

3. Greenhouse Gas in Atmosphere

Prelims Level: Climate Change and its Impacts

Mains Level: Conservation, Environmental Pollution and Degradation, Environmental Impact Assessment

Why in News?

- According to the World Meteorological Organization, levels of heat-trapping greenhouse gases in the atmosphere have reached new record high.

About:

- The WMO **Greenhouse Gas Bulletin** showed that globally averaged concentrations of carbon dioxide (CO₂) reached 407.8 parts per million in 2018, up from 405.5 parts per million (ppm) in 2017.
- CO₂ remains in the atmosphere for centuries and in the oceans for even longer.
- Concentrations of methane and nitrous oxide also surged by higher amounts than during the past decade, according to observations from the **Global Atmosphere Watch network** which includes stations in the remote Arctic, mountain areas and tropical islands.
- From 1990, there has been a 43% increase in total radiative forcing – the warming effect on the climate - by long-lived greenhouse gases. CO₂ accounts for about 80% of this, according to figures from the US National Oceanic and Atmospheric Administration.

Paris Agreement:

- The Paris Agreement builds upon the Convention and for the first time brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so. As such, it charts a new course in the global climate effort.
- The Paris Agreement central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius.
- Additionally, the agreement aims to strengthen the ability of countries to deal with the impacts of climate change.
- To reach these ambitious goals, appropriate financial flows, a New Technology framework and an enhanced capacity building framework will be put in place, thus supporting action

by developing countries and the most vulnerable countries, in line with their own national objectives.

- The Agreement also provides for enhanced transparency of action and support through a more robust transparency framework.

World Meteorological Organization:

- WMO is the specialized agency of the UN for meteorology (weather and climate), operational hydrology and related geophysical sciences, established in 1950.
- India is a member of WMO
- Its mandate covers weather, climate and water resources.

Emission Gap:

- The WMO Greenhouse Gas Bulletin reports on atmospheric concentrations of greenhouse gases. Emission Gap represent what goes into the atmosphere.
- Concentrations represent what remains in the atmosphere after the complex system of interactions between the atmosphere, biosphere, lithosphere, cryosphere and the oceans.
- Gap Report 2019 indicate that greenhouse gas emissions continued to rise in 2018, according to an advanced chapter of the Emissions Gap Report released as part of a United in Science synthesis for the UN Secretary-General's Climate Action Summit in September.

UN Environment | Emissions Gap Report:

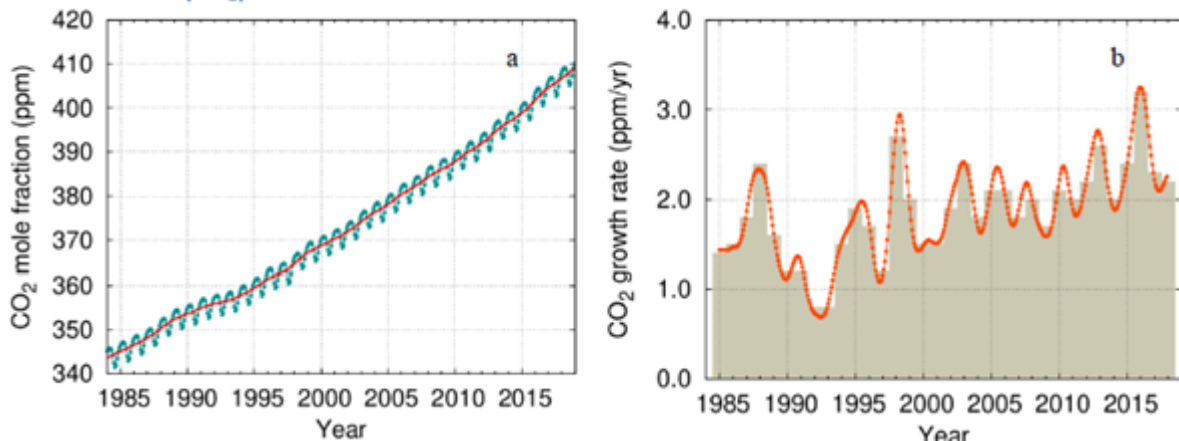
- The flagship report from UN Environment is the definitive assessment of the 'emissions gap' – the gap between anticipated emission levels in 2030, compared to levels consistent with a 2°C / 1.5°C target.
- It found that global emissions are on the rise as national commitments to combat climate change come up short.
- The Emissions Gap report assesses the latest scientific studies on current and estimated future greenhouse gas emissions; they compare these with the emission levels permissible for the world to progress on a least-cost pathway to achieve the goals of the **Paris Agreement**.

WMO | Greenhouse Gas Bulletin:

- The WMO Greenhouse Gas Bulletin reports on atmospheric concentrations of greenhouse gases in the earth's atmosphere.
- There is no sign of a reversal in this trend, which is driving long-term climate change, sea level rise, ocean acidification and more extreme weather.
- The bulletin includes a focus on how isotopes confirm the dominant role of fossil fuel combustion in the increase of atmospheric carbon dioxide.
- Fossil fuels were formed from plant material millions of years ago and do not contain radiocarbon. Burning it will add to the atmosphere radiocarbon-free CO₂, increasing CO₂ levels and decreasing its radiocarbon content. And this is exactly what is demonstrated by the measurements.
- Fifty-four countries contributed data for the Greenhouse Gas Bulletin. Measurement data are reported by participating countries and archived and distributed by the World Data Centre for Greenhouse Gases (WDCGG) at the Japan Meteorological Agency.

Carbon Dioxide:

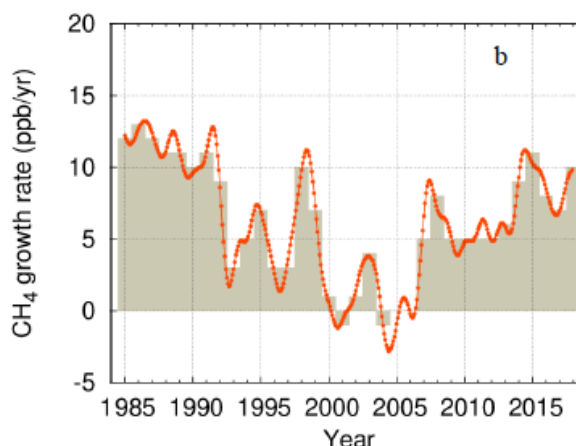
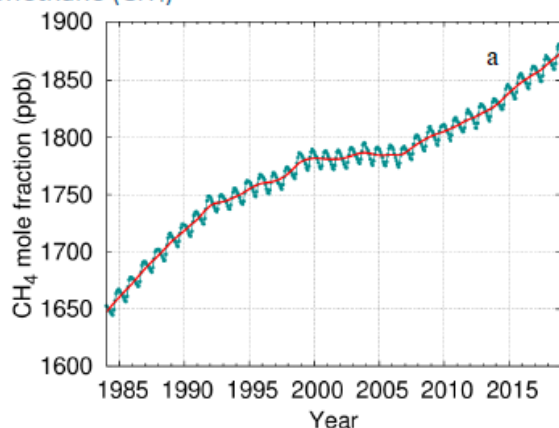
Carbon Dioxide (CO₂)



- Carbon dioxide is the main long-lived greenhouse gas in the atmosphere related to human activities.
- Its concentration reached new highs in 2018 of 407.8 ppm, or 147% of pre-industrial level in 1750. The increase in CO₂ from 2017 to 2018 was above the average growth rate over the last decade.
- The growth rate of CO₂ averaged over three consecutive decades (1985–1995, 1995–2005 and 2005–2015) increased from 1.42 ppm/yr to 1.86 ppm/yr and to 2.06 ppm/yr with the highest annual growth rates observed during El Niño events.

Methane:

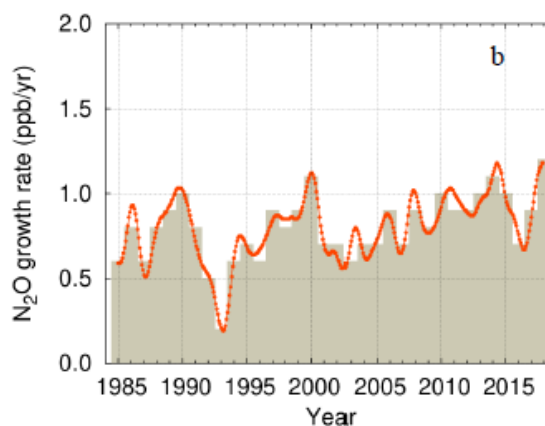
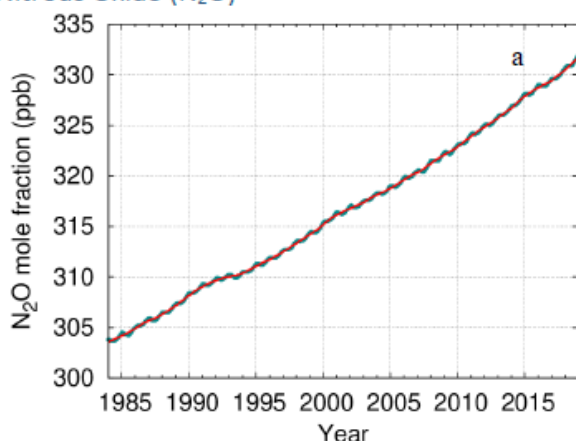
Methane (CH₄)



- Methane (CH₄) is the second most important long-lived greenhouse gas and contributes about 17% of radiative forcing.
- Approximately 40% of methane is emitted into the atmosphere by natural sources (e.g., wetlands and termites), and about 60% comes from human activities like cattle breeding, rice agriculture, fossil fuel exploitation, landfills and biomass burning.
- It reached a new high of about 1869 parts per billion (ppb) in 2018 and is now 259% of the pre-industrial level.
- The increase of CH₄ from 2017 to 2018 was higher than both that observed from 2016 to 2017 and the average over the last decade.

Nitrous Oxide

Nitrous Oxide (N₂O)



- Nitrous oxide (N₂O) is emitted into the atmosphere from both natural (about 60%) and anthropogenic sources (approximately 40%), including oceans, soil, biomass burning, fertilizer use, and various industrial processes.

- Its atmospheric concentration in 2018 was 331.1 parts per billion. This is 123% of pre-industrial levels. The increase from 2017 to 2018 was also higher than that observed from 2016 to 2017 and the average growth rate over the past 10 years.
- It also plays an important role in the destruction of the stratospheric ozone layer which protects us from the harmful ultraviolet rays of the sun. It accounts for about 6% of radiative forcing by long-lived greenhouse gases.

WMO | Global Atmosphere Watch (GAW) Program:

- **It provides information and services related to**
 - ✓ The steadily increasing amounts of greenhouse gases, especially carbon dioxide, are impacting the climate
 - ✓ The depletion of the protective stratospheric ozone layer has increased ultraviolet radiation, which can lead to more incidences of skin cancer and other diseases
 - ✓ The urban air pollution, especially fine particles, which is affecting Human Health.
- **It provides data to all bulletin like,**
 - ✓ Arctic and Antarctic ozone bulletins
 - ✓ Greenhouse gas bulletins
 - ✓ Aerosol bulletins

