

Polar Stratospheric Clouds

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The appearance of **Polar Stratospheric Clouds** recently made **early onset in December** instead of January, suggesting an **atypical Arctic winter**.



[Ref- India Today]

What are Polar stratospheric clouds (PSCs)?

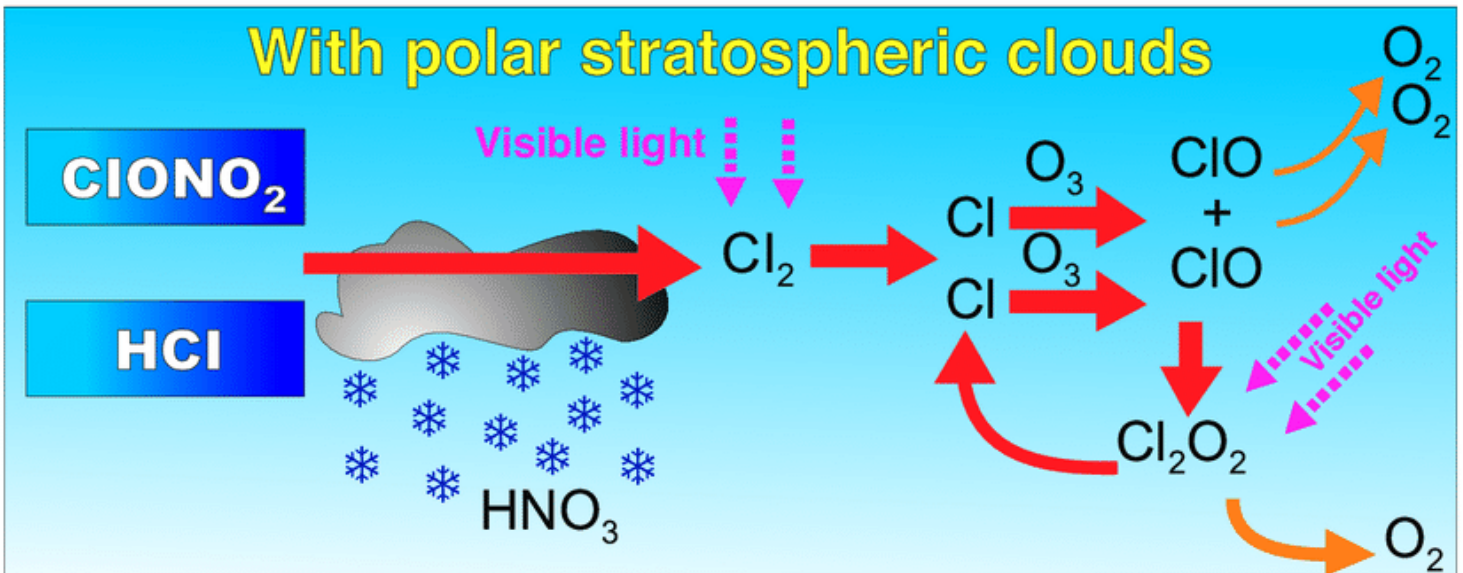
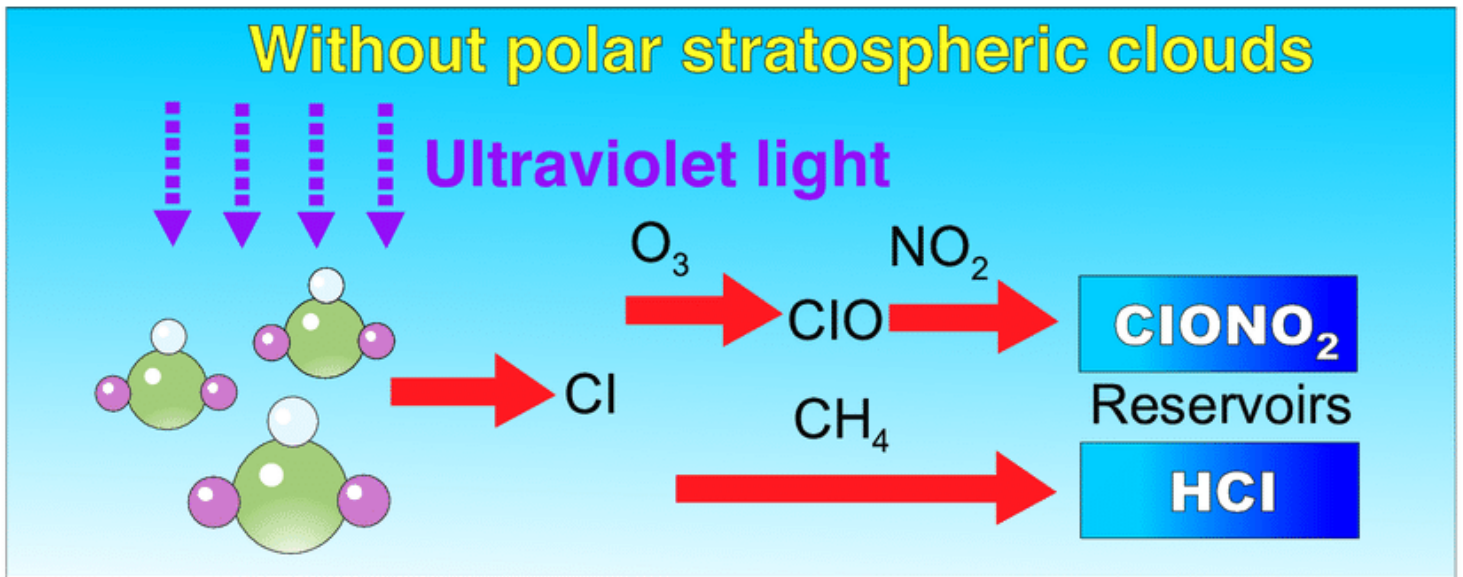
- **Polar stratospheric clouds (PSCs)** are clouds that form in the winter polar **stratosphere** at altitudes of 15,000–25,000 meters.
 - **Stratosphere** is the second layer of Earth's atmosphere, located between the troposphere and mesosphere, lying from 12 to 50 km above the Earth's surface.
- They are known as **nacreous clouds** because their iridescence resembles **mother of pearl**.
- Earth's stratosphere is typically **absent of moisture**, but Arctic winter's **extreme conditions** at

around -85°C allow sparse **water vapor to condense into ice particles**.

- PSCs scatter **high-altitude sunlight**, creating iridescent colors visible even when the **sun is below the horizon**.
- **Observation:** Best sighting is during civil twilight when the sun is between $1-6^{\circ}$ below horizon, mostly in northern latitudes.
- This phenomenon is **most common** in Antarctica, but spotted in the Arctic, Scotland, Scandinavia, Alaska, Canada and the northern Russian Federation.
- This occurs in **downwind of mountain ranges** which can induce gravity waves in the **lower stratosphere**.

Impact on Ozone Layer:

- Substances like **chlorofluorocarbons (CFCs)**, commonly found in aerosols and refrigeration, gradually rise to stratosphere and contribute to **ozone layer depletion**.
- **Ultraviolet light breaks** down CFCs in the stratosphere, releasing **free chlorine atoms**.
- PSCs are linked to **ozone depletion** as they facilitate chemical reactions, converting benign chlorine into reactive, **ozone-destroying forms**.
- They also **remove nitrogen compounds** that moderate the destructive impact of chlorine on the ozone layer.
- Nacreous clouds have **frozen water crystals, nitric acid, and sulphuric acid**, providing an ideal surface for chemical reactions that release chlorine atoms **back into the atmosphere**.



[Ref- Research Gate]