

Course: Basics of Environmental Engineering (Climatology)



Main topic: Type of Climate

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Contents

- Definition of climate
- Types of climate
- Climatic change and its meaning
- Difference between climate and weather
- Cause of climatic change
- Effect of climatic change
- Measure for climate change

Quiz

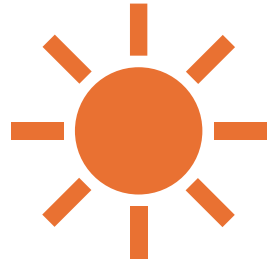
What is climate?

What is climate change?

What is the evidence that shows the climate is changing?

What causes climate change?

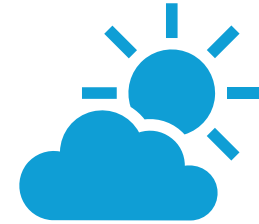
Why is climate change a serious problem?



CLIMATE



Climate refers to the general weather conditions typically found in a specific region over an extended period.



It can also define as the long-term pattern of weather in a particular area.

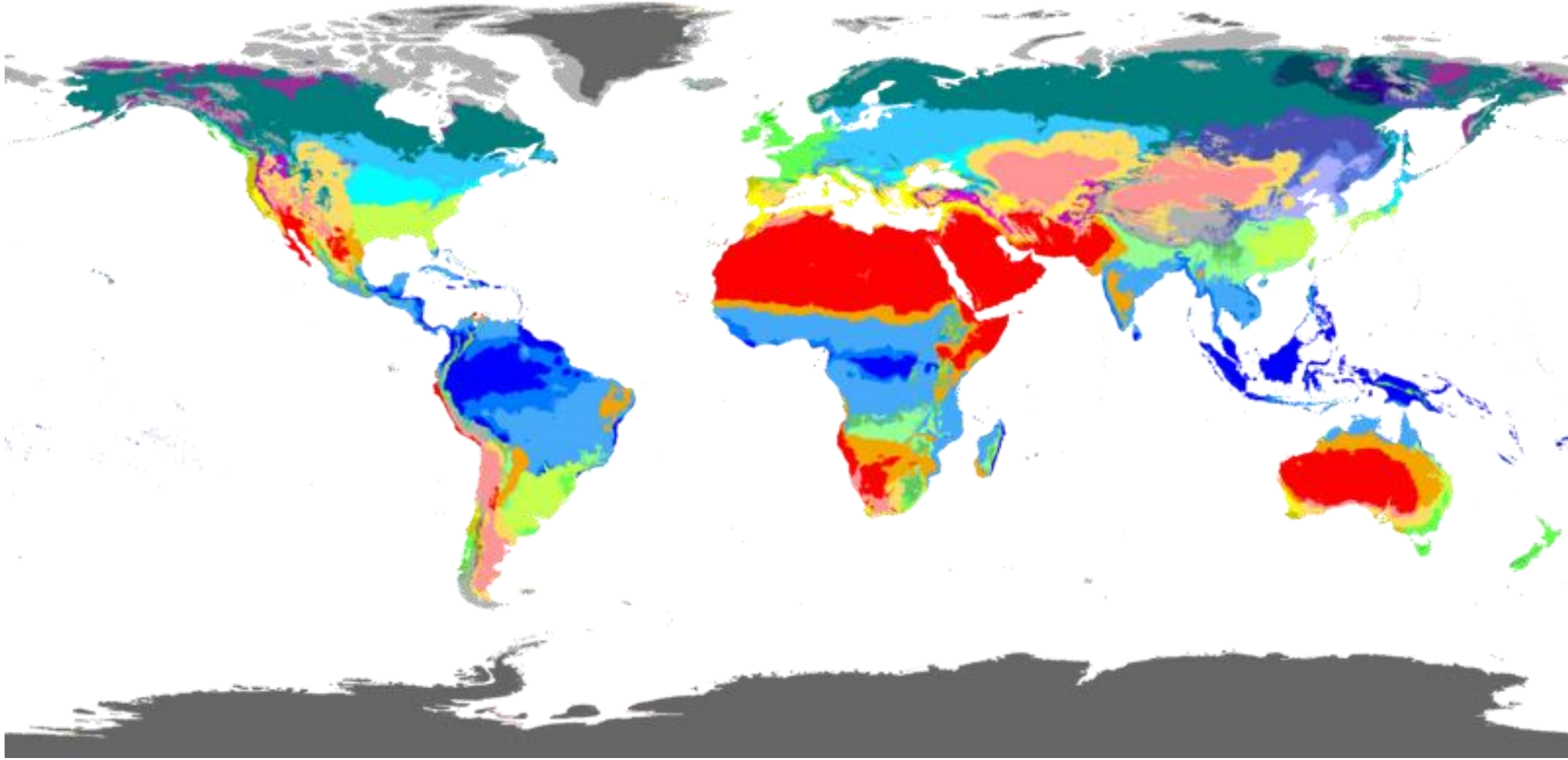
Difference between weather and climate

No	Weather	Climate
1	Atmospheric conditions change with in a short span of time	Climate is generally termed as the average of weather conditions of a region
2	Weather defined as atmosphere at a given time and place	Climate defined as several atmospheric change over a period of time
3	Weather cavers small area	Climate caver a large area comparatively
4	It changes often such as day to day or hour to hour. Examples: wind, moisture, storm snow	It is more or less permanent Examples: temperature, rainfall and humidity

Types of Climate

- The following are different types of climate:
- Tropical(A)** : Characterized by hot and humid conditions with average temperatures exceeding 64°F (18°C) year-round and over 59 inches of precipitation annually.
- Dry (B)**: Areas with minimal precipitation due to rapid evaporation of moisture from the air.

Types of Climate



Temperate (C): Regions experiencing warm, humid summers with thunderstorms and mild winters.

Continental (D): Featuring warm to cool summers and extremely cold winters with snowstorms and

Polar (E): Extremely cold climates where temperatures never exceed 50°F (10°C), even in summer.

TROPICAL



DRY



TEMPERATE



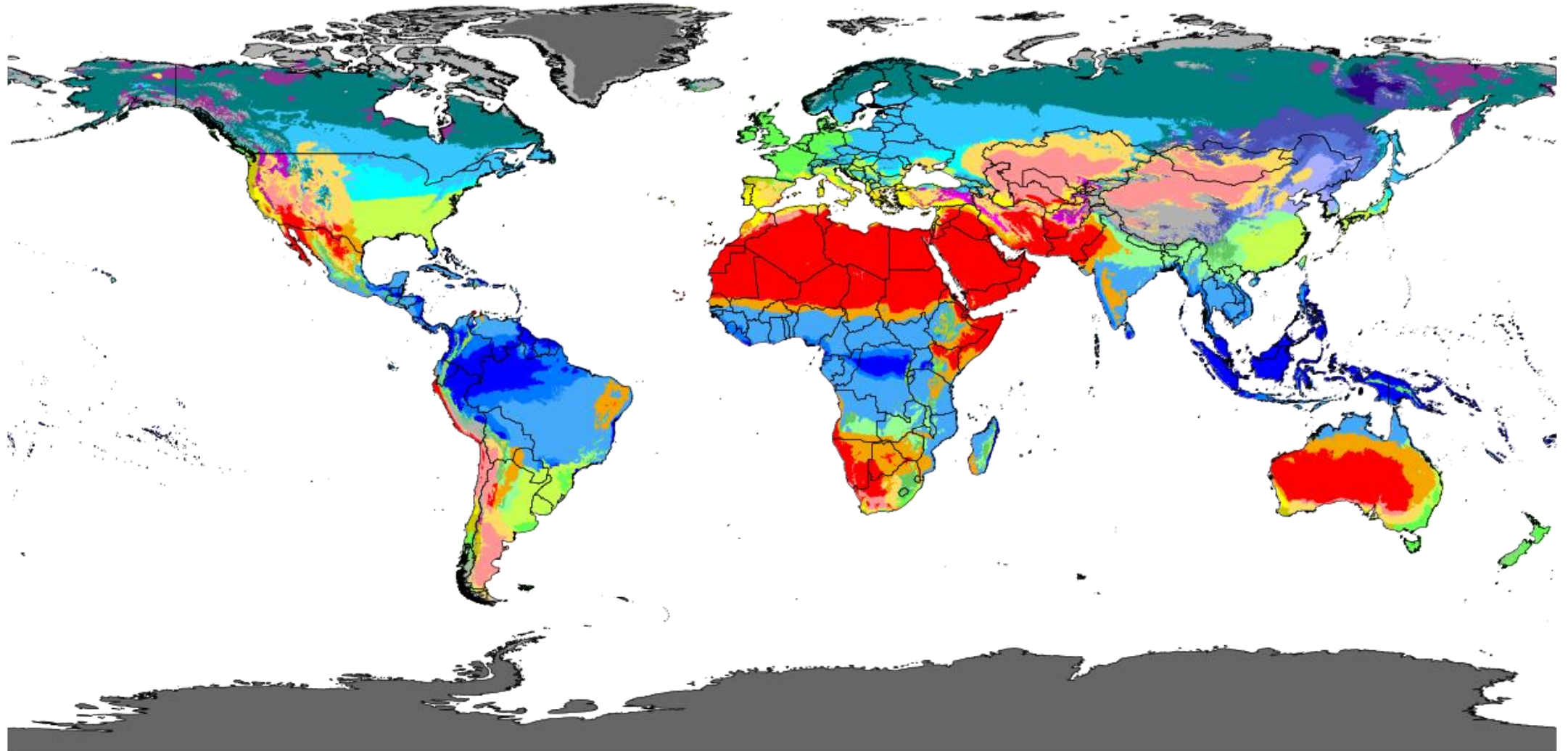
CONTINENTAL



POLAR



Köppen–Geiger climate classification 1991–2020



Af	BWh	BSk	Csc	Cwc	Cfc	Dsc	Dwb	Dfa	Dfd
Am	BWk	Csa	Cwa	Cfa	Dsa	Dsd	Dwc	Dfb	ET
Aw	BSh	Csb	Cwb	Cfb	Dsb	Dwa	Dwd	Dfc	EF

Climate change

- **Climate change** is a scientifically established phenomenon supported by unequivocal evidence.
- Earth is experiencing warming at an unprecedented rate, primarily driven by human activities.



Climate change

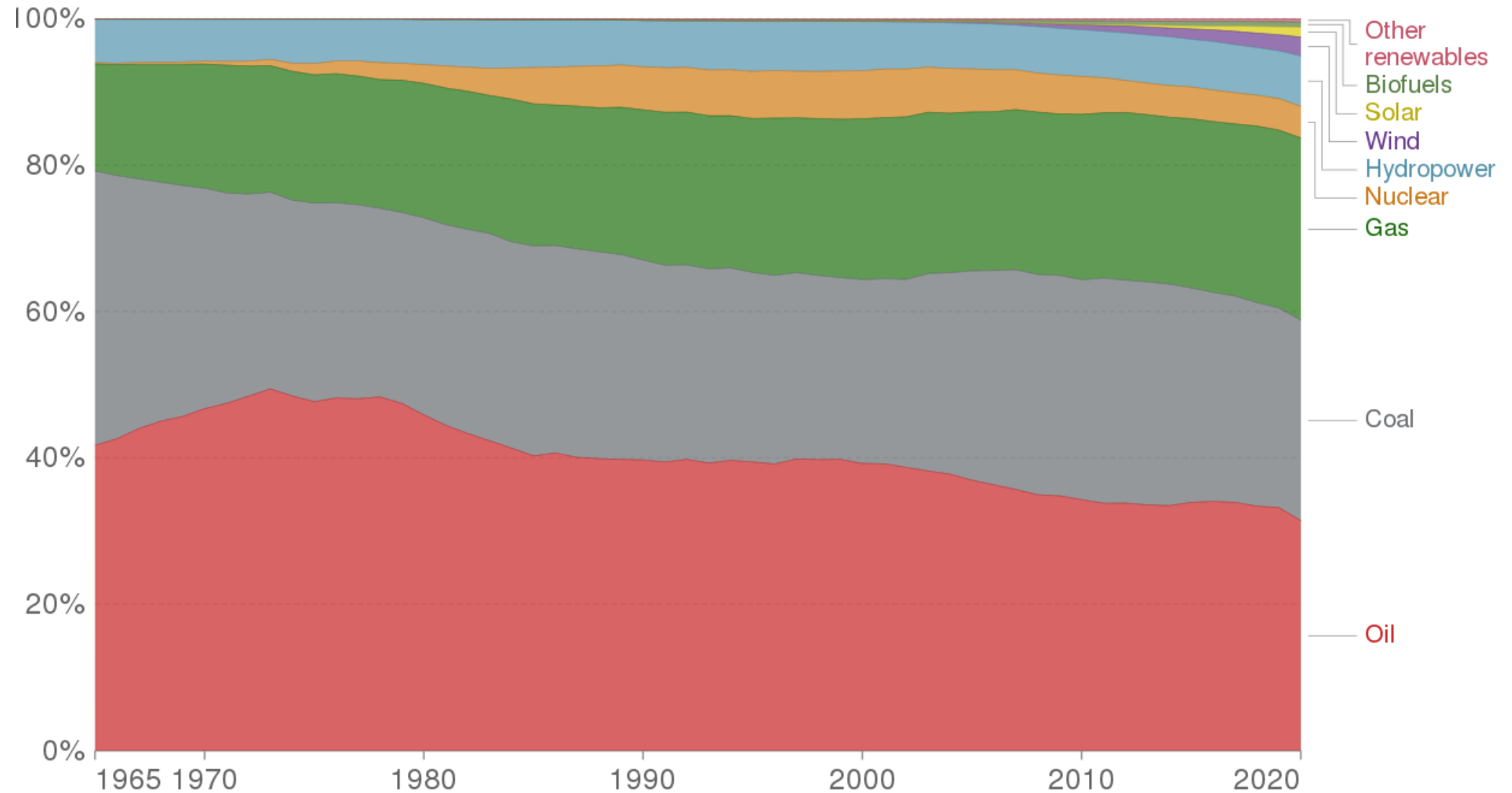


Climate change is primarily caused by a combination of human activities and natural processes:

- ✓ **Greenhouse Gas Emissions;** The burning of fossil fuels, such as coal, oil, and gas, releases significant amounts of carbon dioxide (CO₂) into the atmosphere. This enhances the greenhouse effect, leading to a rise in global temperatures of the earth both (land and water).

- ✓ **Manufacturing and Industry:** Industrial processes, including manufacturing goods like cement, steel, plastics, and electronics, also produce greenhouse gas emissions.
- ✓ **Deforestation:** Clearing forests for agriculture or other purposes releases stored carbon into the atmosphere and reduces the Earth's capacity to absorb CO₂.

✓ **Energy Consumption:** For example, charcoals ,petroleum and also peat cools contributes to formations of green house gases.



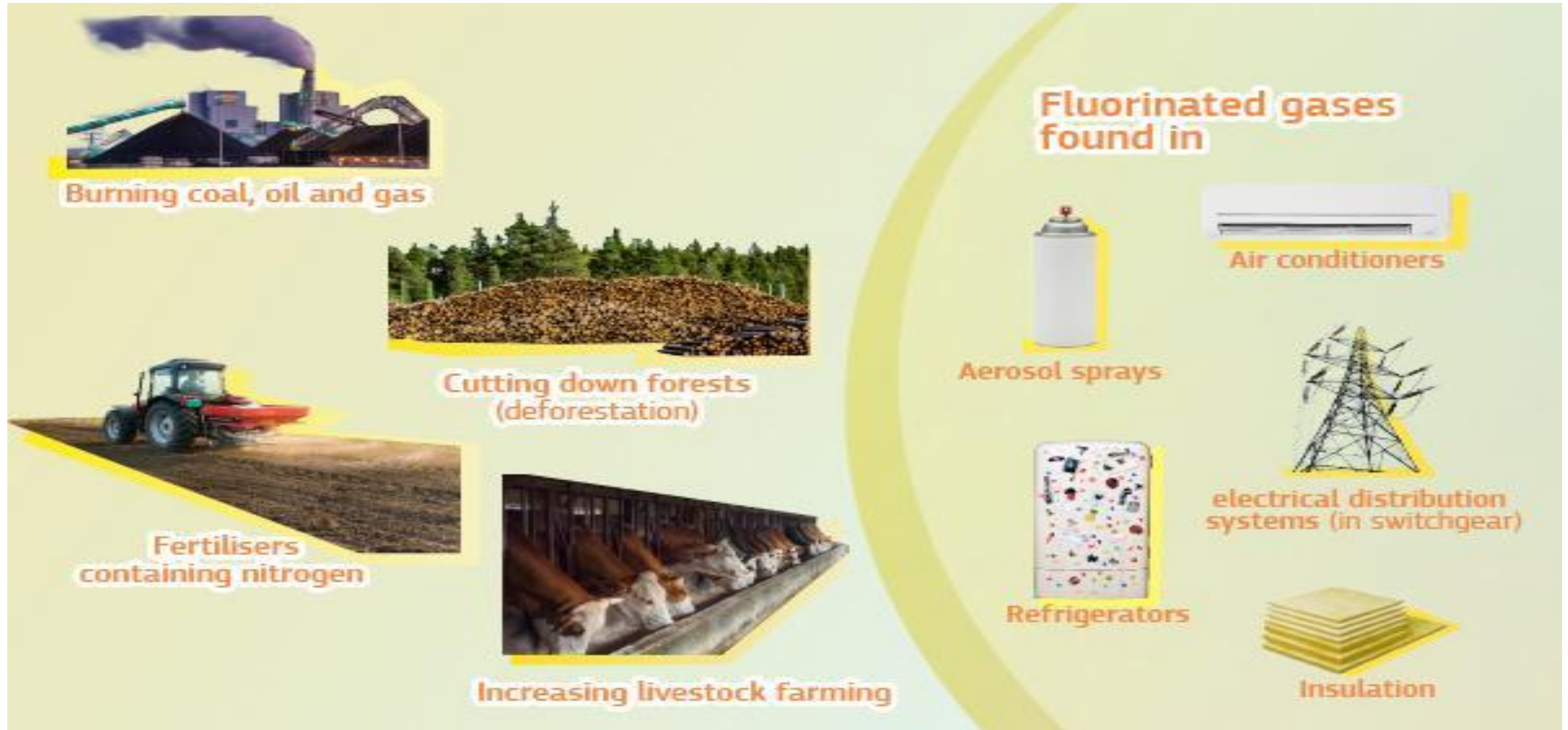
- ✓ **Power Generation:** The generation of electricity and heat by burning fossil fuels
- ✓ **Transportation:** Vehicles powered by fossil fuels emit carbon dioxide and other pollutants, contributing significantly to greenhouse gas emissions.
- ✓ **Food Production:** Agriculture-related activities release greenhouse gases through land use changes, livestock digestion, fertilizer use, and energy consumption in farming.

Natural cause of climate change



- **Volcanic Eruptions:** Volcanic eruptions release large amounts of gases and ash into the atmosphere, which can affect the Earth's climate by blocking sunlight .
- **Tectonic Shifts;** Such as the shifting of continents and mountain-building processes, can impact regional climates by altering ocean currents and atmospheric circulation patterns
- **Orbital Changes:** Changes in the Earth's orbit around the Sun, known as Milankovitch cycles, can lead to variations in seasonal distribution of sunlight reaching the Earth's surface.

Cause of Climate Change in Summary



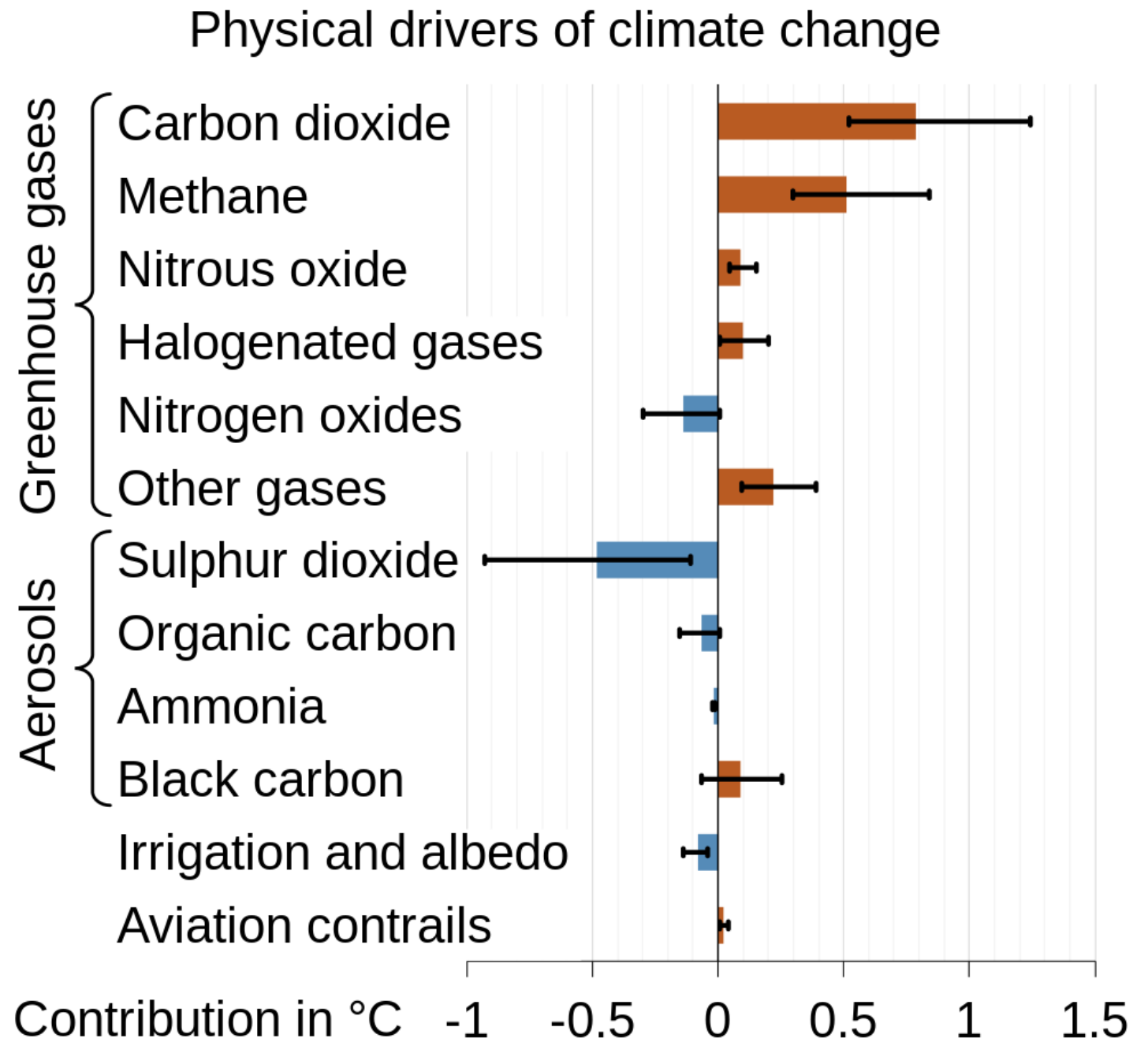
https://climate.ec.europa.eu/climate-change/causes-climate-change_en

Factors that Affect Climate

- ✓ **Relief (Topography):** The distribution of precipitation and wind patterns in a region are influenced by the topography, which includes mountains, valleys, and slopes.
- ✓ **Human Activities,** Examples of these activities include deforestation, urbanization, industrialization, and greenhouse gas emissions. When greenhouse gases are released into the atmosphere, heat is trapped, which raises global temperatures and modifies weather patterns.

Climate elements are the fundamental components that make up the climate system and contribute to its dynamics. These includes;

❖ **Temperature,** Changes in temperature can have far-reaching effects on various aspects of the environment, such as precipitation patterns, sea level rise.



Precipitation

Precipitation refers to any form of water that falls from the atmosphere to the Earth's surface, including rain, snow, sleet, and hail.



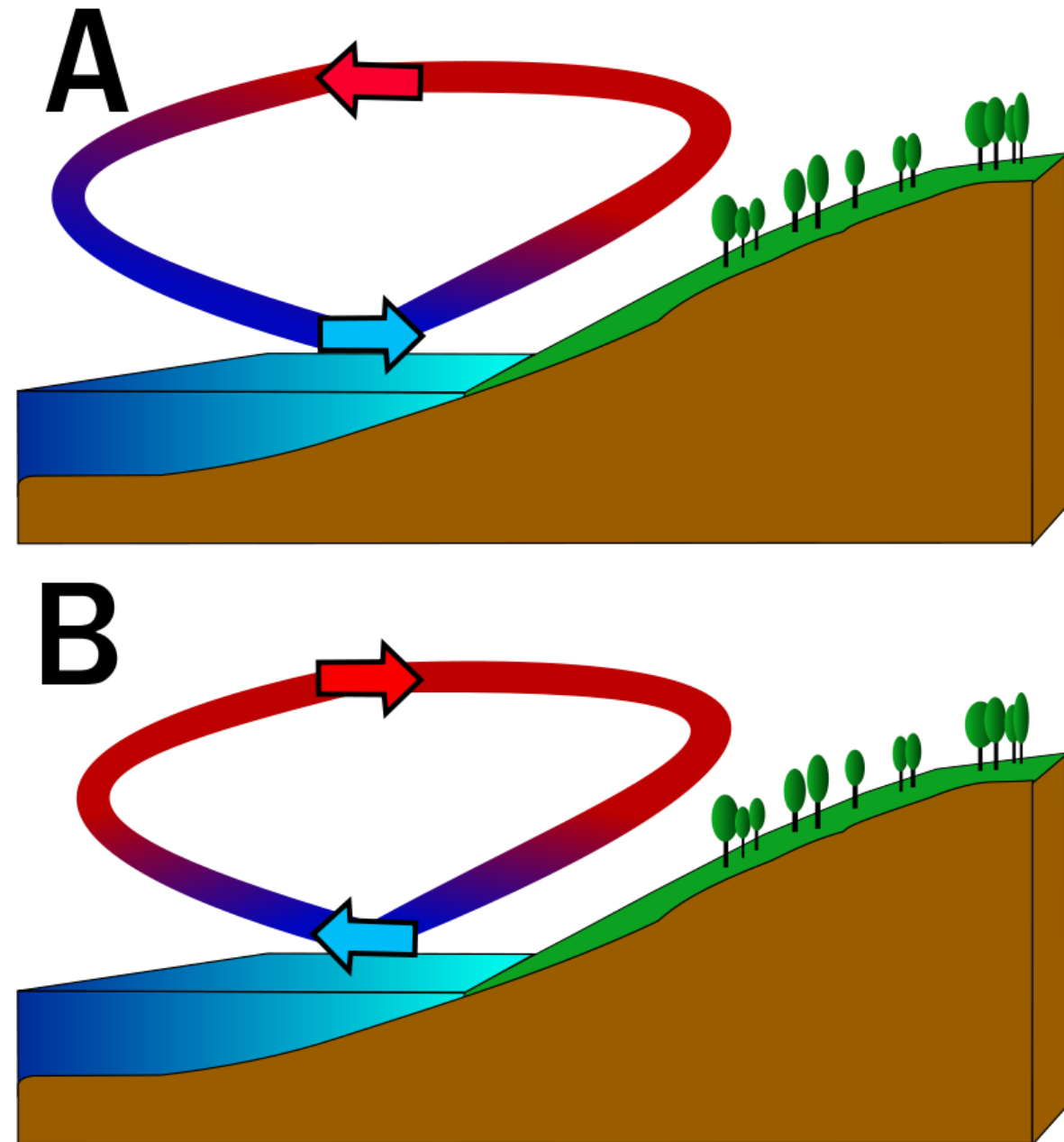
Humidity is a measure of the amount of water vapor present in the air. It indicates how much moisture the air holds relative to the maximum amount it could hold at a given temperature.

Types of humidity

❖ **Absolute Humidity:** This refers to the actual amount of water vapor in the air, typically measured in grams per cubic meter.

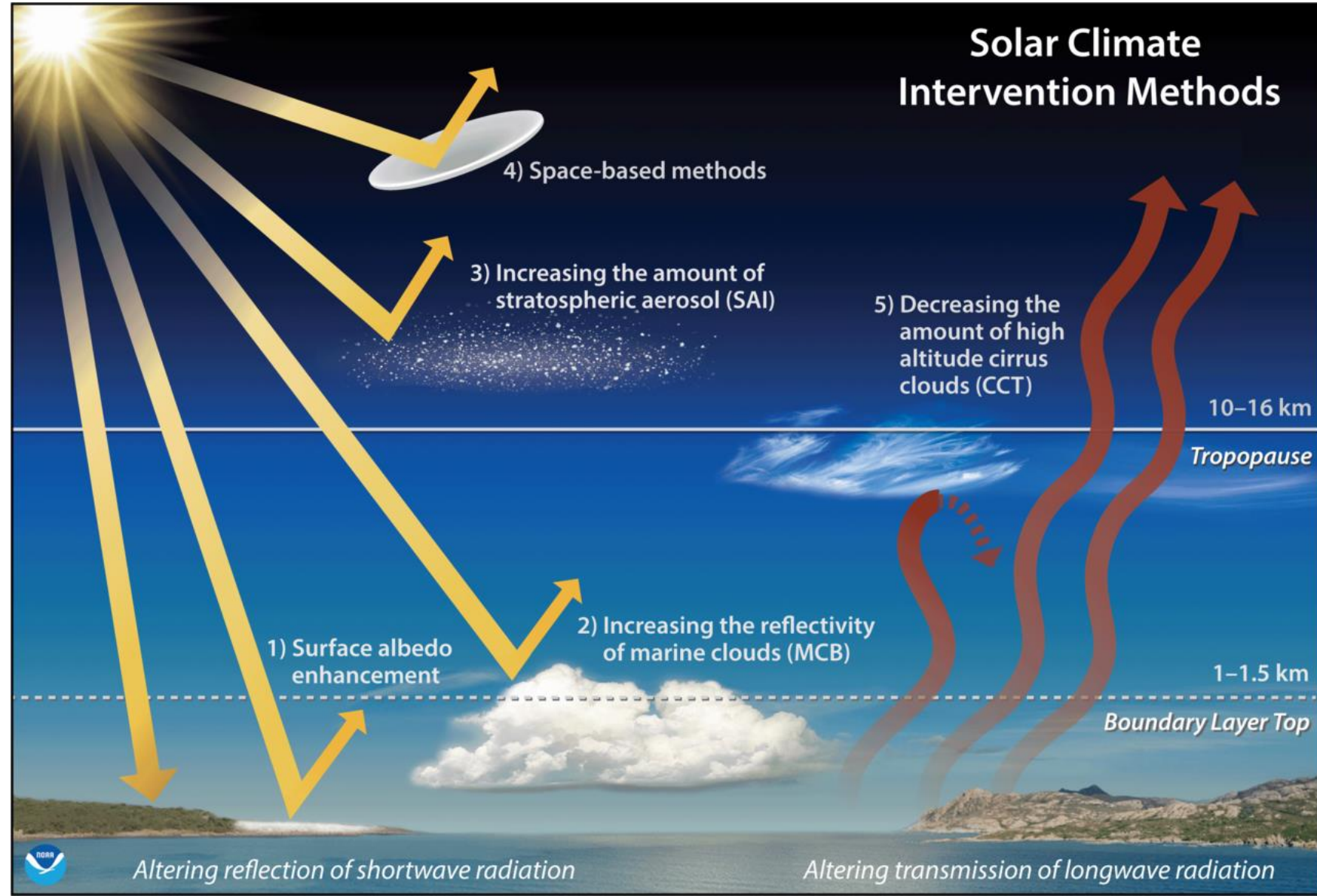
❖ **Relative Humidity:** Relative humidity compares the current amount of water vapor in the air to the maximum it could hold at that temperature, expressed as a percentage.

Wind is the movement of air caused by pressure differences resulting from temperature variations on Earth's surface.



Solar Radiation:

The energy received from the Sun, which drives Earth's climate system. Or is the electromagnetic radiation emitted by the sun.



Agriculture and food security

❖ **Droughts and Water Scarcity:** Changes in precipitation patterns affect water availability for agriculture.

❖ **Increased Wildfires:** as the results of high temperature of the earth surface .this same times affects crops located in that areas.

❖ **Rising Sea Levels:** Coastal agriculture faces threats from rising seas, leading to soil salinization and loss of arable land

Ecosystems and biodiversity

❖ **Ocean Acidification:** Increased carbon dioxide in the atmosphere leads to more acidic oceans, harming marine biodiversity.

❖ **Melting Glaciers and Ice Sheets:** This affects impacts ecosystems that rely on ice, like arctic marine ecosystem and polar regions where(Polar Bear).

Shifts in Plant and Animal

Ranges: As species move to higher altitudes or latitudes due to changing temperatures, ecosystems experience shifts in their composition and dynamics.



Some measures

- **Shifting away from fossil fuels:** Fossil fuels are the biggest source of greenhouse gases, so
- transitioning to modern renewable energy sources like solar, wind and geothermal power, and
- advancing sustainable modes of transportation, is crucial.

- ✓ **Improving energy efficiency:** Using less energy overall – in buildings, industries, public and private spaces, energy generation and transmission, and transportation – helps reduce emissions.
- ✓ **Changing agricultural practices:** Certain farming methods release high amounts of methane and nitrous oxide, which are potent greenhouse gases.

- ✓ **The sustainable management and conservation of forests:** Forests act as carbon sinks, absorbing carbon dioxide and reducing the overall concentration of greenhouse gases in the atmosphere.
- ✓ **Restoring and conserving critical ecosystems:** In addition to forests, ecosystems such as wetlands, peatlands, and grasslands, as well as coastal biomes such as mangrove forests, also contribute significantly to carbon sequestration, while supporting biodiversity and enhancing climate resilience.

Climate change mitigation and adaptation

are two complementary approaches to addressing the challenges posed by climate change. While mitigation focuses on reducing the causes of climate change by decreasing greenhouse gas emissions, adaptation involves adjusting to the current and expected impacts of climate change to minimize its negative effects



ANSWERS TO THE QUESTIONS

- ✓ Climate refers to average weather conditions over many years.
- ✓ Climate change involves significant changes, over several decades or longer, in temperature, precipitation, wind patterns, and other aspects of climate.
- ✓ Scientists have documented long-term changes globally in temperature, precipitation, sea level rise, and Arctic warming. Reductions in sea ice, snow cover, and thawing permafrost are among the profound impacts observed.

CONCLUSION

Climate as we have seen above, is long term weather condition of particular area or region.

Also, it influenced by many factors such as temperature, pressure and humidity etc . However, it is categorized into different types. Additionally, climate can change due to human activities, global warming, fossil fuels etc. But we can apply different measures such as use of electric vehicles , renewable resources and afforestation to reduce and over come the effects of climate change.

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