

Ozone hole

March 29, 2020

Why in news?

- During September and October, 2019, the annual **ozone hole over the Antarctic reached its peak extent of 16.4 million sq. km and then shrank to less than 10 million sq. km.** This has been the smallest observed since 1982.

What is an ozone hole and how is it formed?

- It is actually a region of exceptionally **depleted ozone in the stratosphere over the Antarctic** that happens at the beginning of the **Southern Hemisphere spring (August–October).**
- It is **caused by chemicals called CFCs, i.e. Chlorofluorocarbons.**
- These CFCs escape into the atmosphere from refrigeration and propellant devices and processes.
- In the stratosphere, **ultraviolet light breaks the bond holding chlorine atoms (Cl) to the CFC molecule.**
- A **free chlorine atom goes on to participate in a series of chemical reactions that both destroy ozone** and return the free chlorine atom to the atmosphere unchanged, where it can destroy more and more ozone molecules.
- **Polar stratospheric clouds (PSCs) and ozone:**
- In the **long months of polar darkness** over Antarctica in the winter, atmospheric conditions are unusual.
- An endlessly **circling whirlpool of stratospheric winds called the polar vortex** isolates the air in the center.
- Because it is completely dark, the air in the vortex gets so cold that clouds form.
- Unusual chemical reactions can **occur only on the surface of polar stratospheric cloud particles,** which may be water, ice, or nitric acid, depending on the temperature.

- These frozen crystals **provide a surface for the reactions that free chlorine atoms** in the Antarctic stratosphere.
- These reactions **convert the inactive chlorine reservoir chemicals into more active forms**, especially chlorine gas (Cl₂).
- **When the sunlight returns to the South Pole in October**, UV light rapidly breaks the bond between the two chlorine atoms, releasing free chlorine into the stratosphere, thus ozone molecules get destroyed.
- In the **early spring as polar vortex weakens**, the ozone-destroying forms of chlorine disperse.
- The ozone layer stabilizes until the following spring.