

EWCE 105

ENVIRONMENTAL CHEMISTRY
Lecture –11

Lecture Outlines

- Greenhouse Gases
- Greenhouse Effect
- Climate Change (Greenhouse Warming)

Greenhouses



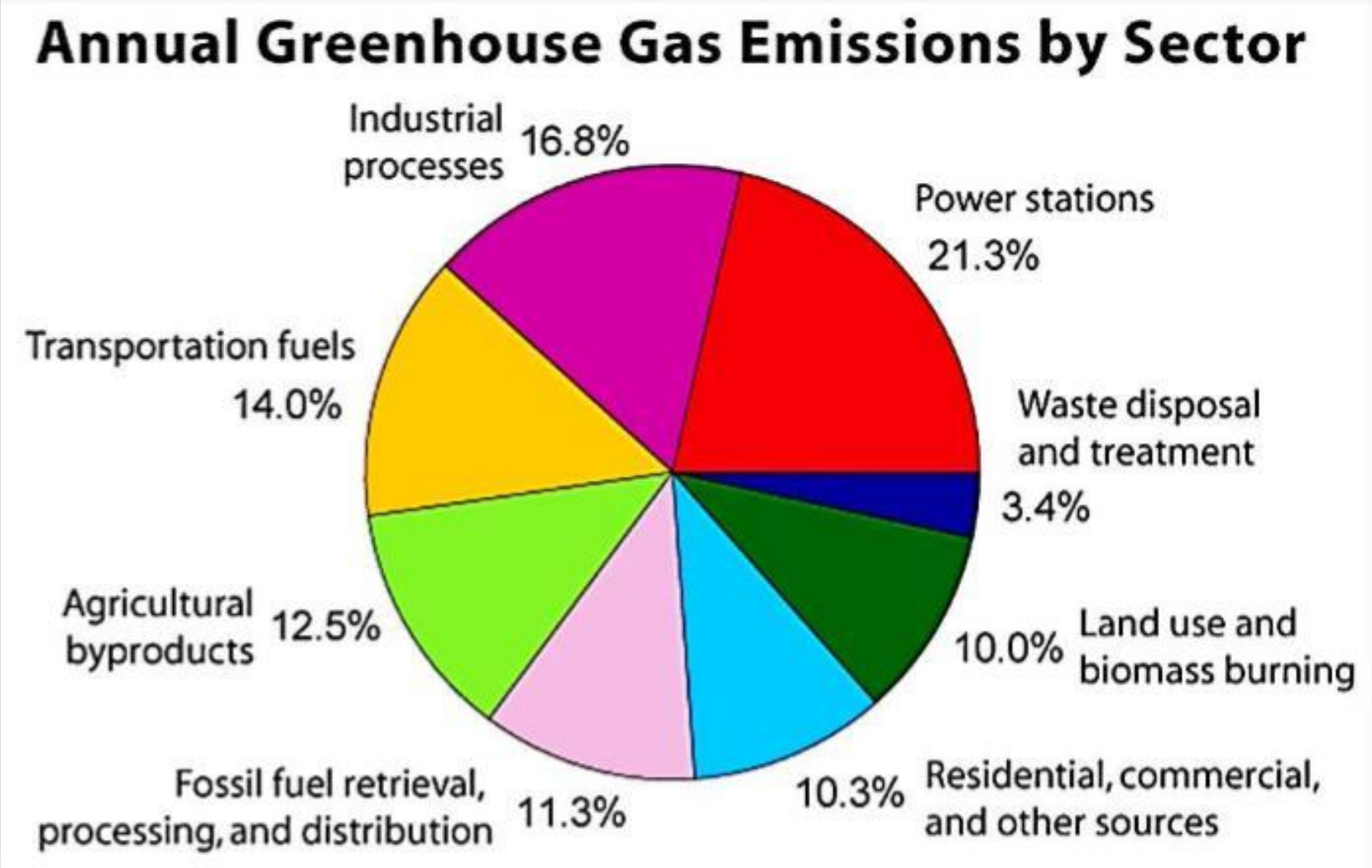
- Greenhouses are used to grow plants, especially in the cold countries.
- Most greenhouses look like a small glass house.
- Greenhouses work by trapping heat from the sun.
- The glass panels of the greenhouse let light in but keep heat from escaping.

Greenhouse Gases

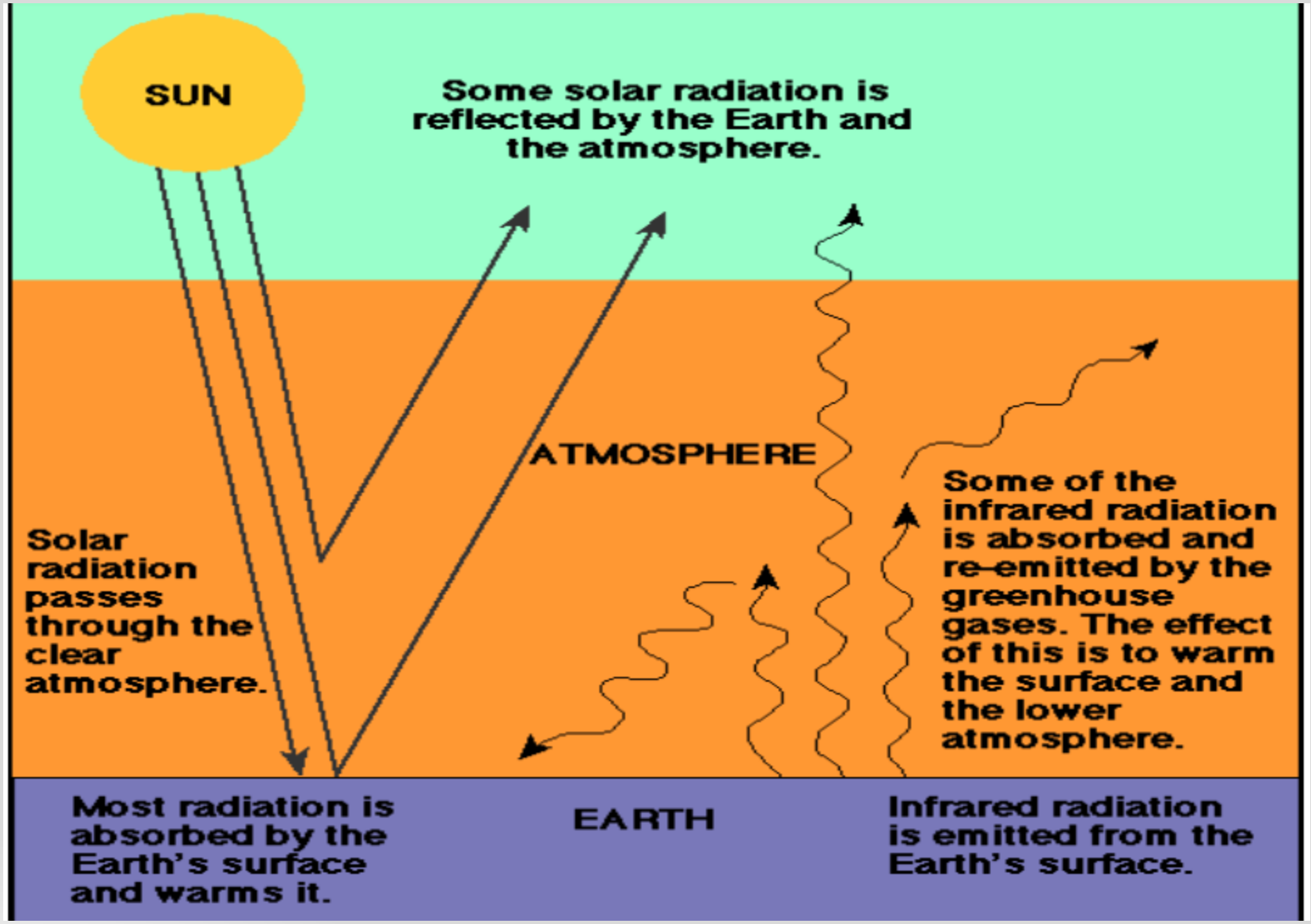
A greenhouse gas (sometimes abbreviated GHG) - is a gas that absorbs and emits radiant energy within the thermal infrared range.

- Greenhouse gases cause the greenhouse effect.
- The primary greenhouse gases in Earth's atmosphere are **water vapor, carbon dioxide, methane, nitrous oxide and ozone.**
- Without greenhouse gases, the **average temperature of Earth's surface** would be about **−18 °C** .

Greenhouse Gases



Why Greenhouse Effect?



What is Greenhouse Effect?

- Greenhouse gases are transparent to most of wavelength of light.
- Allow sunlight to enter the atmosphere freely.
- However, when the earth is warmed by the sunlight, it gives off heat in the form of infrared radiation.
- The infrared radiation is absorbed by the greenhouse gases.
- This cause warming of the atmosphere.
- The phenomena of increasing the temp. is called greenhouse effect.

Mechanism of Greenhouse Effect

- Sunlight enters the Earth's atmosphere, passing through the blanket of greenhouse gases.
- As it reaches the Earth's surface, land, water, and biosphere absorb the sunlight's energy.
- Once absorbed, this energy is sent back into the atmosphere.
- Some of the energy passes back into space.
- But much of it remains trapped in the atmosphere by the GHGs, causing our **world to heat up**.

Role in climate change

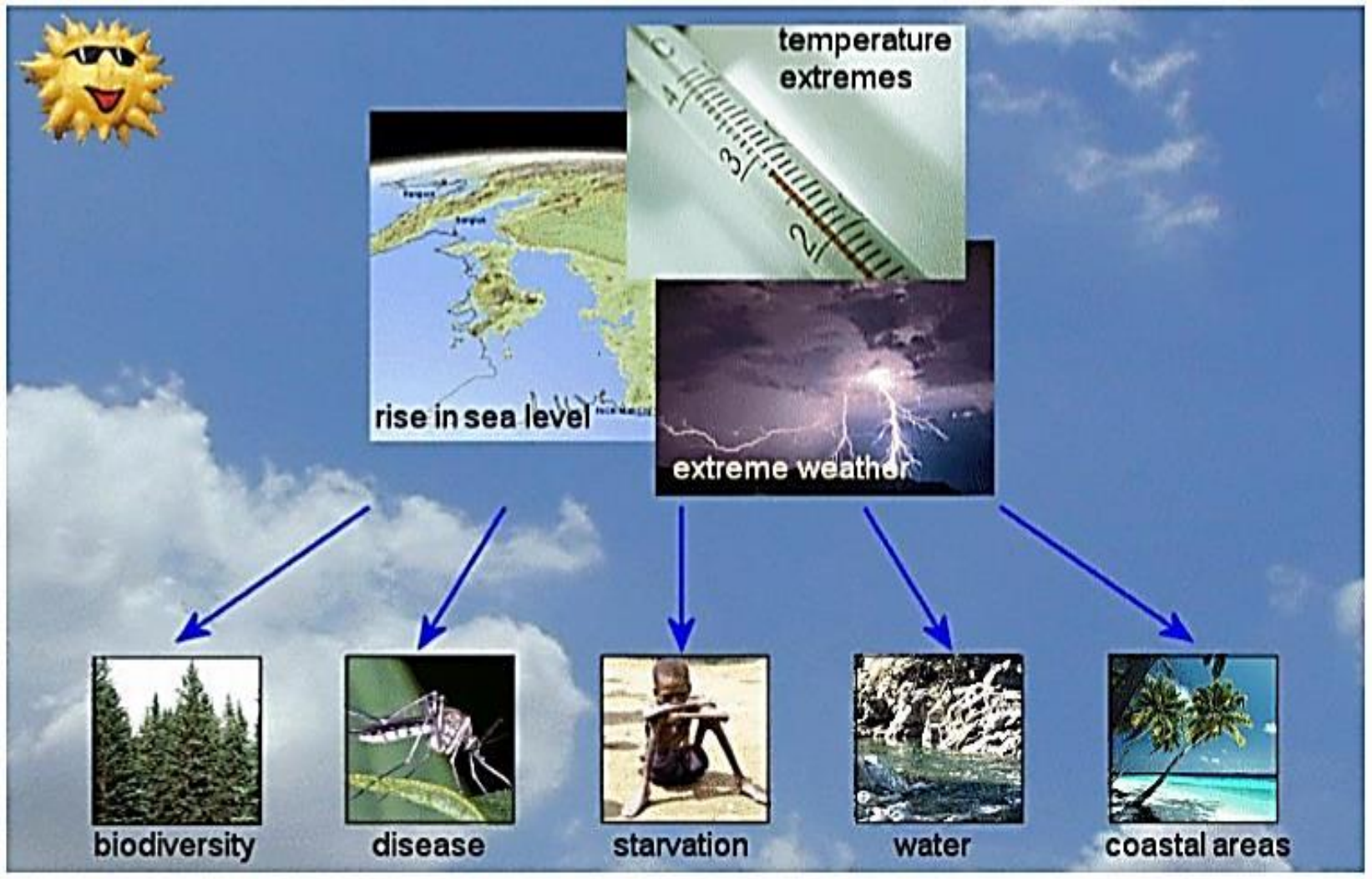
- Humans are causing warming on a global scale by releasing additional greenhouse gases into the atmosphere. The largest source of additional GHG is from burning fossil fuels (e.g. coal, gasoline, and natural gas)
- These additional greenhouse gases are responsible for altering the natural balance of the Greenhouse Effect.
- As more greenhouse gases are produced, they accumulate in the atmosphere and absorb long wave counter radiation. (i.e. infra-red) More radiation is then radiated back towards Earth, causing enhanced warming or more well known as **global warming**.
- One of the adverse effects of greenhouse warming is the **climate change** in a negative way.

Global warming and Climate change



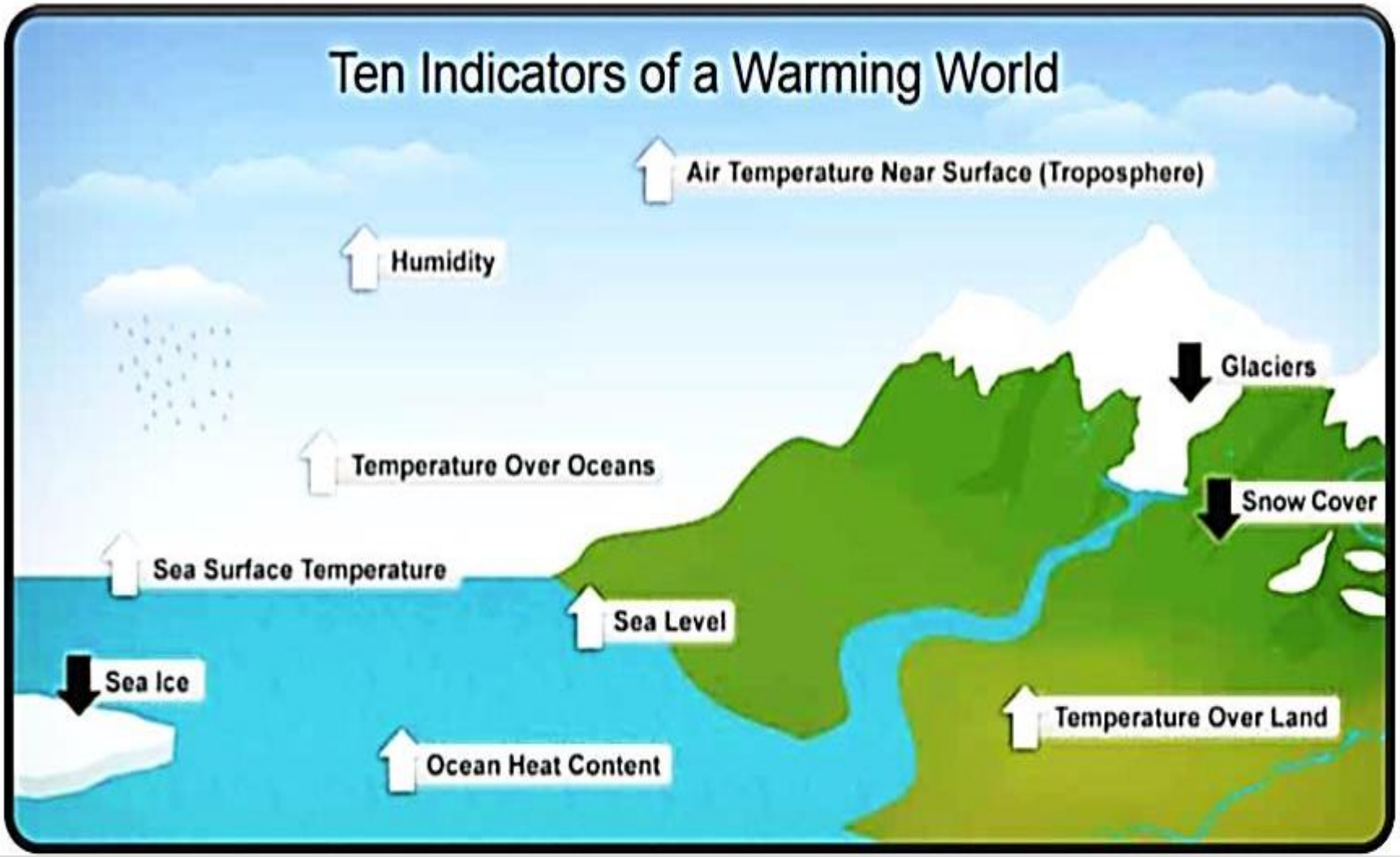
- Global warming is the long-term rise in the average temperature of the Earth's climate system.
- The terms global warming and climate change are often used interchangeably.

What are the Effects of Climate Change?

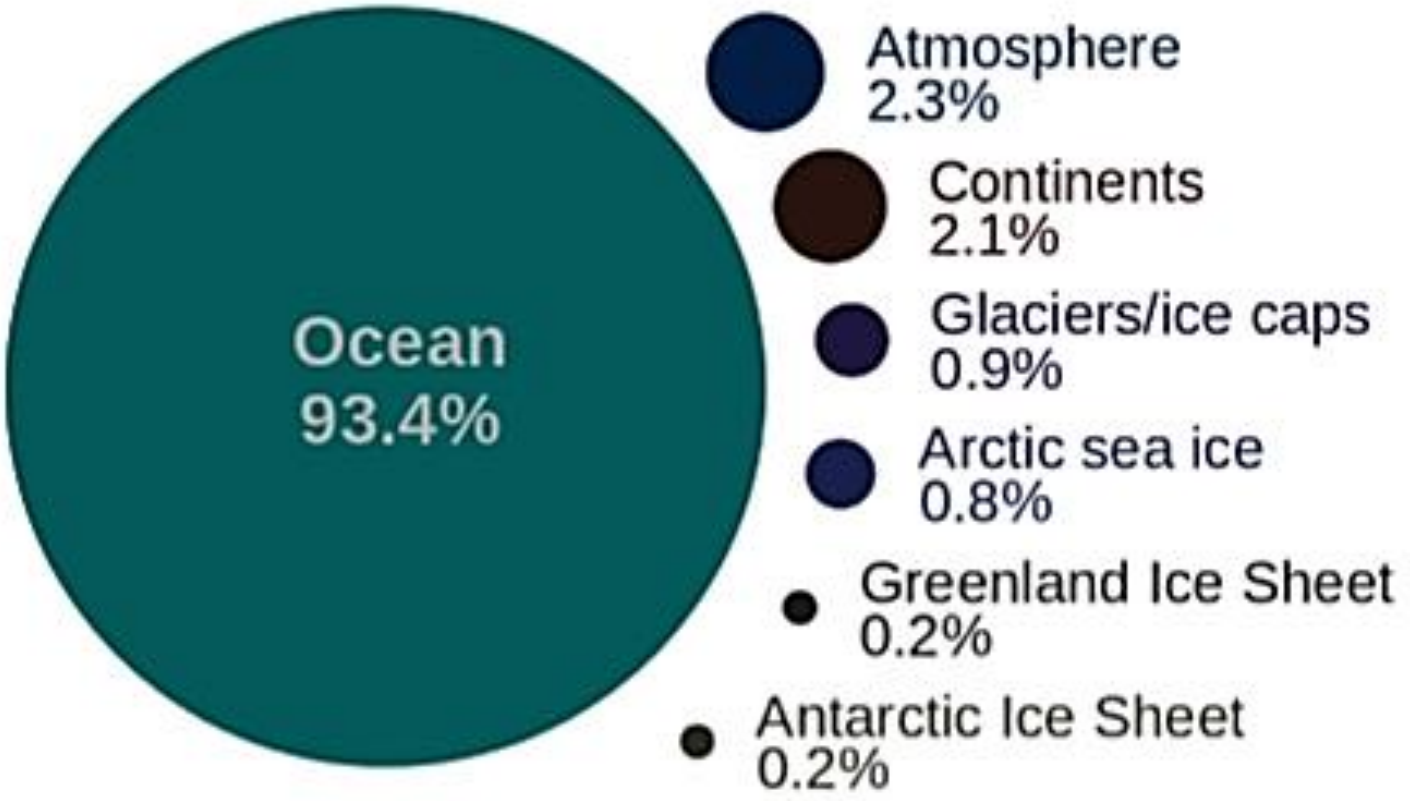


Adverse Effects of Greenhouse Warming

- Predictions of average global temperature increase of 1.5–5° C, as much again as since the last ice age.
- Would greatly affect climate and rainfall.
- Melting of the polar and Greenland ice caps along with expansion of warmer ocean water would raise sea levels by 0.5–1.5 meters.
- Decreased rainfall and increased water evaporation would contribute to severe drought and water shortages.


Ten Indicators of a Warming World
Air Temperature Near Surface (Troposphere)
Humidity
Glaciers
Temperature Over Oceans
Snow Cover
Sea Surface Temperature
Sea Level
Sea Ice
Temperature Over Land
Ocean Heat Content

Where is global warming going?



Some Facts on Climate Change- IPCC

- Given current concentrations and on-going emissions of greenhouse gases, it is likely that by the end of this century,
    - Increase in global temperature will exceed 1.5°C compared to 1850 to 1900 for all but one scenario.
    - The world's oceans will warm and ice melt will continue.
    - Average sea level rise is predicted as 24 – 30cm by 2065 and 4063cm by 2100.
    - Most aspects of climate change will persist for many centuries even if emissions are stopped.

- The Intergovernmental Panel on Climate Change (IPCC) is an intergovernmental body of the United Nations, dedicated to providing the world with scientific view of climate change.

Complex Requirement

- Greenhouse gases, mainly water vapor, are essential to maintain the temperature of the Earth; without them this planet would likely be so cold as to be uninhabitable.

- In fact the temp. would be – 18^{o}C in absence of GHGs (avg. temp. of the earth is 15^{o}C).

- Therefore, the greenhouse effect is not altogether undesirable.

Lecture Summary

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- Greenhouse Effect
- Climate Change (Greenhouse Warming)

The End