



Record Global Warming and its Effect on India

For Prelims: [World Meteorological Organization \(WMO\)](#), [Paris Agreement](#), [India Meteorological Department \(IMD\)](#), [Arctic Region](#), [Albedo Effect](#), [Himalayas](#), [Particulate Matter](#), [Aerosols](#), [Solar Radiation](#), [Sea Level Rise](#), [Droughts](#), [Heat Waves](#), [Cold Waves](#), [Wildfire](#), [Ecosystem](#), [Mission Mausam](#).

For Mains: Present status of global warming in the world and India, Ways to address global warming.

[Source: IE](#)

Why in News?

The [World Meteorological Organization \(WMO\)](#) has confirmed that **2024 is the warmest year on record**. The past ten years **2015-2024** are the ten **warmest years** on record.

- According to [IMD](#), the temperature increase in **India is lower than the global average rise** in temperature.
- However, concerns exist that **global climate models** don't accurately reflect changes in **India**, highlighting the need to **improve its climate observation** and impact assessment capabilities.

What are the Key Findings by the WMO?

- **Record Global Temperature:** In 2024, the global average surface temperature was **1.55°C above the pre-industrial levels (1850-1900 period)**, marking the **first year** with a temperature **exceeding 1.5°C** above this baseline.
- **Ocean Heat:** The **top 2000 meters of ocean water** absorbed a record **16 zettajoules of heat**, roughly **140 times the total global electricity generation** in 2023.
 - Around **90%** of excess heat from global warming is **stored in the ocean**.
- **Temperature Assessment:** Although 2024's temperature **surpassed 1.5°C**, the WMO assures that the [Paris Agreement](#)'s goals remain **intact**.
 - It emphasizes that **every fraction** of a degree worsens climate impacts on **ecosystems and human systems**.
 - The **Paris Agreement** is a **legally binding** global agreement under [UNFCCC](#) to limit global warming to well **below 2°C** above pre-industrial levels, with an **ambition to limit warming to 1.5°C**.
- **Warming in India:** [India Meteorological Department \(IMD\)](#) said that in 2024 India was **0.65 degrees Celsius** higher than normal but lower than the **global average of 1.55°C**.
 - **IMD** data shows that temperature over India in **2024** was about **1.2 °C** higher than the **1901-1910 average**.

Note: **Land temperatures** have risen by **1.59°C** since preindustrial times, while **oceans** have warmed by **0.88°C**, according to the [6th IPCC report](#).

What are the Reasons Behind Lower Warming Over India?

- **Geographic Location:** Global temperature rise has been **more noticeable at higher latitudes**, especially near the **poles**, due to heat transfer from the **tropics** through **air circulation systems** and the fact that **higher latitudes** already have **lower temperatures**.
 - India is located in the **tropical zone**, closer to the equator which does not experience such **geographical phenomenon**.
- **Albedo Effect:** In the **Arctic region**, higher heating is caused by **low albedo effect**, where melting ice exposes land or water that **traps more heat than ice-covered surfaces**, which reflect sunlight.
 - In India, **albedo effect on snow** is restricted to **Himalayan areas**.
- **Aerosols and Pollution:** The **particulate matter** and **aerosols** have a **cooling effect** because they scatter the **solar radiation** back into space. Aerosols also help in **cloud formation** which, in turn, help in reflecting sunlight back to space.
 - **High air pollution** in India due **particulate matter and aerosols** have a **small unintended consequence** of lowering the temperature rise.
- **Altitude Variations:** India's landmass is **not uniform**, with distinct variations in temperature rise across regions.
 - Some areas see more warming due to **local climate and geography**, but the national average temperature rise remains lower.

Other Global Warming Related Findings

- **Exposure to Extreme Heat:** India, China, Indonesia, Nigeria, and Bangladesh were the **top five countries** with the **highest total hours of exposure to extreme heat** in 2020.
 - From **1995 to 2020**, global exposure to extreme heat due to trade increased by **89%**, from 221.5 billion person-hours to 419.0 billion person-hours.
- **Disproportionate Exposure:** **Lower-middle-income and low-income economies** accounted for **53.7% and 18.3%** of global exposure to extreme heat, respectively, while contributing only **5.7% and 1%** of global labor compensation.
- In **2020**, **Germany** had only **28.1 hours of extreme heat exposure per capita**, and the **United States** had **260.9 hours**, while countries like **Thailand and Nigeria** had much higher figures (**1319.5 and 1186.8 hours per capita, respectively**).

What are the Consequences of Rising Global Temperatures?

- **Sea Level Rise:** **Global sea level** has **risen** by about **8 inches** since **1880** and is projected to rise by at least another **foot by 2100** inundating coastal areas, displacing communities, and disrupting ecosystems.
 - Oceans **absorb** significant **CO2**, increasing acidity and harming marine life.
- **Droughts and Heat Waves:** **Droughts** and **heat waves** are likely to intensify, while **cold waves** are expected to weaken and occur less frequently.
 - Warming and prolonged drought have intensified **wildfire** seasons and increased fire risks.
- **Biodiversity Loss:** Rising temperatures and shifting weather **disrupt ecosystems**, driving many species toward **extinction**.
- **Related Effects:** Extreme weather disrupts **food production**, causing shortages and **price hikes**, while rising temperatures **worsen air quality**, increase heat illnesses, and spread diseases.

OCEAN WARMING

The ocean absorbs most of the excess heat due to global warming caused by greenhouse gas (GHG) emissions, leading to rising ocean temperatures

Increase in Ocean Temperature

1.2°C from 1950 to 2020

Projected to Future Increase

1.7°C to 3.8°C from 2020 to 2100

Causes of Ocean Warming (due to Global Warming)

- 🕒 **GHG Emissions:** Fossil fuels burning releases CO₂ and GHG
- 🕒 **Deforestation:** Lesser trees → More CO₂ & GHG → Global Warming → Warming of Ocean
- 🕒 **Industrial Activities:** Emit various pollutants that contribute to greenhouse effect
- 🕒 **Agricultural Practices:** Produces methane and nitrous oxide – potent greenhouse gases
- 🕒 **Heat Absorption by Oceans:** Oceans absorb ~90% of excess heat generated by GHGs

Impact of Ocean Warming

- 🕒 **Sea Level Rise:** Warmer water expands, causing sea levels to rise
- 🕒 **Coral Bleaching:** Corals expel the algae (zooxanthellae) living in their tissues and turn completely white
- 🕒 **Ocean Acidification:** Ocean absorbs ~1/4th of total CO₂ thus making it more acidic (non-metallic oxides - acidic in nature)
- 🕒 **Impacts on Marine Life:** Causes many marine species to shift towards the poles and disrupts food webs
- 🕒 **Impacts on Climate Patterns:** Influences atmospheric circulation patterns, such as El Niño and La Niña & extreme weather events



Drishti IAS

How India Can Better Observe Global Warming?

- **Expansion of Weather Stations:** India needs to expand its **weather stations**, especially in rural areas, with stations in every major panchayat under the [Viksit Bharat vision for 2047](#), to gather real-time data for accurate climate assessments.
- **Enhancing Computing Capabilities:** India must invest in **advanced computing and analysis infrastructure** to process climate data for improved [disaster management](#), agricultural forecasting, and climate resilience strategies.
- **Regular Impact Assessments:** India needs to conduct **India-specific** climate change impact assessments to track the evolving climate risks like **sea level rise, and ecosystem changes**.
- **Mission Mausam:** [Mission Mausam](#) should be strengthened and integrated with national and international systems for better [weather prediction](#), especially in coastal and mountainous regions.
 - Mission Mausam aims to **enhance** India's ability to **predict and respond to extreme weather events** and the impacts of **climate change**.
- **Localized Impact Studies:** India needs to invest in **localized studies** that reflect the specific climate challenges faced by different regions such as the **Himalayas, coastal areas, and urban centers** for targeted adaptation strategies and policy interventions.

What is the World Meteorological Organization (WMO)?

- The **World Meteorological Organization (WMO)** is an intergovernmental organisation with a membership of **192 Member States and Territories**.
 - **India** is a member of WMO.
- It originated from the **International Meteorological Organization (IMO)**, which was established after the **1873 Vienna International Meteorological Congress**.
- Established by the ratification of the WMO Convention on **23rd March 1950**, WMO became the **specialised agency of the UN for meteorology (weather and climate), operational hydrology and related geophysical sciences**.
- WMO is headquartered in **Geneva, Switzerland**.

Way Forward

- **Six-Sector Approach:** Adopt the [United Nations Environment Programme](#)'s strategy to cut emissions across **energy, industry, agriculture, forests, transport, and building sectors**.
- **Reforestation and Afforestation:** Plant trees to act as [carbon sinks](#), absorbing CO₂ from the atmosphere.
 - [Restore degraded forests](#) and protect existing ones to preserve biodiversity and carbon storage capacity.
- **Energy Efficiency:** Promote **energy-efficient appliances**, buildings, and industrial processes.
 - Implement stricter **energy standards** and adopt smart technologies to optimize energy use.
- **Sustainable Agriculture:** Adopt [climate-smart agricultural practices](#), such as [sustainable irrigation techniques](#), [drought-resistant crop varieties](#), and [agroforestry](#).

Drishti Mains Question:

Discuss the factors contributing to the global temperature rise and analyze why India experiences relatively lower warming compared to global averages.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims

Q. Which of the following statements is/are correct about the deposits of 'methane hydrate'? (2019)

1. Global warming might trigger the release of methane gas from these deposits.
2. Large deposits of 'methane hydrate' are found in Arctic Tundra and under the sea floor.
3. Methane in atmosphere oxidizes to carbon dioxide after a decade or two.

Select the correct answer using the code given below.

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Ans: (d)

Q "Momentum for Change: Climate Neutral Now" is an initiative launched by (2018)

- (a) The Intergovernmental Panel on Climate Change
- (b) The UNEP Secretariat
- (c) The UNFCCC Secretariat
- (d) The World Meteorological Organisation

Ans: (c)

Mains

Q. 'Climate change' is a global problem. How India will be affected by climate change? How Himalayan and coastal states of India will be affected by climate change? **(2017)**

PDF Refernece URL: <https://www.drishtiias.com/printpdf/record-global-warming-and-its-effect-on-india>

