Greenhouse Gas Bulletin released by WMO

By IASToppers | 2023-11-07 15:10:00

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The **World Meteorological Organisation** (WMO) recently released its "**Greenhouse Gas Bulletin**".

[ref-NPR]

Key highlights:

- Heat trapping **greenhouse gas** (GHG) concentrations continued to increase in **2023**.
- Global averaged concentrations of carbon dioxide (CO2), the most important GHG, in 2022 were **50**% above the pre-industrial era for the first time.
- From **1990** to **2022**, the warming effect on the climate called **radiative forcing by long-lived GHGs** increased by 49%.
    - CO2 accounted for about **78**% of this **increase**.
- The climate system is close to "**tipping points**", a point after which certain level of change will lead to self-accelerating and irreversible cascade of changes.
- The 3 major greenhouse gases- **CO_2**, **Methane** and **Nitrous Oxide** exhibit significant variability influenced by both **natural processes** and **human activities**.
    - This variability has the potential to either **enhance** or **mitigate** changes over specific periods.
- **Methane** accounts for about **16**% of the warming effect of long-lived GHGs while **nitrous oxide** accounts for about **7%** of the radiative forcing.
    - **Methane** is a powerful GHG that remains in the atmosphere for about a decade.
- With every **degree rise** in warming there is a **7%** increase in water vapour availability, leading to a rise in **extreme rainfall** events during the monsoon season.

About Radiative forcing:

- Radiative forcing is the change in **energy flux** in the atmosphere caused by natural or anthropogenic factors of climate change.

- It is used to **quantify** and **compare** the **external drivers** of change to Earth's energy balance.
- **Positive radiative** forcing means that the Earth is **receiving** more **incoming energy** from **sunlight** than it is **radiating back** to space, leading to **warming** of Earth.
- **Negative radiative** forcing means that the Earth is **losing** more energy to space than it **receives** from the Sun, leading to **cooling** of Earth.
- It is evaluated at the **tropopause** and at the top of the **stratosphere**.
- It is affected by factors such as solar insolation, surface albedo, and the atmospheric concentrations of GHGs (radiatively active gases) and aerosols.
    - **Solar insolation** is the amount of **solar radiation** received by a planet.
    - **Albedo** is a measure of amount of light that is **reflected** by the surface of the planet.

About Radiative forcing by long-lived GHGs:

- The radiative forcing of long-lived GHGs have been increasing in earth's atmosphere since the industrial revolution.
    - **Long-lived GHGs** are the GHGs that can **sustain** itself in the earth's atmosphere for many **years** or **decade** before being decomposed naturally.
- The major contributors include- **carbon dioxide** (CO_2), **methane** (CH_4), **nitrous oxide** (N_2O); **CFCs** (chlorofluorocarbons) **12** and **11** and many **halogen-based gases**.
    - Together they account for about **96**% of the direct radiative forcing by long-lived GHGs increases since **1750**.
- Increasing the concentration of GHGs leads to a **positive radiative forcing**.

Greenhouse Gas	Lifetime in the atmosphere	100-Year Global Warming Potential	100-Year Global Temperature Change Potential
Carbon Dioxide	see below*	1	1
Methane	12.4	28	4
Nitrous Oxide	12.4	265	234
Fluorinated Gases	A few weeks to thousands of years	Varies (the highest is sulfur hexafluoride at 23,500)	Varies (the highest is sulfur hexafluoride at 28,200)

Source: (IPCC, 2014b, p.87)

[ref-research gate]

About the World Meteorological Organization (WMO):

- The World Meteorological Organization (WMO) is a **specialized agency** of the United Nations responsible for promoting international cooperation in meteorology, climatology, hydrology, and

related fields.

- It was established in **1950** and is headquartered in **Geneva**, Switzerland.
- It originated from the **International Meteorological Organization**, a forum founded in 1873 founded in **1873** for exchanging weather data and research.
- Its goal is to facilitate the exchange of information and promote collaboration among the **meteorological** and **hydrological** services of its member countries.
- It has **193 Members** including India.
- It is governed by the **World Meteorological Congress**, composed of member states, which meets every **4 years** to set **policies** and **priorities**.

Functions:

- It promotes the **standardization** of **meteorological** and other relevant observations and ensure the uniform **publication** of observations and **statistics**.
- It coordinates **global scientific research** to improve understanding and prediction of the Earth's **atmosphere** and **climate**.
- It provides a framework for the **free international exchange** of meteorological and other geophysical data and information.
- It oversees the **Global Observing System** (GOS), which collects data from a network of observing stations worldwide.
    - GOS is essential for weather forecasting, climate monitoring, and environmental assessments.
- It helps in addressing climate change-related issues, including monitoring greenhouse gas concentrations and providing scientific assessments on climate change impacts.

