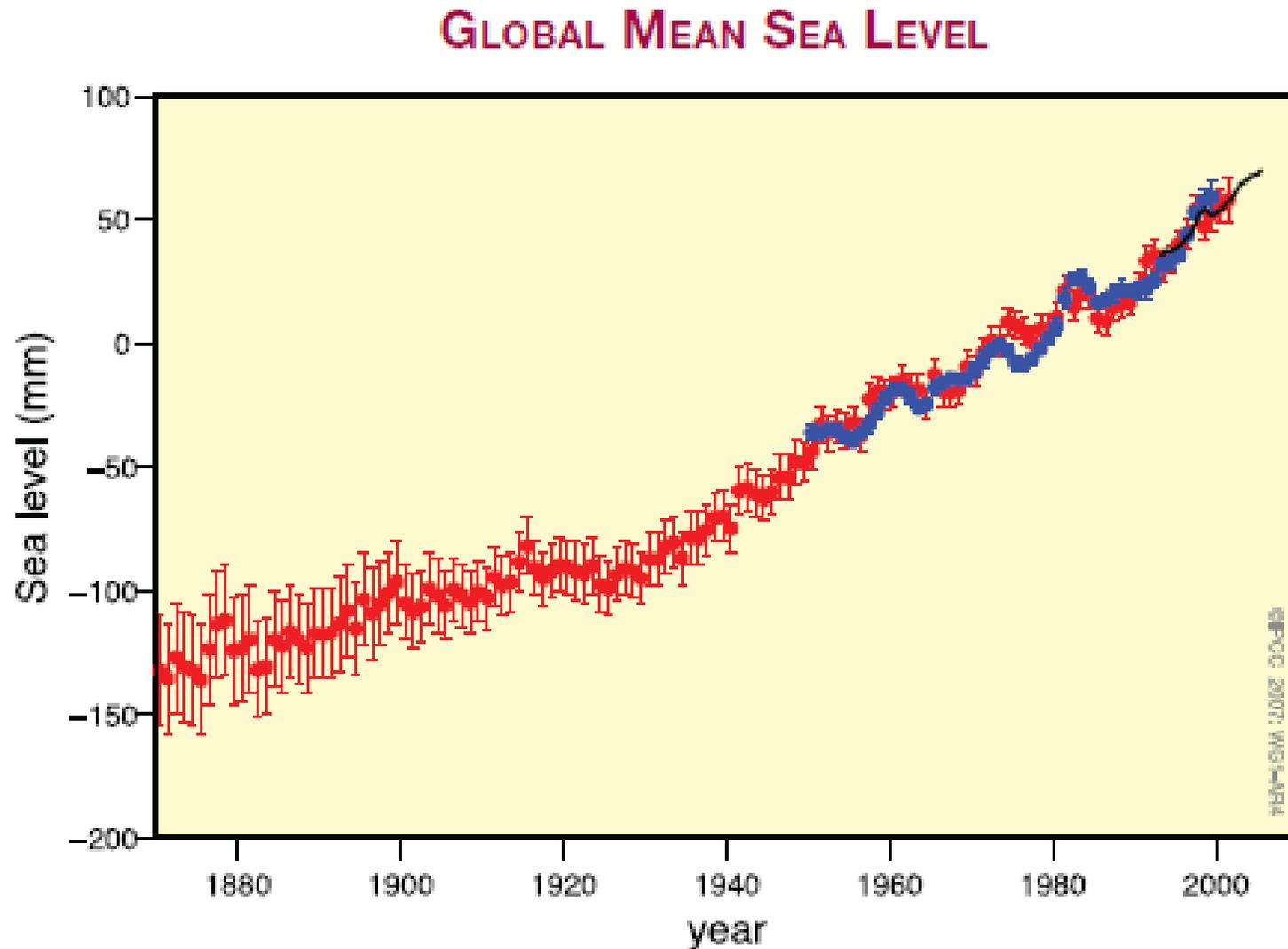
Number of events  
Data plotted by decade



Source: Millennium Ecosystem Assessment

# Climate Change (Sea-level Rise)

**Global Mean Sea Level is Rising (Solomon et al., 2007) !!!**

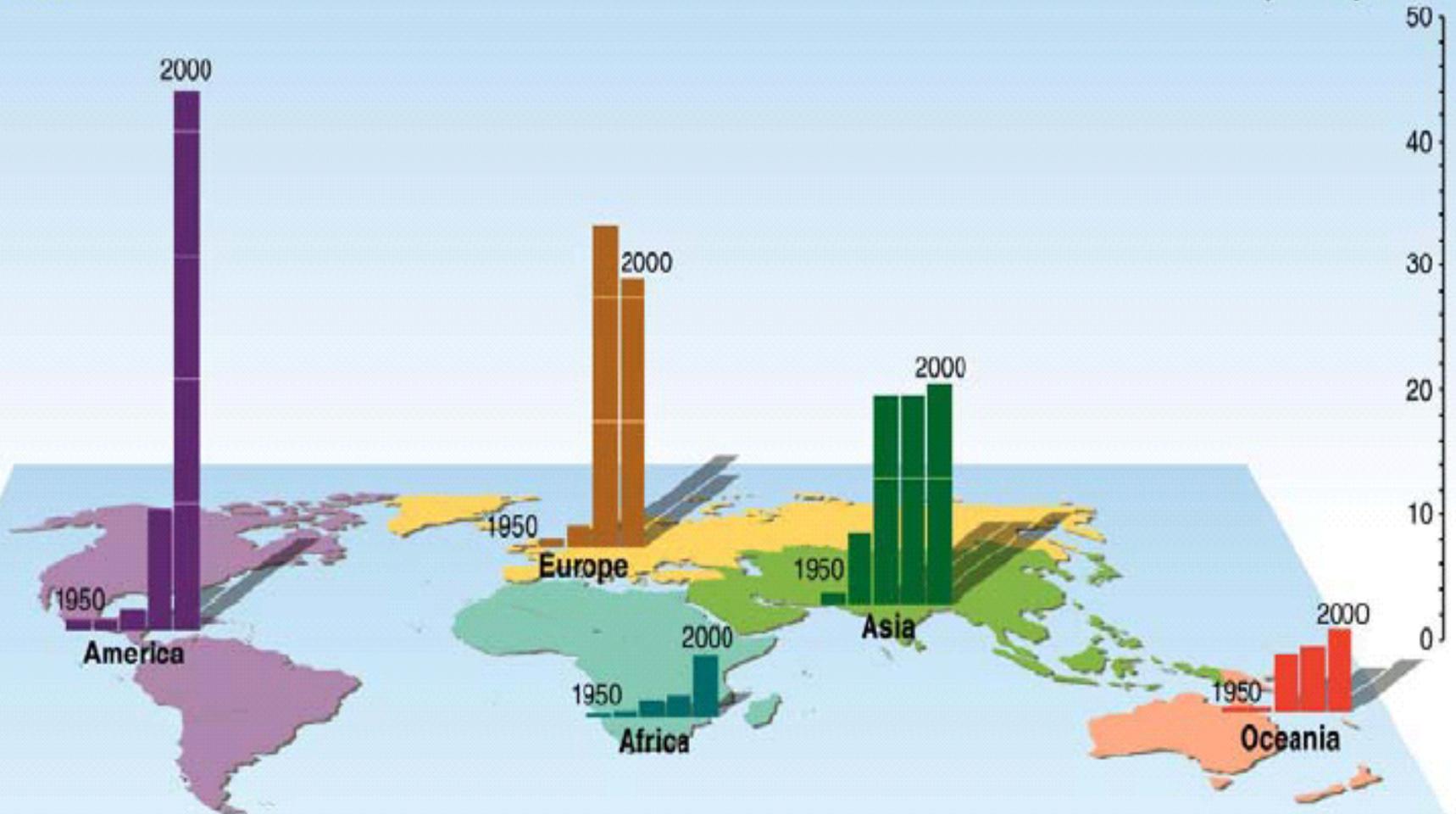


# Climate Change (Lets Have a Feel...)

## No. of Wildfire Events since 1950

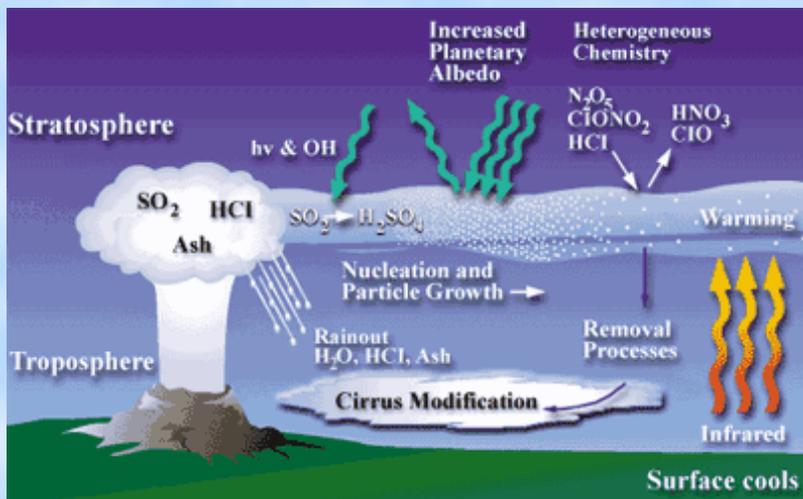
### Wild fires

Number of events  
Data plotted by decade



Source: Millennium Ecosystem Assessment

# Natural Influences on Global Climate



- variations in the energy output of the Sun
- variations in the Earth's orbit and tilt
- continental drift
- changes in atmospheric composition from volcanoes, biological activity, weathering of rocks
- internal dynamics of ice-ocean-land-atmosphere system

# Human Influences on Global Climate



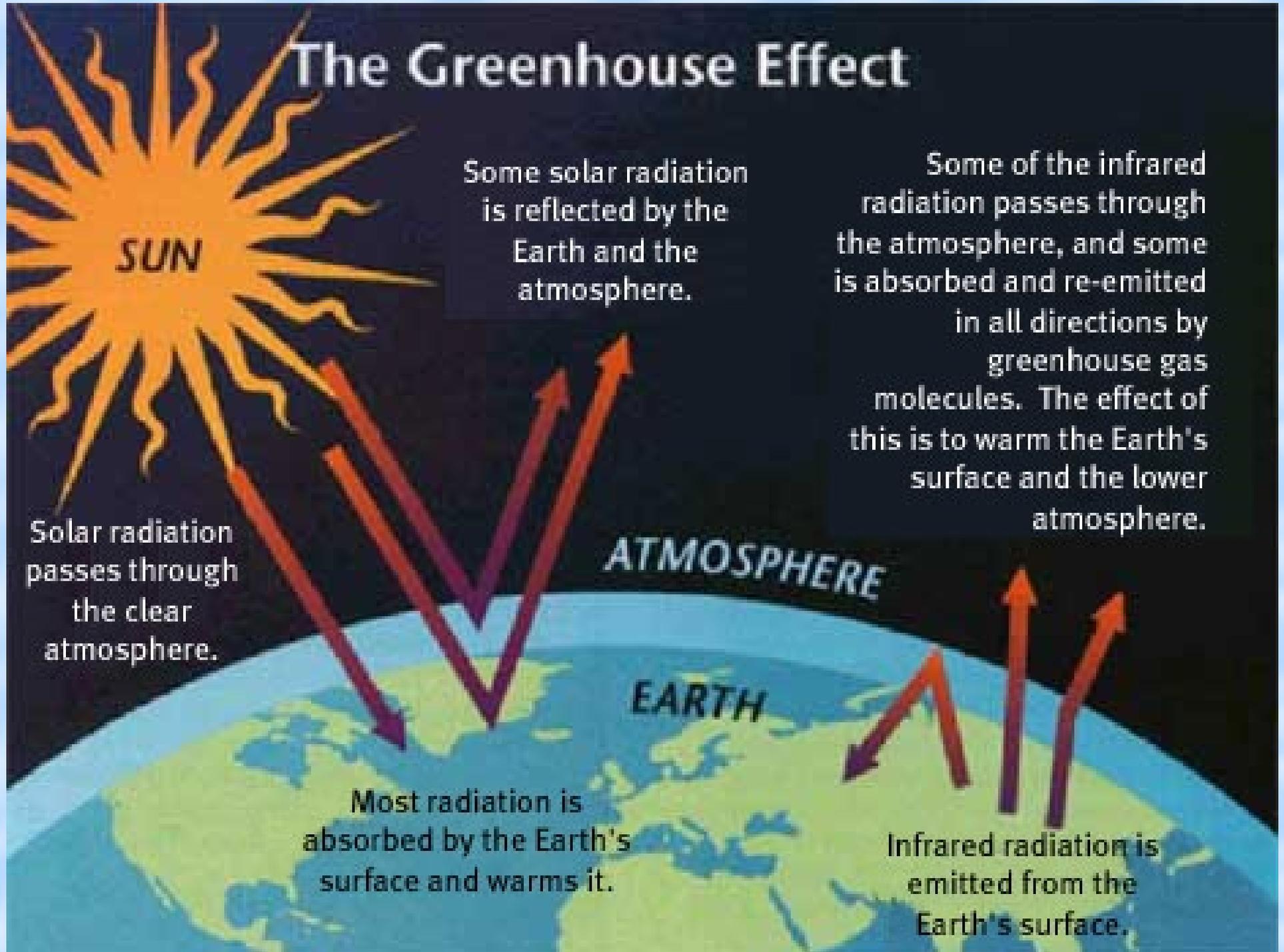
- rising concentration of greenhouse gases from deforestation, agricultural practices, fossil-fuel burning
- rising concentration of particulate matter from agricultural burning, cultivation, fossil-fuel burning,
- alteration of Earth's surface reflectivity by deforestation, desertification
- increased high cloudiness from aircraft contrails

# Greenhouse Gases

Greenhouse gases are gases in an atmosphere that absorb and emit radiation within the thermal infrared range. Greenhouse gases greatly affect the temperature of the Earth; without them, Earth's surface would be on average about 33°C colder than at present.

1. Water Vapor ( $\text{H}_2\text{O}$ )
2. Carbon dioxide ( $\text{CO}_2$ )
3. Methane ( $\text{CH}_4$ )
4. Nitrous oxide ( $\text{NO}_x$ )
5. Hydroflourocarbons (HFCs)
6. Perflourocarbons (PFCs)
7. Sulfur hexaflouride ( $\text{SF}_6$ )

# The Greenhouse Effect



# Release of Greenhouse Gases into the Atmosphere



## Natural:

Release of methane from arctic tundra and wetlands

## Anthropogenic:

Use of fossil fuels (industry, transportation)  
Land use change (agriculture, deforestation)

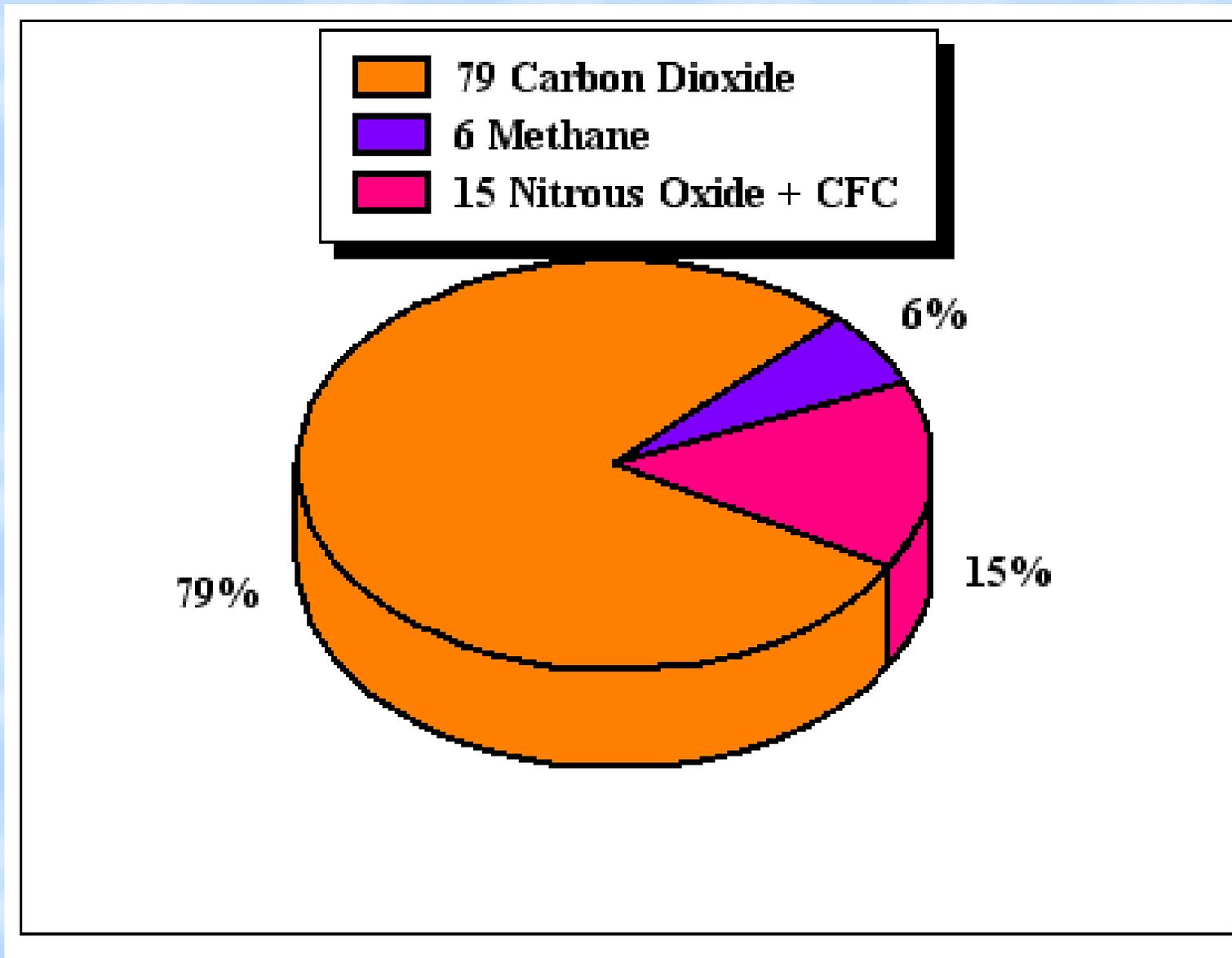


# **What is Climate Change: Some Facts !**

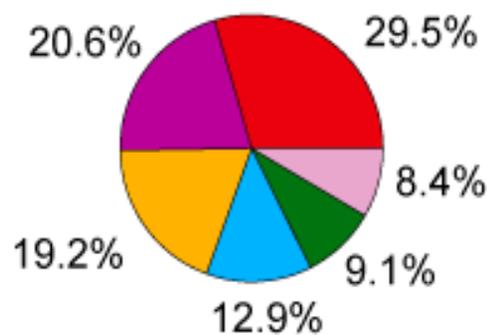
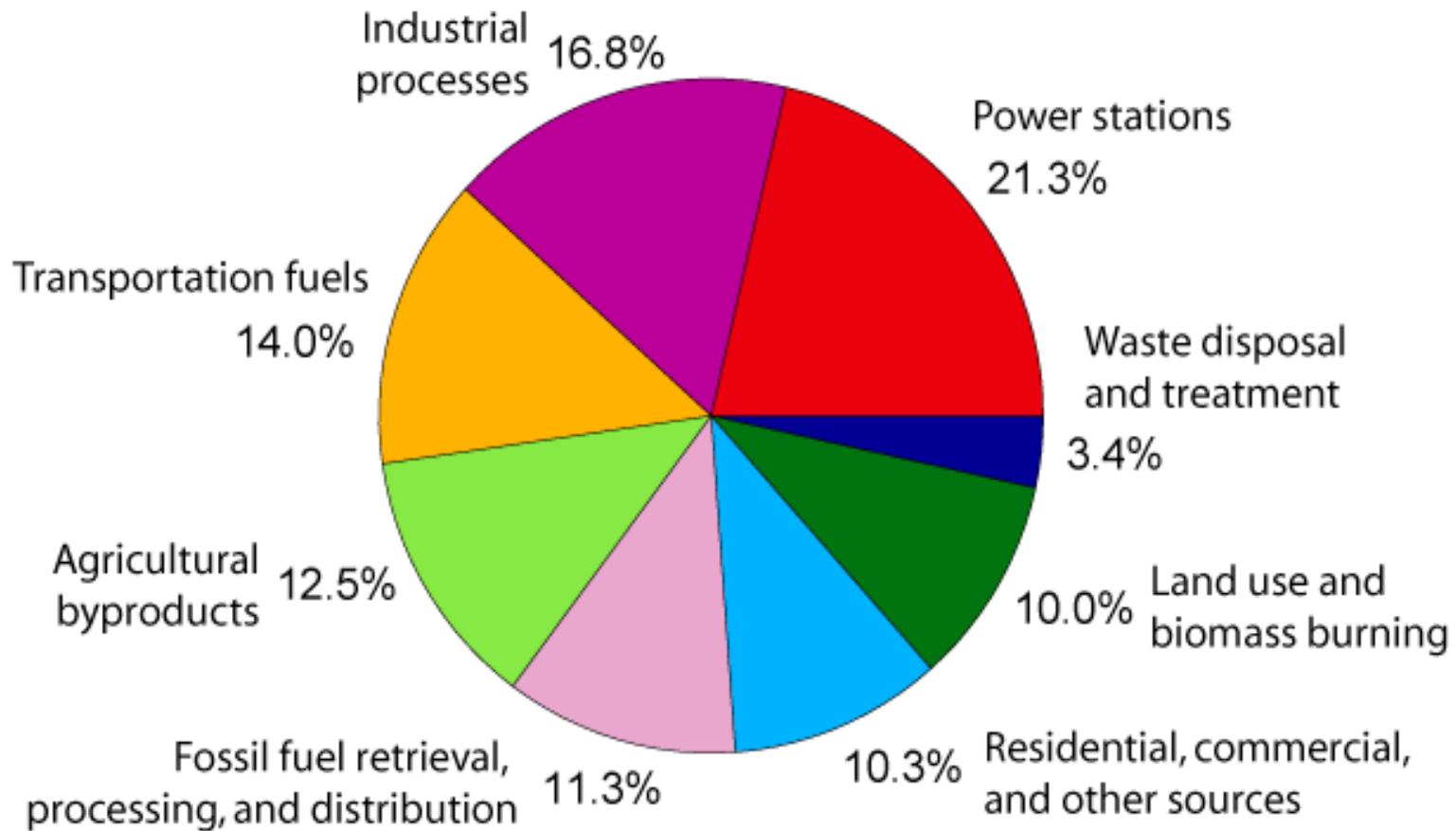
**Warm near the equator and cold at the poles, our planet is able to support a variety of living things because of its diverse regional climates.**

**There is a scientific consensus that – the global climate is warming as a result of the addition of heat-trapping greenhouse gases which are increasing dramatically in the atmosphere as a result of human activities.**

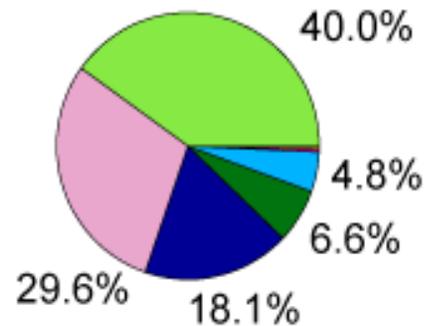
# Percentage Contribution of Greenhouse Gases to Global Warming



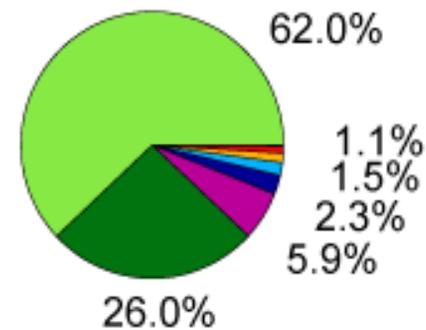
# Annual Greenhouse Gas Emissions by Sector



**Carbon Dioxide**  
(72% of total)



**Methane**  
(18% of total)



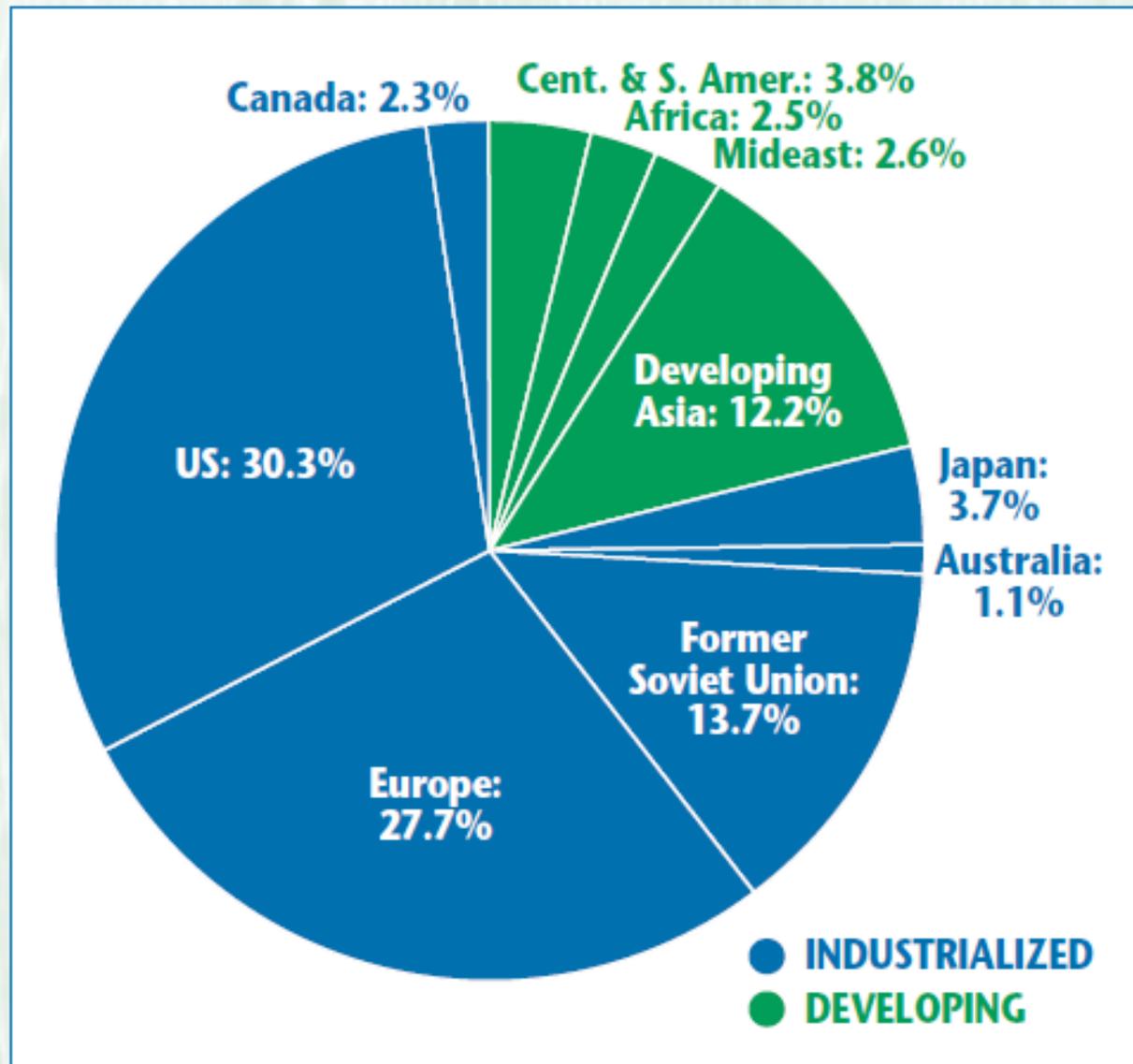
**Nitrous Oxide**  
(9% of total)

# Yearly Per Capita Emissions of CO<sub>2</sub> in Tons



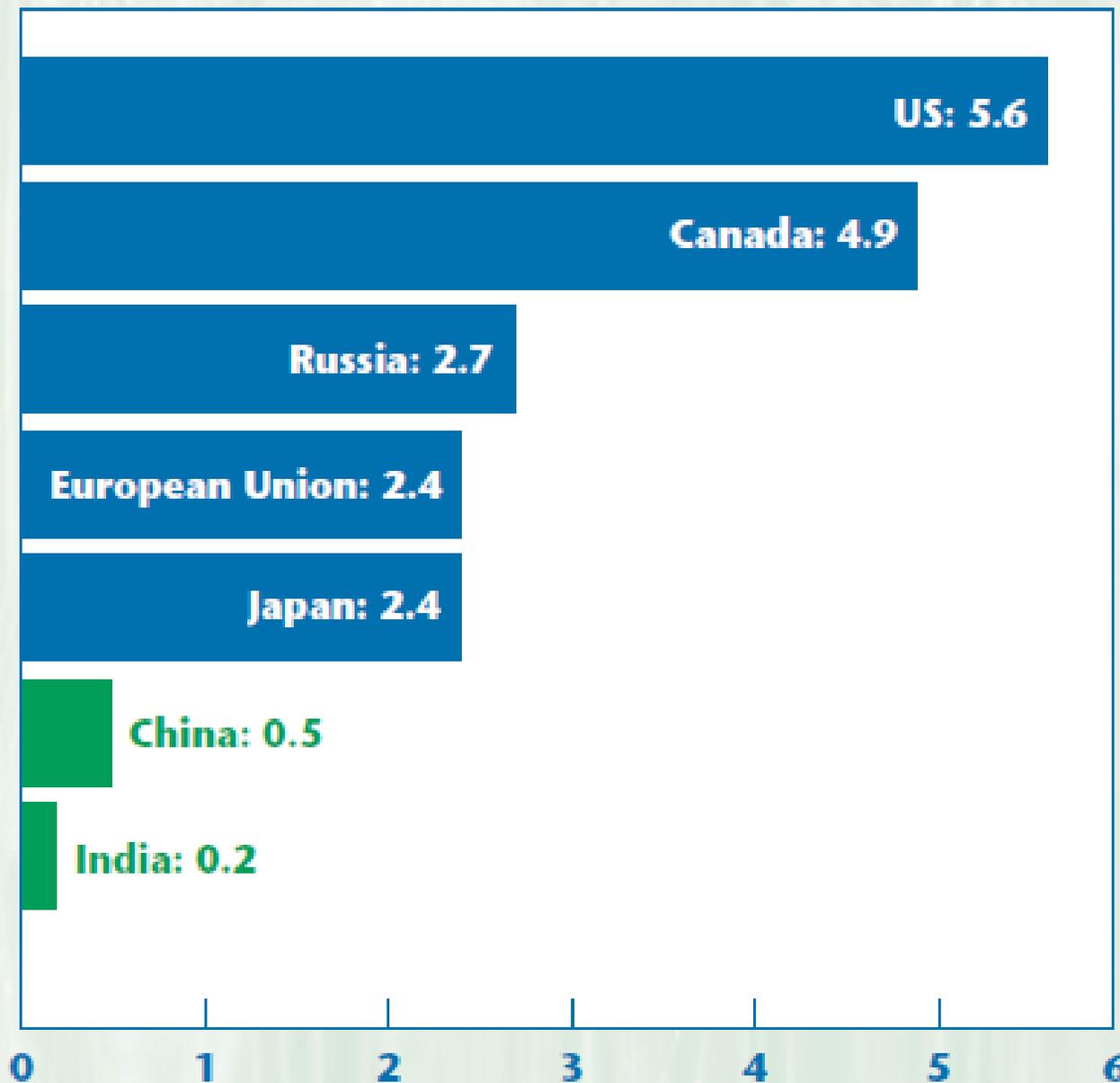
Image Courtesy: (TIME Magazine: 9<sup>th</sup> April 2001):

# Percent of Cumulative Global CO<sub>2</sub> Emissions From Industrial Sources, 1900–1999



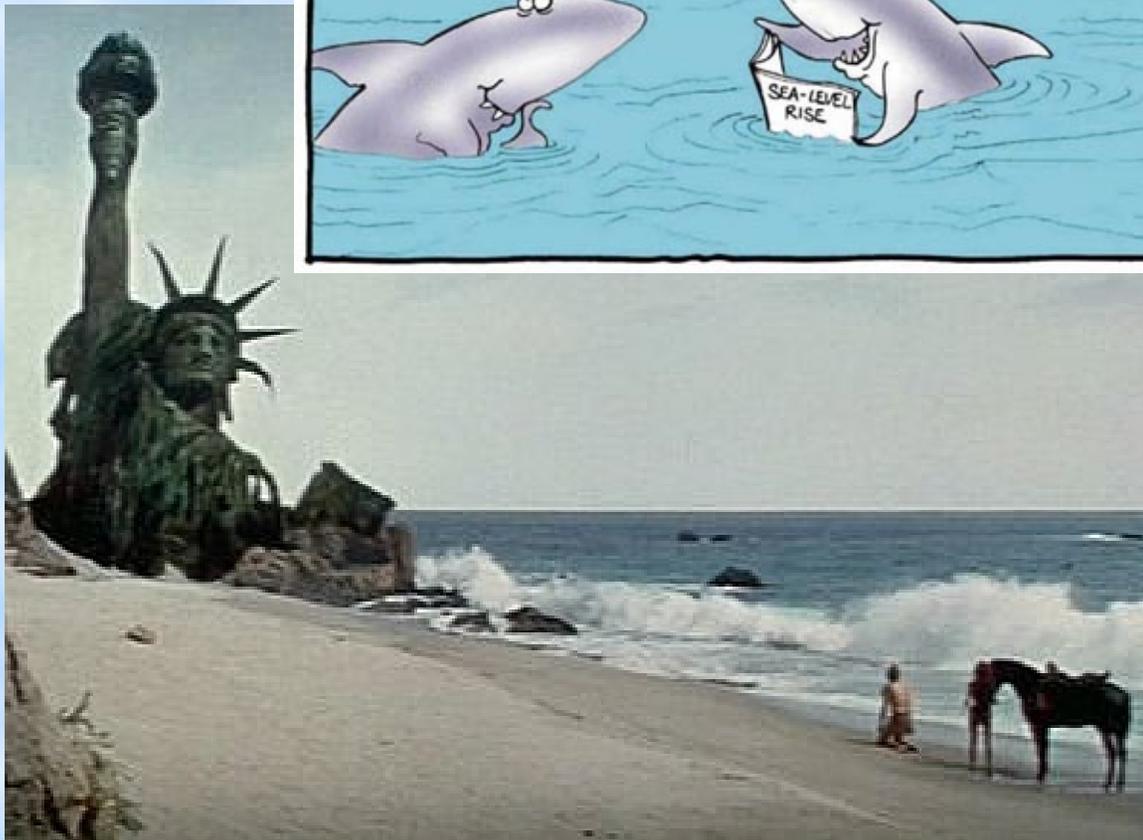
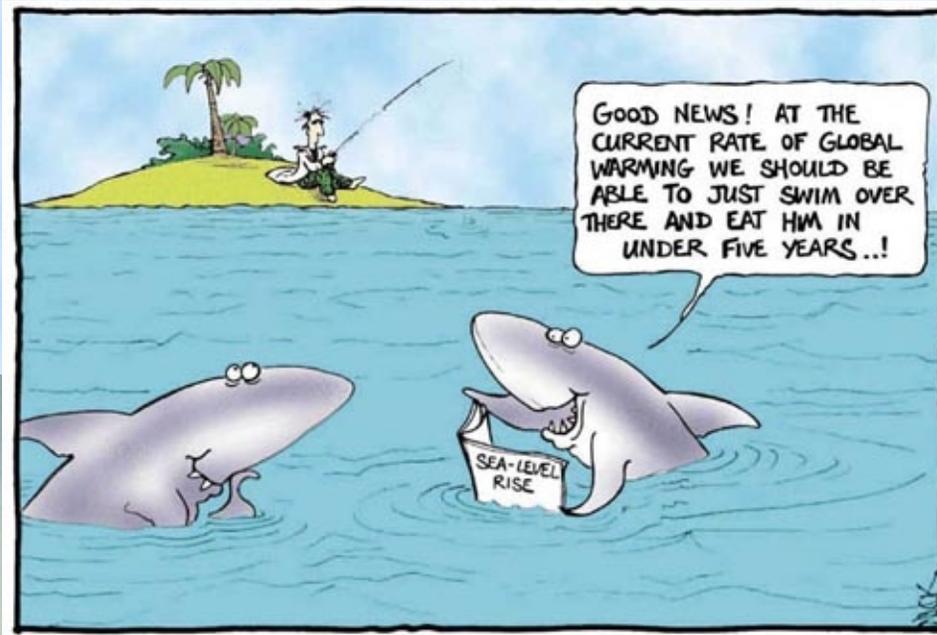
Source: World Resources Institute, 2001

## Per Capita CO<sub>2</sub> Emissions from Fossil Fuels (in tons of CO<sub>2</sub>)

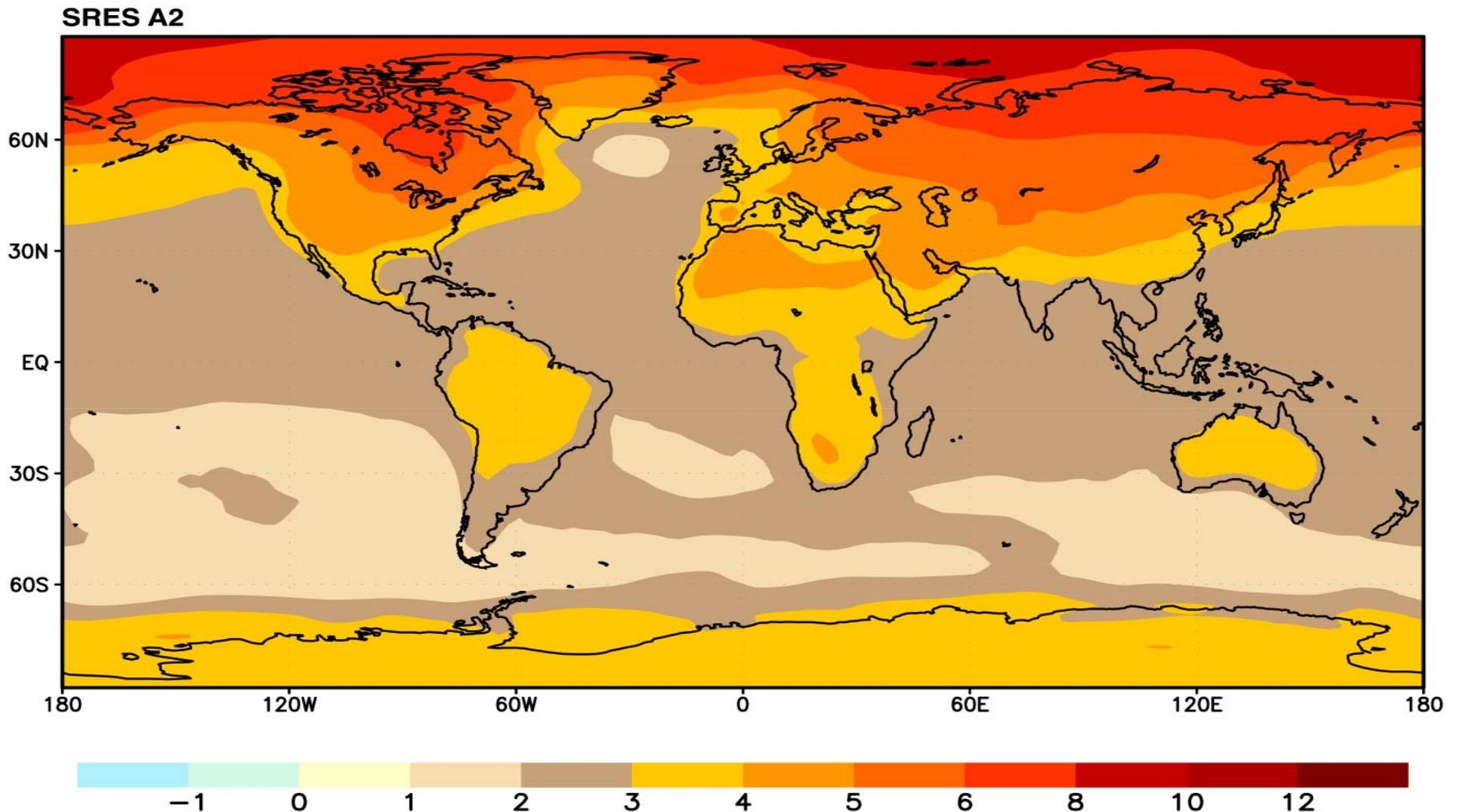


Source: World Resources Institute, 2001

# Climate Change: Future Trends !



# Annual mean temperature change, 2071 to 2100 relative to 1990: Global Average in 2085 = 3.1°C (Courtesy: IPCC)



# Recent Sea Level Rise

23 Annual Tide Gauge Records

- Three Year Average
- Satellite Altimetry

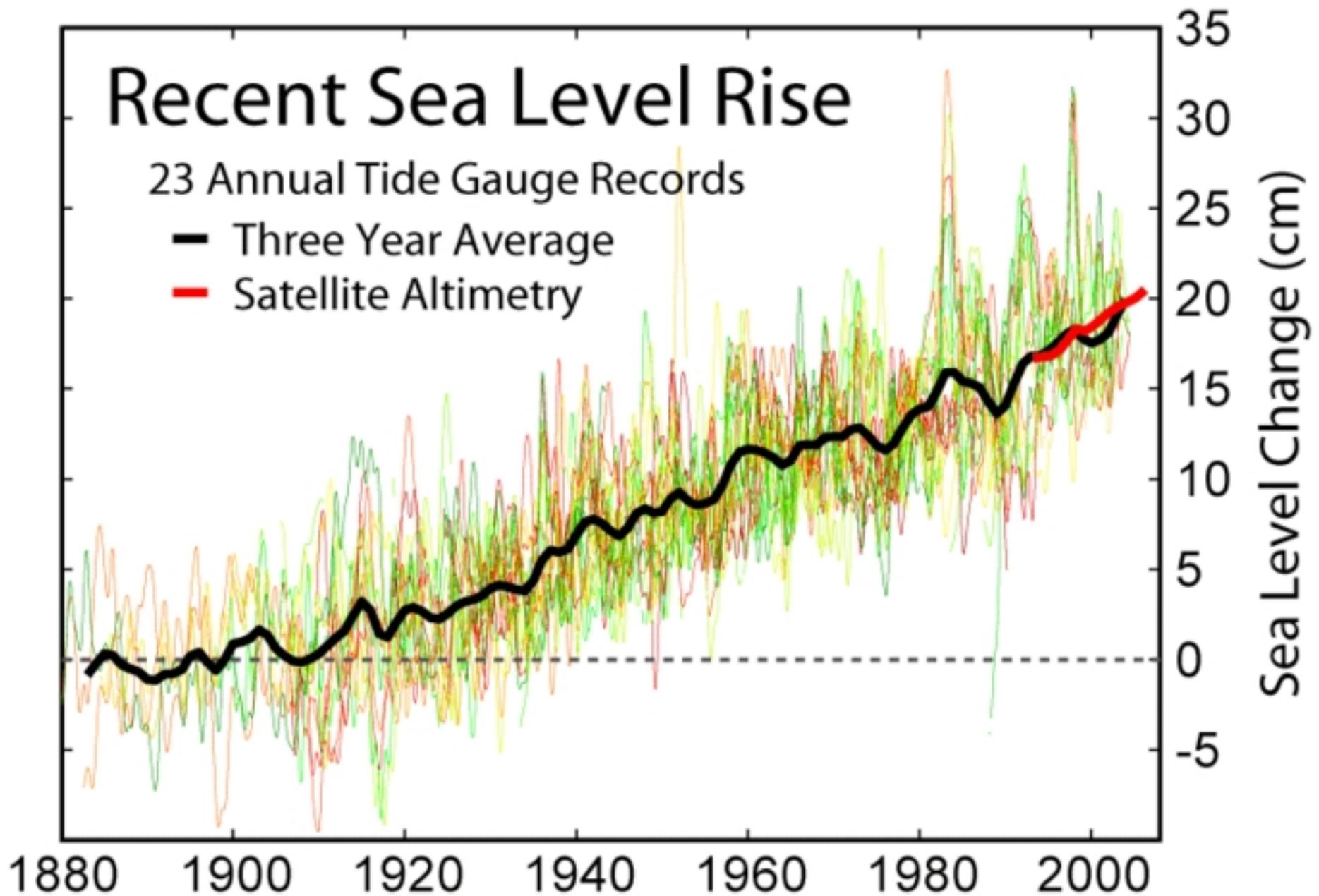
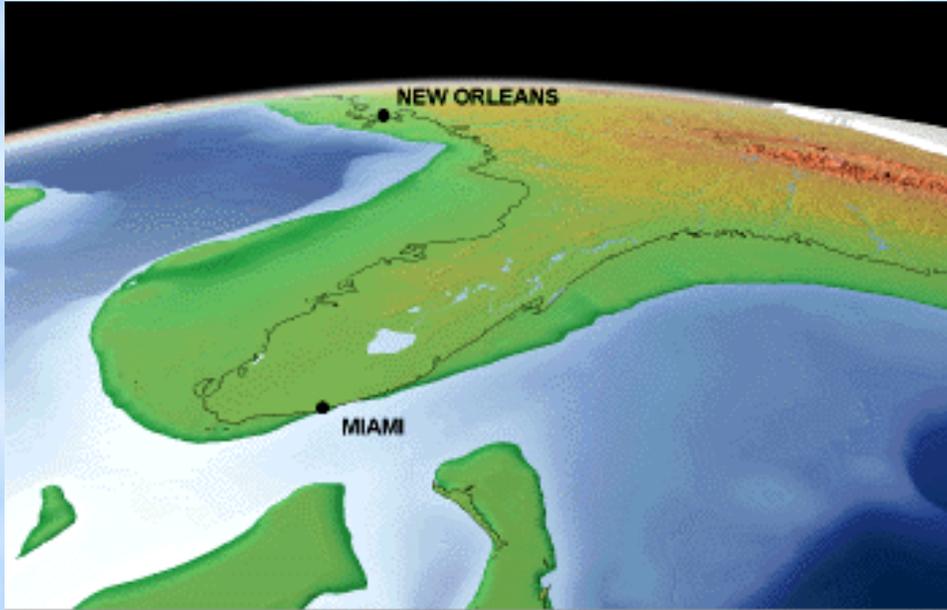


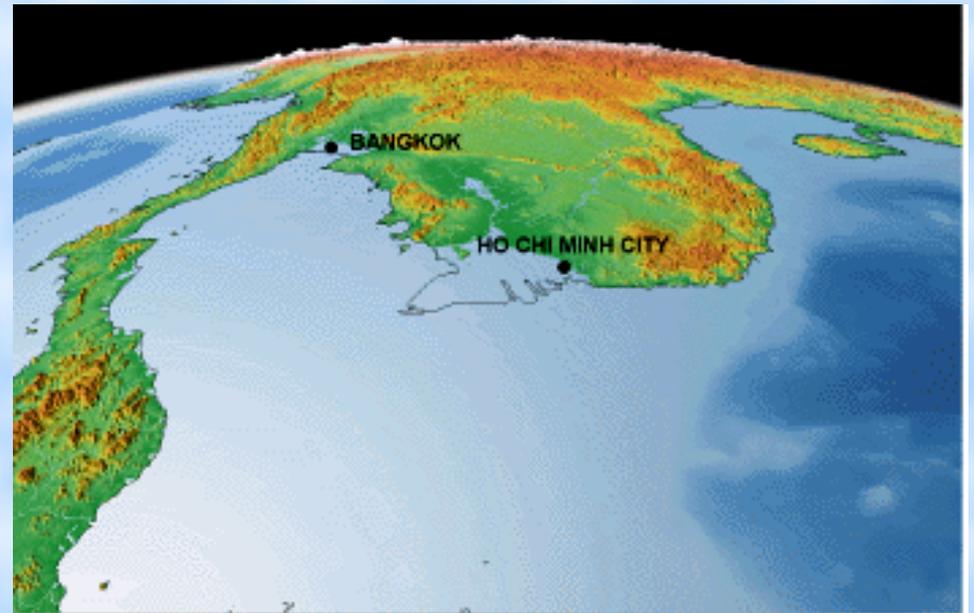
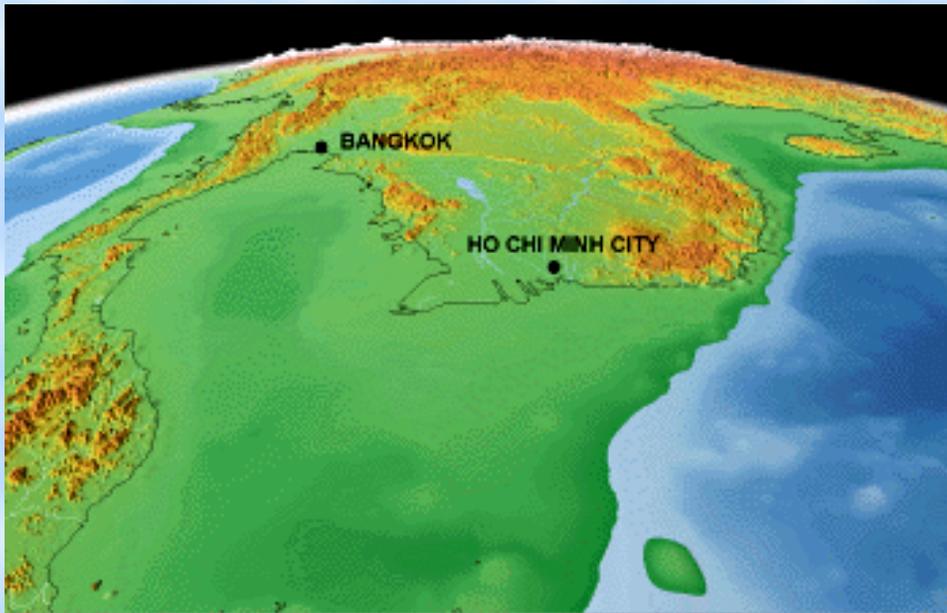
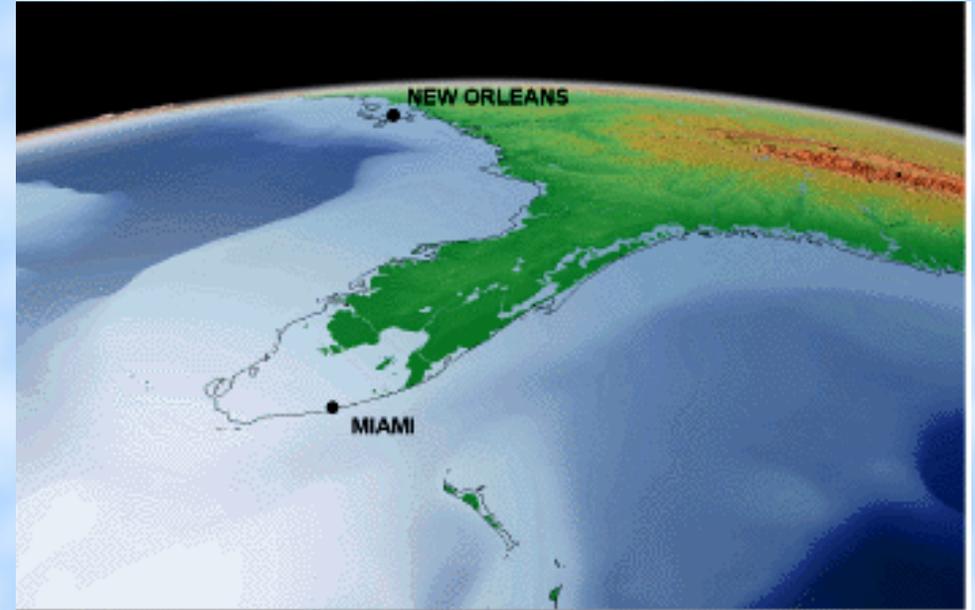
Image Courtesy: <http://www.wildwildweather.com/>

# Past and Future Rise in Sea Level

20,000 years ago



2200? (+ 5 meters)



# Regions Vulnerable to Sea Level Rise



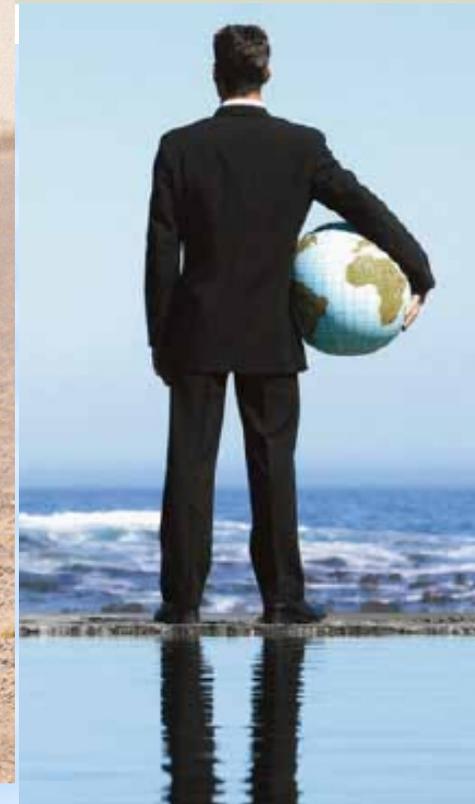
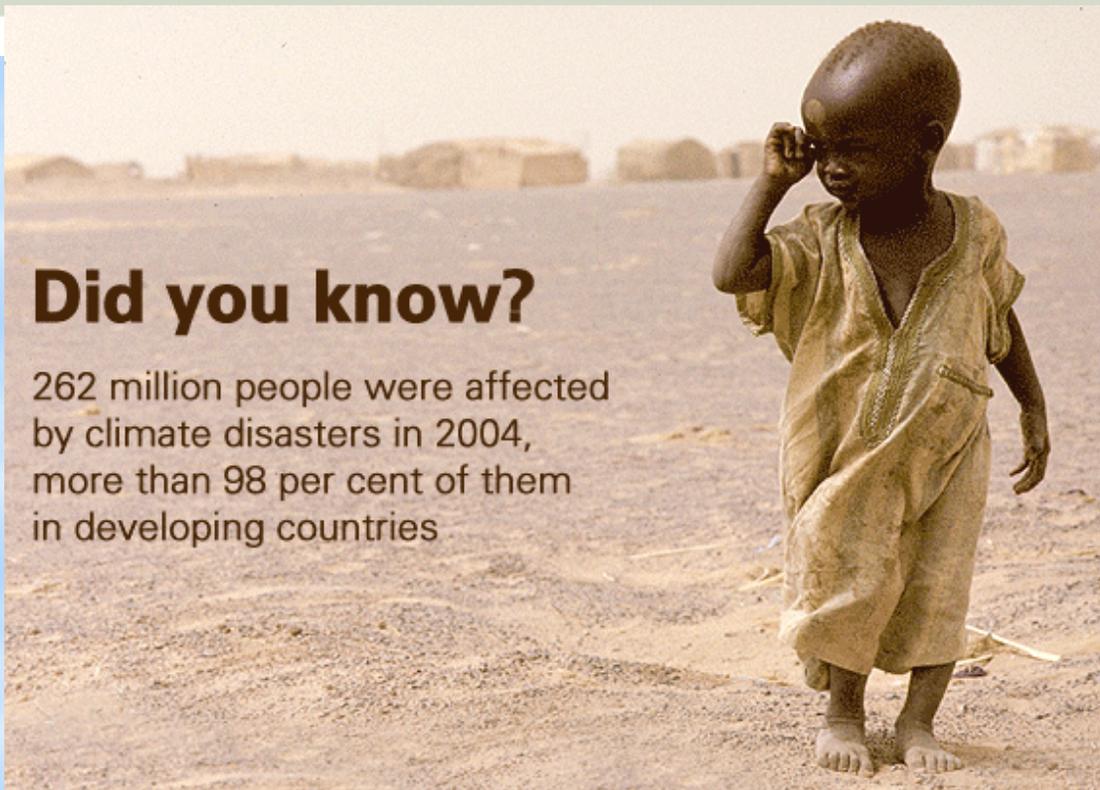
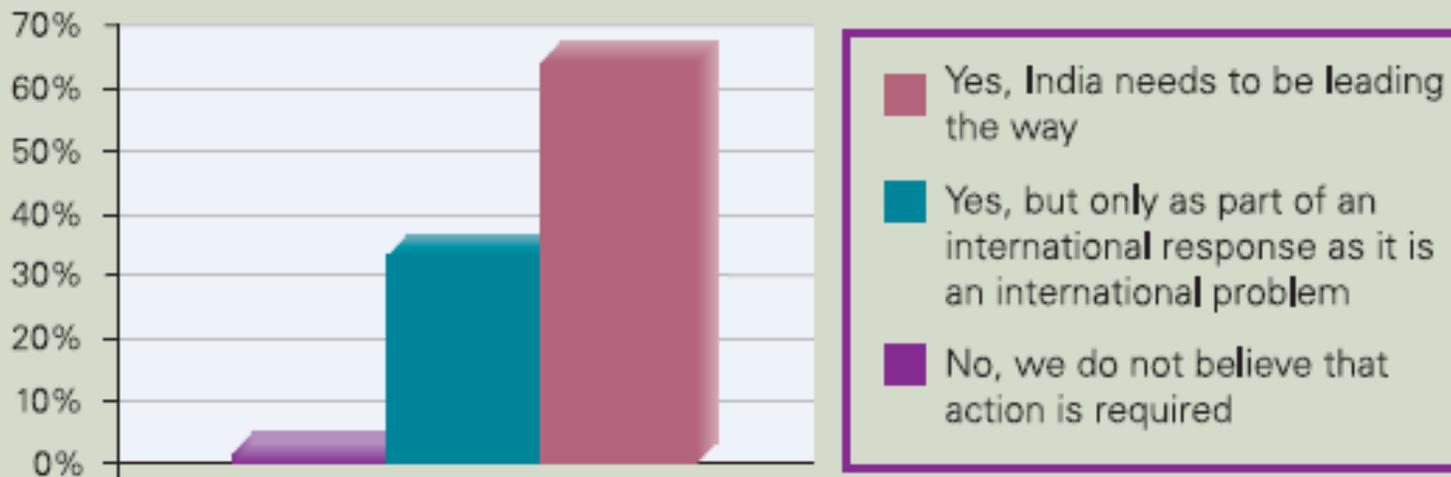
Image Courtesy: <http://sb350.pbworks.com/Sea-Level-Rise>

# **Climate Change: Impact and Adaption**

## **Rationale: Why is Adaption Important ?**

- \* Greenhouse gases already in the atmosphere mean we will have to adapt to some climate change**
- \* Responsibility for adaptation falls widely - not just Govt.**
- \* Costs of not adapting; long timescales; need to prioritise**
- \* Need to engage and raise awareness**
- \* Develop common assumptions; toolkit; guidance**
- \* Establish mechanism for reporting and monitoring**

## Figure 6 : Does India need to act on climate change, given that its per capita carbon emission is amongst the lowest in the world?



# **Global Warming and Climate Change: Road Ahead ...**



**We all need to go together in the right direction...  
(Be An Alert Citizen and Act Now...Before it is too late ...)**

# **Act Now...Before its too late !!!**

Procrastination is not an option. Scientists agree that if we wait 10, 20 or 50 years, the problem will be much more difficult to address and the consequences for us will be that much more serious.

We're treating our atmosphere like we once did our rivers. We used to dump waste thoughtlessly into our waterways, believing that they were infinite in their capacity to hold rubbish. But when entire fisheries were poisoned and rivers began to catch fire, we realized what a horrible mistake that was.

**Government is doing its Job.  
Lets not spend too much time on that..**

**Rather, lets discuss on –  
how personally can we contribute effectively to this Global Problem ?**

