

Glossary Climate Change

NB. Unless otherwise stated, have been taken from the IPCC Fourth Assessment Report.

Abrupt change: *The nonlinearity of the climate system may lead to abrupt climate change, sometimes called rapid climate change, abrupt events or even surprises. The term abrupt often refers to time scales faster than the typical time scale of the responsible forcing. However, not all abrupt climate changes need be externally forced. Some possible abrupt events that have been proposed include a dramatic reorganisation of the thermohaline circulation, rapid deglaciation and massive melting of permafrost or increases in soil respiration leading to fast changes in the carbon cycle. Others may be truly unexpected, resulting from a strong, rapidly changing forcing of a nonlinear system.*

Albedo: *The fraction of solar radiation reflected by a surface or object, often expressed as a percentage. Snow-covered surfaces have a high albedo, the surface albedo of soils ranges from high to low, and vegetation-covered surfaces and oceans have a low albedo. The Earth's planetary albedo varies mainly through varying cloudiness snow, ice, leaf area and land cover changes.*

Albedo feedback: *A climate feedback involving changes in the albedo (~0.3). In a warming climate, it is anticipated that the cryosphere would shrink, the Earth's overall albedo. It usually refers to changes in the cryosphere, which has an albedo much larger (~0.8) than the average planetary albedo would decrease and more solar radiation would be absorbed to warm the Earth still further.*

Anthropogenic: *Resulting from or produced by human beings.*

Adaptation: *Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished including anticipatory, autonomous and planned adaptation.*

Biomass: *The total mass of living organisms in a given area or volume; dead plant material can be included as dead biomass.*

Carbon dioxide (CO₂): *A naturally occurring gas, also a by-product of burning fossil fuels from fossil carbon deposits, such as oil, gas and coal, of burning biomass and of land use changes and other industrial processes. It is the principal anthropogenic greenhouse gas that affects the Earth's radiative balance. It is the reference gas against which other greenhouse gases are measured and therefore has a Global Warming Potential of 1.*

Climate change: *Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'. The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes. See also Climate variability; Detection and Attribution.*

Climate variability: *Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability).*

Cryosphere: *The component of the climate system consisting of all snow, ice and frozen ground (including permafrost) on and beneath the surface of the Earth and ocean.*

Ecosystem: *A system of living organisms interacting with each other and their physical environment. The boundaries of what could be called an ecosystem are somewhat arbitrary, depending on the focus of interest or study. Thus, the extent of an ecosystem may range from very small spatial scales to, ultimately, the entire Earth.*

Extreme weather: *An extreme weather event is an event that is rare at a particular place and time of year. Definitions of rare vary, but an extreme weather event would normally be as rare as or rarer than the 10th or 90th percentile of the observed probability density function. By definition, the characteristics of what is called extreme weather may vary from place to place in an absolute sense. Single extreme events cannot be simply and directly attributed to anthropogenic climate change, as there is always a finite chance the event in question might have occurred naturally. When a pattern of extreme weather persists for some time, such as a season, it may be classed as an extreme climate event, especially if it yields an average or total that is itself extreme (e.g., drought or heavy rainfall over a season).*

Equilibrium line *The boundary between the region on a glacier where there is a net annual loss of ice mass (ablation area) and that where there is a net annual gain (accumulation area). The altitude of this boundary is referred to as equilibrium line altitude.*

Feedback: *An interaction mechanism between processes is called a feedback. When the result of an initial process triggers changes in a second process that in turn influences the initial one. A positive feedback intensifies the original process, and a negative feedback reduces it.*

Food web: *A network of trophic relationships within an ecological community involving several interconnected food chains.*

Glacier: *A mass of land ice flowing downhill (by internal deformation and sliding at the base) and constrained by the surrounding topography (e.g. the sides of a valley or surrounding peaks). A glacier is maintained by accumulation of snow at high altitudes, balanced by melting at low altitudes or discharged into the sea.*

Global warming: *The gradual increase, observed or projected, in global surface temperature, as one of the consequences of radiative forcing caused by anthropogenic emissions.*

Greenhouse effect: *Greenhouse gases effectively absorb thermal infrared radiation, emitted by the Earth's surface, by the atmosphere itself due to the same gases, and by clouds. Atmospheric radiation is emitted to all sides, including downward to the Earth's surface. Thus, greenhouse gases trap heat within the surface-troposphere system. This is called the greenhouse effect. Thermal infrared radiation in the troposphere is strongly coupled to the temperature of the atmosphere at the altitude at which it is emitted. In the troposphere, the temperature generally decreases with height. Effectively, infrared radiation emitted to space originates from an altitude with a temperature of, on average, -19°C , in balance with the net incoming solar radiation, whereas the Earth's surface is kept at a much higher temperature of, on average, $+14^{\circ}\text{C}$. An increase in the concentration of greenhouse*

gases leads to an increased infrared opacity of the atmosphere, and therefore to an effective radiation into space from a higher altitude at a lower temperature. This causes a radiative forcing that leads to an enhancement of the greenhouse effect, the so-called enhanced greenhouse effect.

Habitat: *The locality or natural home in a particular plant, animal, or group of closely associated organisms lives.*

Hydrosphere: *The component of the climate system comprising liquid surface and subterranean water, such as oceans, seas, rivers, fresh water lakes, underground water, etc.*

Ice cap: *A dome shaped ice mass, usually covering a highland area, which is considerably smaller in extent than an ice sheet.*

Ice Sheet: *A mass of land ice that is sufficiently deep to cover most of the underlying bedrock topography, so that its shape is mainly determined by its dynamics (the flow of the ice as it deforms internally and/or slides at its base). An ice sheet flows outward from a high central ice plateau with a small average surface slope. The margins usually slope more steeply, and most ice is discharged through fast-flowing ice streams or outlet glaciers, in some cases into the sea or into ice shelves floating on the sea. There are only three large ice sheets in the modern world, one on Greenland and two on Antarctica, the East and West Antarctic Ice Sheets, divided by the Transantarctic Mountains. During glacial periods there were others.*

Ice shelf: *A floating slab of ice of considerable thickness extending from the coast (usually of great horizontal extent with a level or gently sloping surface), often filling embayments in the coastline of the ice sheets. Nearly all ice shelves are in Antarctica, where most of the ice discharged seaward flows into ice shelves.*

Invasive species: *A species aggressively expanding its range and population density into a region in which it is not native, often through outcompeting or otherwise dominating native species.*

Mitigation: *An anthropogenic intervention to reduce the anthropogenic forcing of the climate system; it includes strategies to reduce greenhouse gas sources and emissions and enhancing greenhouse gas sinks.*

Mass balance (of glaciers, ice caps or ice sheets): *The balance between the mass input to the ice body (accumulation) and the mass loss (ablation, iceberg calving).*

Ocean acidification: *Increased concentrations of CO₂ in sea water causing a measurable increase in acidity (i.e., a reduction in ocean pH). This may lead to reduced calcification rates of calcifying organisms such as corals, mollusks, algae and crustacea.*

Permafrost: *Ground (soil or rock including ice and organic material) that remains at or below 0°C for at least two consecutive years (Van Everdingen, 1998).*

pH: *pH is a dimensionless measure of the acidity of water (or any solution) given by its concentration of hydrogen ions (H⁺). pH is measured on a logarithmic scale where $pH = -\log_{10}(H^+)$. Thus, a pH decrease of 1 unit corresponds to a 10-fold increase in the concentration of H⁺, or acidity.*

Relative sea level: *Sea level measured by a tide gauge with respect to the land upon which it is situated. Mean sea level is normally defined as the average relative sea level over a period, such as a month or a year, long enough to average out transients such as waves and tides.*

Sea ice: Any form of ice found at sea that has originated from the freezing of sea water. Sea ice may be discontinuous pieces (ice floes) moved on the ocean surface by wind and currents (pack ice), or a motionless sheet attached to the coast (land fast ice). Sea ice less than one year old is first year ice. Multiyear ice is sea ice that has survived one summer melt season.

Sea level change: Sea level can change, both globally and locally, due to (i) changes in the shape of the ocean basins, (ii) changes in the total mass of water and (iii) changes in water density. Sea level changes induced by changes in water density are called steric. Density changes induced by temperature changes only are called thermosteric, while density changes induced by salinity changes are called halosteric.

Sea level equivalent: The change in global average sea level that would occur if a given amount of water or ice were added to or removed from the oceans.

Sea surface temperature: The sea surface temperature is the temperature of the subsurface bulk temperature in the top few metres of the ocean, measured by ships, buoys and drifters. From ships, measurements of water samples in buckets were mostly switched in the 1940s to samples from engine intake water. Satellite measurements of skin temperature (uppermost layer; a fraction of a millimetre thick) in the infrared or the top centimetre or so in the microwave are also used, but must be adjusted to be compatible with the bulk temperature.

Sea ice: Any form of ice found at sea that has originated from the freezing of seawater. Sea ice may be discontinuous pieces (ice floes) moved on the ocean surface by wind and currents (pack ice), or a motionless sheet attached to the coast (land-fast ice). Sea ice less than one year old is called first-year ice. Multi-year ice is sea ice that has survived at least one summer melt season.

Sensitivity: The degree to which a system is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g. a change in crop yield in response to a change in the mean range or variability of temperature) or indirect (e.g. damages caused by an increase in frequency of coastal flooding due to sea-level rise).

Snow line: The lower limit of permanent snow cover, below which snow does not accumulate.

Tipping point: A climate tipping point occurs when a small change in forcing triggers a strongly nonlinear response in the internal dynamics of part of the climate system, qualitatively changing its future state (Lenton, 2011).

Greenhouse gases:

Greenhouse gases act like a blanket. They absorb energy from the sun that is reflected by the Earth's surface and slow down or prevent the loss of heat to space. The result of this is that Earth gets warmer than it would otherwise be. This process is known as the "greenhouse effect". Without the natural Greenhouse effect life on Earth would not be possible. However, it's the additional greenhouse gases that humans have very rapidly added to the atmosphere that are responsible for increasing the natural warming effect of these gases out of balance. The main greenhouse gases emitted by human activity are:

Carbon dioxide (CO₂) - Fossil fuel use is the primary source of CO₂. The way in which people use land is also an important source of CO₂, especially when it involves deforestation. Land can also remove CO₂ from the atmosphere through reforestation, improvement of soils, and other activities.

Methane (CH₄) - Agricultural activities, waste management, and energy use all contribute to CH₄ emissions.

Nitrous oxide (N₂O) - Agricultural activities, such as fertilizer use, are the primary source of N₂O emissions.

Fluorinated gases (F-gases) - Industrial processes, refrigeration, and the use of a variety of consumer products contribute to emissions of F-gases, which include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆).

Of these gasses it is the additional carbon dioxide levels since the Industrial Revolution that are responsible for the greatest amount of additional global warming.

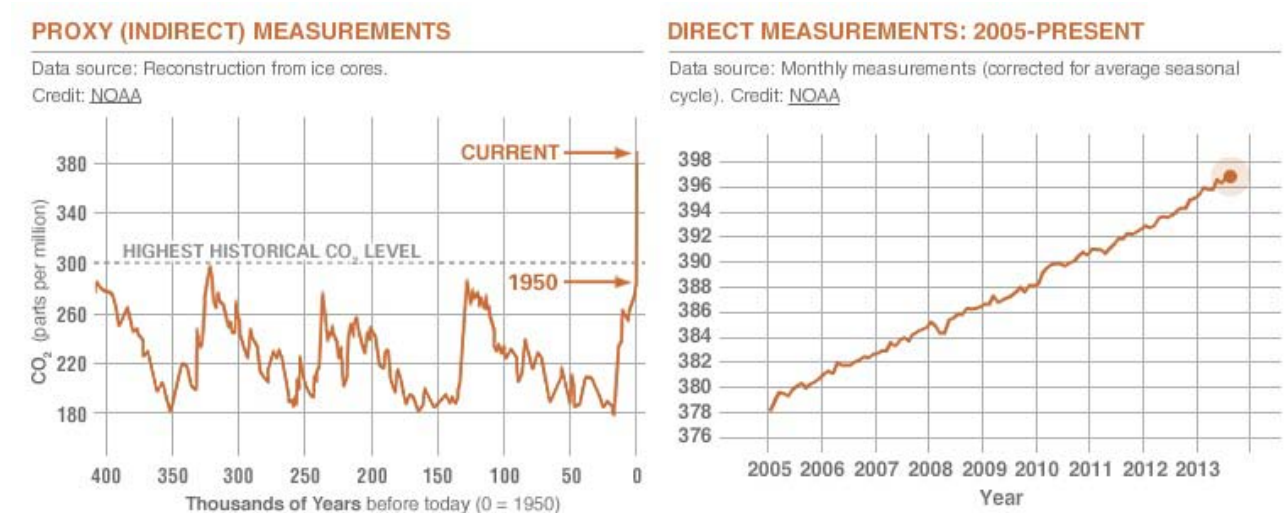


Figure 16. Carbon dioxide (CO₂) is an important heat-trapping (greenhouse) gas, which is released through human activities such as deforestation and burning fossil fuels, as well as natural processes such as respiration and volcanic eruptions. The chart on the left shows the CO₂ levels in the Earth's atmosphere during the last three glacial cycles, as reconstructed from ice cores. The chart on the right shows CO₂ levels in recent years, corrected for average seasonal cycles. NASA http://climate.nasa.gov/key_indicators

Read more:

<http://www.epa.gov/climatechange/ghgemissions/global.html>

http://www.ipcc.ch/publications_and_data/ar4/syr/en/spm.html