

Atmospheric
Science

Sun, Space, and Survival

The relationship between solar radiation
and Earth's protective atmosphere



The Solar Spectrum

Solar Physics

The Sun is a massive nuclear reactor emitting energy across the electromagnetic spectrum.

Ultraviolet radiation

Critical segment of solar energy interacting with the atmosphere.



Visible light

Critical segment of electromagnetic radiation emitted by the Sun.



Infrared radiation

Segment of solar energy perceived as heat.

Categorizing Ultraviolet Radiation

UV-B

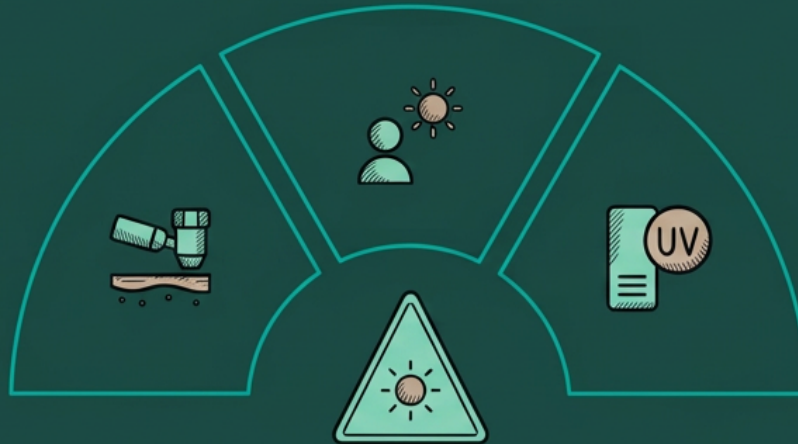
Medium-wave radiation (280–315 nm) partially filtered by the atmosphere, causing sunburns and Vitamin D synthesis.

UV-A

Long-wave radiation (315–400 nm) not absorbed by the ozone layer, causing skin aging and DNA damage.

UV-C

Short-wave, highest-energy radiation (100–280 nm) completely absorbed by oxygen and ozone in the upper atmosphere.



Layers of the Atmosphere



Troposphere

The lowest layer where we live and where all weather occurs. It contains 75% of the atmosphere's mass.



Stratosphere

Home to the Ozone Layer. Unlike the troposphere, temperature here increases with altitude due to UV absorption.



Mesosphere

The coldest layer of the atmosphere, where most meteors burn up upon entry.



Thermosphere

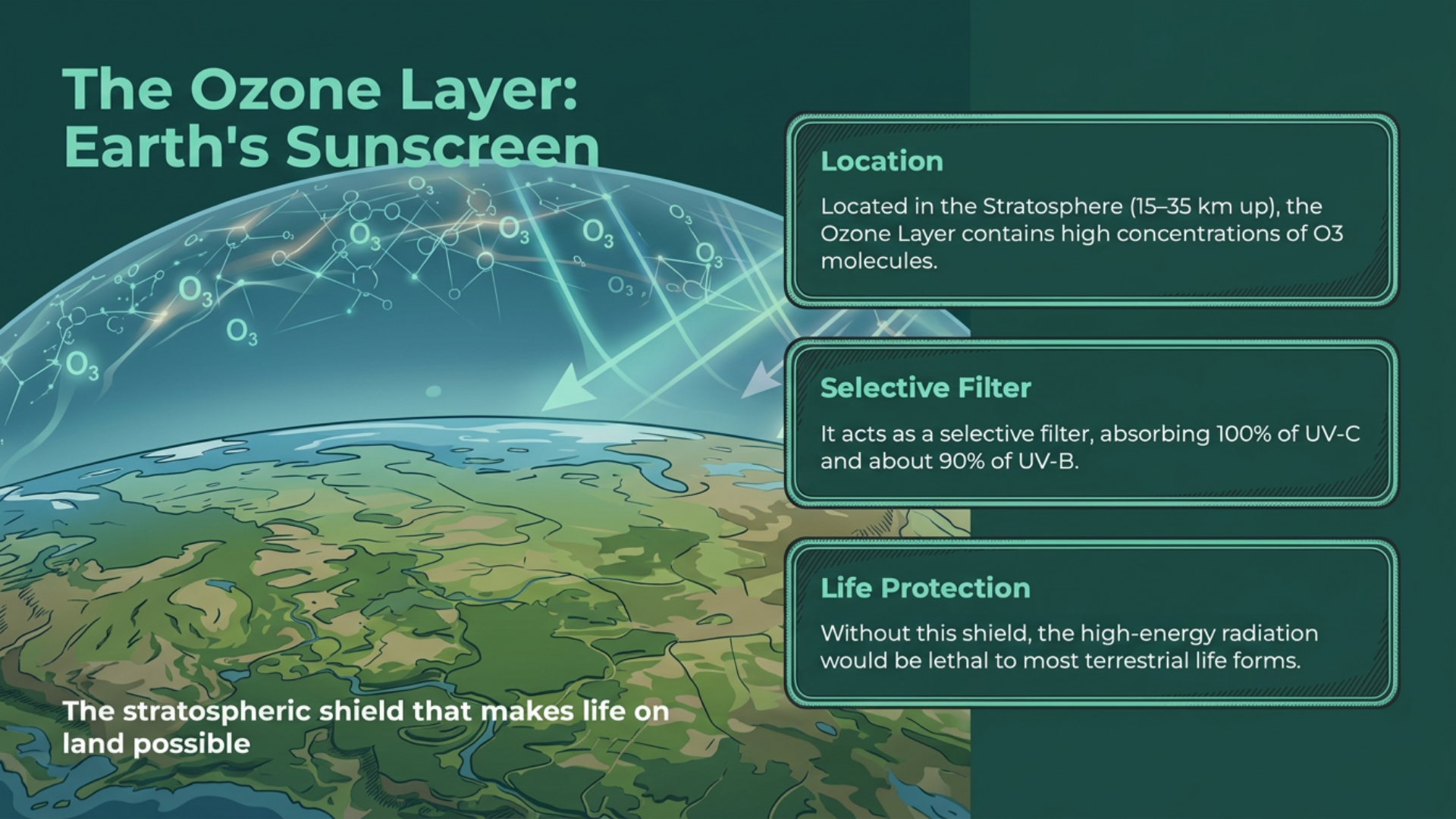
A high-energy layer that absorbs X-rays and extreme UV radiation; it is the orbital home of the ISS.



Exosphere

The thin, final frontier where the atmosphere gradually fades into the vacuum of space.

The Ozone Layer: Earth's Sunscreen



Location

Located in the Stratosphere (15–35 km up), the Ozone Layer contains high concentrations of O₃ molecules.

Selective Filter

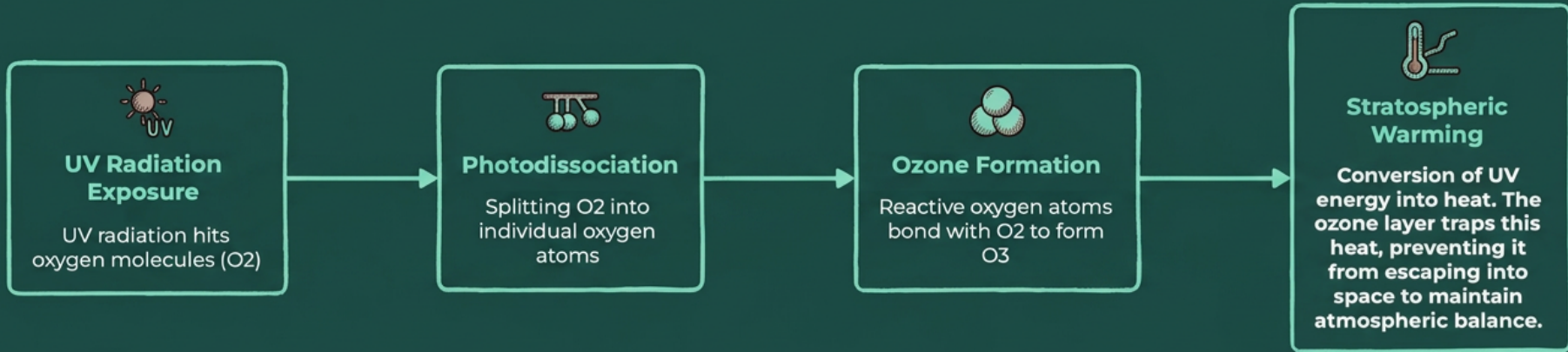
It acts as a selective filter, absorbing 100% of UV-C and about 90% of UV-B.

Life Protection

Without this shield, the high-energy radiation would be lethal to most terrestrial life forms.

The stratospheric shield that makes life on land possible

The Ozone-Oxygen Cycle (Chapman Cycle)



Ozone Discovery & Recovery: A Century of Progress

Discovery & Depletion

Discovered in 1913 by French physicists Charles Fabry and Henri Buisson.

Human-made CFCs began damaging the layer in the mid-20th century.

Significant thinning observed over Antarctica by the 1980s.



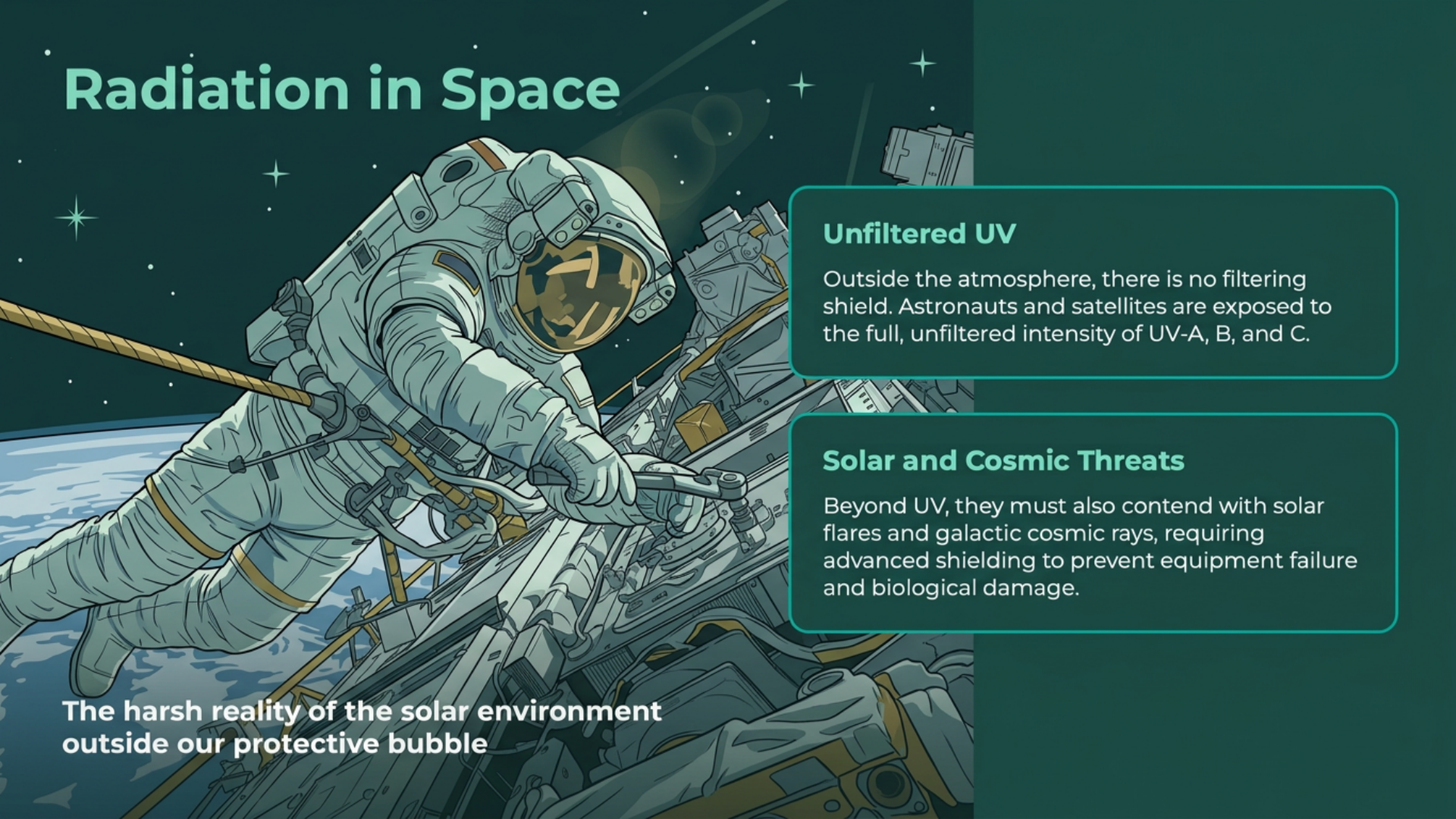
Action & Recovery

1987 Montreal Protocol: A global ban on harmful CFCs.

Ozone levels are recovering at 1-3% per decade since 2000.

Full recovery expected by 2040 (global) and 2066 (Antarctica).

Radiation in Space

An illustration of an astronaut in a white spacesuit with orange accents, working on a complex satellite structure in space. The astronaut is tethered and using a tool. The background shows the Earth's blue and white horizon and a dark sky with stars and a yellow comet streak.

Unfiltered UV

Outside the atmosphere, there is no filtering shield. Astronauts and satellites are exposed to the full, unfiltered intensity of UV-A, B, and C.

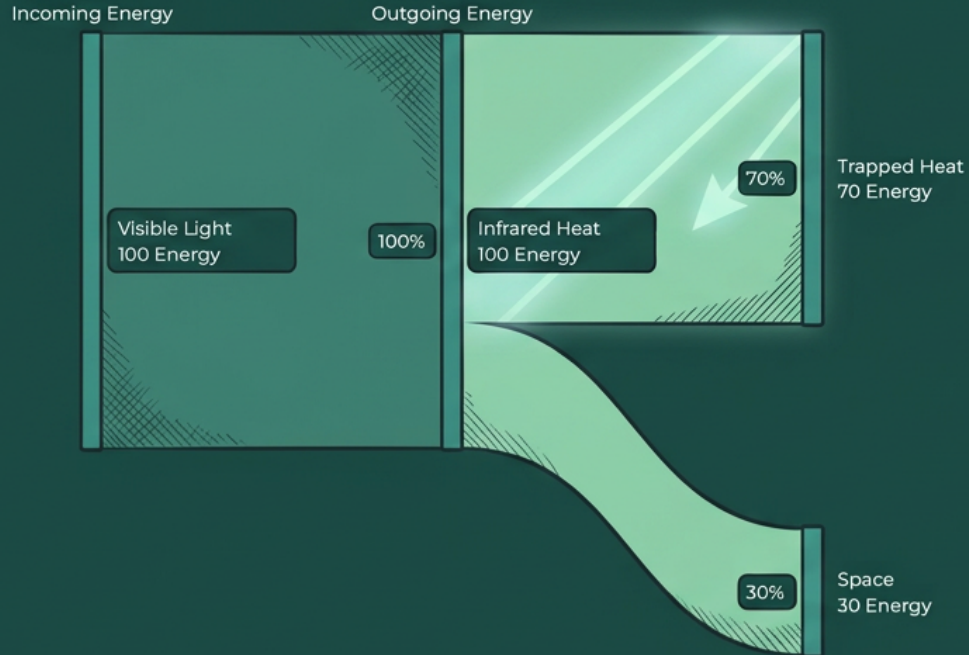
Solar and Cosmic Threats

Beyond UV, they must also contend with solar flares and galactic cosmic rays, requiring advanced shielding to prevent equipment failure and biological damage.

**The harsh reality of the solar environment
outside our protective bubble**

Earth Energy Balance

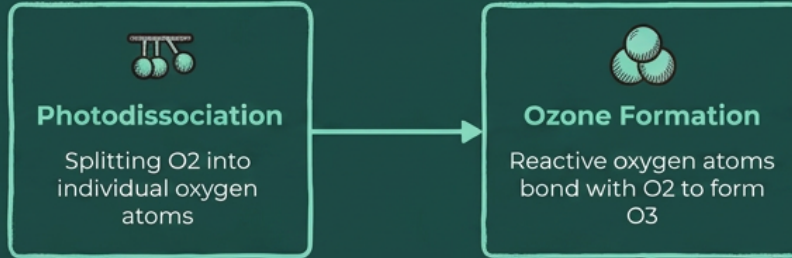
Greenhouse gases trap outgoing infrared heat to maintain habitable surface temperatures, though excess accumulation poses a critical risk to life.



Ozone-Oxygen Cycle (Chapman Cycle)

The shift from a stable greenhouse effect to global warming

Climate change is driven by an increase in greenhouse gases like CO₂ and methane.



Which environmental phenomenon are you addressing?



UV Radiation

- Ozone depletion allows more rays to reach the surface
- Poses a direct health risk to living organisms



Climate Change

- Greenhouse gases trap infrared heat
- Creates a long-term temperature risk for the planet

How a warming planet accelerates further change



The Barrier of Disinformation

These influences create gridlock in international bodies like the ICC, where unanimous voting requirements allow a few actors to block progress for the entire planet.



Conclusion

A Fragile Balance

Protecting the interconnected systems of radiation, atmosphere, and climate

