Glossary: Greenhouse Gases and Climate Science

Term	Definition
Absorption Band	A specific range of wavelengths of electromagnetic radiation that a molecule can absorb due to vibrational or rotational transitions.
Albedo	The fraction of incoming solar radiation reflected by a surface; Earth's average albedo is about 0.3.
Anthropogenic	Originating from human activity, especially referring to emissions, pollutants, or environmental impacts.
Atmospheric Lifetime	The average time a gas molecule remains in the atmosphere before being removed by chemical reaction or other processes.
Atmospheric Window	A spectral region (particularly 8–13 μm) in which Earth's IR radiation escapes to space with minimal atmospheric absorption.
Carbon Capture and Storage (CCS)	A set of technologies that capture CO_2 emissions from sources like power plants and store them underground to prevent atmospheric release.
Carbon Dioxide Equivalent (CO_2e)	A metric that expresses the warming impact of a greenhouse gas in terms of the amount of CO_2 that would have the same effect.
Carbon Sink	A natural or artificial reservoir that absorbs more carbon than it emits, such as forests, soils, and oceans.
Chlorofluorocarbons (CFCs)	Synthetic compounds containing chlorine, fluorine, and carbon; used as refrigerants and propellants, they are potent GHGs and ozone depleters.
Climate Feedback	A process that amplifies (positive feedback) or dampens (negative feedback) climate system responses, e.g., water vapor feedback.
Concentration (atmospheric)	The amount of a gas present in a unit of air, usually expressed in parts per million (ppm), billion (ppb), or trillion (ppt).

Dipole Moment	A measure of the separation of positive and negative electrical charges in a molecule; key to determining IR absorption ability.
Enhanced Greenhouse Effect	The intensified warming of Earth's surface due to increased concentrations of greenhouse gases from human activity.
Fluorinated Gases	Synthetic greenhouse gases (e.g., HFCs, PFCs, SF_6) used in industry and refrigeration; extremely potent and long-lived.
Global Warming	The long-term rise in Earth's average surface temperature due to increased concentrations of greenhouse gases.
Global Warming Potential (GWP)	A measure of how much heat a greenhouse gas traps in the atmosphere over a specific time period compared to CO_2.
Greenhouse Effect	The natural process by which greenhouse gases absorb and re-emit infrared radiation, warming Earth's surface and lower atmosphere.
Greenhouse Gas (GHG)	A gas that absorbs infrared radiation and contributes to the greenhouse effect (e.g., CO_2, CH_4, N_2O, H_2O, O_3).
Hydroxyl Radical (OH)	A highly reactive molecule that initiates the breakdown of many atmospheric trace gases, including methane.
Infrared (IR) Radiation	Electromagnetic radiation with wavelengths longer than visible light, emitted by Earth and absorbed by greenhouse gases.
Intergovernmental Panel on Climate Change (IPCC)	A UN body that assesses scientific information related to climate change.
Kyoto Protocol	A 1997 international agreement committing developed countries to legally binding greenhouse gas emission reductions.
Montreal Protocol	A 1987 international treaty to phase out ozone-depleting substances like CFCs, with strong climate co-benefits.
Photolysis	A chemical reaction in which a substance is broken down by photons, especially UV light (e.g., breakdown of N_2O in the stratosphere).

Positive Radiative Forcing	A condition where more energy enters Earth's system than exits, leading to warming (measured in W/m²).
Radiative Forcing	The change in the balance between incoming solar radiation and outgoing infrared radiation, due to factors like greenhouse gases or aerosols.
Radiative Transfer	The physical process by which energy in the form of electromagnetic radiation is emitted, absorbed, and scattered through the atmosphere.
Residence Time	The average duration a molecule of gas remains in the atmosphere before removal. Often synonymous with atmospheric lifetime.
Spectroscopy	The study of how matter interacts with electromagnetic radiation, used to identify and quantify greenhouse gases.
Stratosphere	The atmospheric layer above the troposphere, extending from ~10 km to 50 km altitude, where the ozone layer is located.
Sulfur Hexafluoride (SF_6)	A synthetic gas used in electrical equipment; has a GWP of over 23,000 and an atmospheric lifetime >3,000 years.
Thermal Infrared Spectrum	The portion of the IR spectrum (typically 4–100 μm) where Earth's surface emits the majority of its thermal radiation.
Troposphere	The lowest layer of Earth's atmosphere (~0–12 km), where weather occurs and most greenhouse gas activity takes place.
Venus Greenhouse Effect	The extreme warming on Venus caused by a dense CO_2 atmosphere, resulting in surface temperatures >460 °C.
Wetlands	Ecosystems like marshes and swamps that naturally emit methane due to anaerobic microbial activity.