

Climate Change: What to Do? How to Fix It?
Glossary
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Glossary of terms including some jargon, common acronyms and abbreviations.

AMO: Atlantic Multi-decadal Oscillation

Anthropocene: The informal name given to the current epoch in which humans are impacting the climate.

Anthropogenic: A scientific word for “human caused”.

ARGO: is a system for observing temperature, salinity, and currents in the Earth's oceans, which has been operational since the early 2000s. Argo consists of a fleet of approximately 3600 drifting floats deployed worldwide. The Argo program is named after the Greek mythical ship by the same name. The mythical ship *Argo* was said to have been planned or constructed with the help of Athena. According to other legends she contained in her prow a magical piece of timber that could speak and render prophecies. After the successful journey, *Argo* was consecrated to the ocean depths. She was then translated into the sky and turned into the constellation of *Argo Navis*.

Aqua: Aqua is a multi-national NASA scientific research satellite in orbit around the Earth, studying the precipitation, evaporation, and cycling of water.

AR4 & AR5: The names of the climate models used to produce the finding in the 2007 and 2014 IPCC reports respectively. Earlier less refined models went by the names TAR, SAR and FAR, starting with FAR.

A-train: The A-train (from Afternoon Train) is a satellite constellation of six Earth observation satellites of varied nationality in sun-synchronous orbit at an altitude of 705 kilometers above the Earth. The orbit, at an inclination of 98.14°, crosses the equator each day at around 1:30 pm solar time, giving the constellation its name; the "A" stands for

"afternoon;" and crosses the equator again on the night side of the Earth, at around 1:30 am. They are spaced a few minutes apart from each other so their collective observations may be used to build high-definition three-dimensional images of the Earth's atmosphere and surface.

The train, as of July 2014,^[3] consists of six active satellites:

- OCO-2, the lead spacecraft in the formation, replaced the failed OCO and was launched for NASA on July 2, 2014.
- GCOM-W1 "SHIZUKU", follows OCO-2 by 11 minutes, launched by JAXA on May 18, 2012.
- Aqua, runs 4 minutes behind GCOM-W1, launched for NASA on May 4, 2002.
- CloudSat, a cooperative effort between NASA and the Canadian Space Agency, runs 2 minutes and 30 seconds behind Aqua, launched with CALIPSO on April 28, 2006.
- CALIPSO, a joint effort of CNES (the French Space Agency) and NASA, follows CloudSat by no more than 15 seconds, launched on April 28, 2006.
- Aura, a multi-national satellite, lags Aqua by 15 minutes, crossing the equator 8 minutes behind due to different orbital track to allow for synergy with Aqua, launched for NASA on July 15, 2004.
- PARASOL, launched by CNES on December 18, 2004 and moved to another (lower) orbit on December 2, 2009.

Aura: The name "[Aura](#)" comes from the [Latin](#) word for air. Aura studies the ozone layer and other aspects of air quality.

Bar: A metric unit of pressure. The atmospheric pressure at sea level is about 1 bar.

BAU: Business as usual

Used to define the continual rise in global energy usage

BC: black carbon

Blackbody or black-body radiation: The radiation emitted by any isolated body in thermal equilibrium with its surroundings. All normal matter emits electromagnetic radiation when it has a temperature above 0 Kelvin. The spectrum of the emission depends on temperature to the 4th power and is known as the Planck spectrum. Black-body radiation is sometimes called *complete radiation* or *temperature*

radiation or thermal radiation. It is the result of a body's internal energy into electromagnetic radiation.

Bitumen: Originally bitumen was an asphalt of Asia Minor used in ancient times as a cement and mortar. Now the name applies to any of various mixtures of hydrocarbons (as tar) that occur naturally or are obtained as residues after heat-refining natural substances (as petroleum).

Bodel or Bodélé dust: Dust from the Bodélé depression in the Saharan desert, also called Saharan dust.

CALIPSO: CALIPSO is short for *Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations*. The satellite monitors aerosols and clouds.

CDIAC: The Carbon Dioxide Information Analysis Center

CFL: Compact fluorescent light bulb

CloudSat: CloudSat uses [radar](#) to measure the altitude and properties of clouds.

CERES: Clouds and the Earth's Radiant Energy System. This is the name of a satellite measuring the flow of energy into and from the Earth.

Chlorofluorocarbons or CFC: CFCs (aka Freon) are organic compound that contains only carbon, chlorine, and fluorine, produced as a volatile derivative of methane, ethane, and propane. Used as refrigerants, propellants and solvents, they cause depletion of the ozone that shields humans from solar ultraviolet radiation.

Coriolis Effect: is a deflection of moving objects when they are viewed in a rotating reference frame.

CLAW hypothesis: A biological regulation of climate was proposed (named after the initials of the authors of the paper) whereby emissions of dimethyl sulfide from oceanic phytoplankton resulted in the formation of aerosol particles that acted as cloud condensation nuclei in

the marine boundary layer. This hypothesis is out of favor as a major but the process may play a minor role in regulating climate.

Dengue fever: A mosquito-borne tropical disease caused by the dengue virus. It infects 50 to 528 million people worldwide a year, leading to half a million hospitalizations, and approximately 25,000 deaths. Rates of dengue increased 30 fold between 1960 and 2010. This increase is believed to be due to a combination of urbanization, population growth, increased international travel, and global warming.

Dome C: Dome C, also known as **Dome Circe** or **Dome Charlie**, is the location of an EPICA ice core the covers the past 800,000 years on the Antarctic ice sheet. It is located at an altitude of 3,233 meters (10,607 ft) above sea level, is one of several summits or "domes" of the Antarctic Ice Sheet on the Antarctic Plateau.

DMS dimethyl sulfide, (CH₃)₂S:

Found in marine phytoplankton, common in foods
DMS is oxidized in the marine atmosphere to various sulfur-containing compounds. Among these compounds, sulfuric acid has the potential to create new aerosols that act as cloud condensation nuclei. Through this interaction with cloud formation, the massive production of atmospheric DMS over the oceans may have a significant impact on the Earth's climate. The CLAW hypothesis suggests that in this manner DMS may play a role in planetary homeostasis.

Dynamo, magnetic dynamo or Dynamo theory: The dynamo theory describes the process through which a rotating, convecting, and electrically conducting fluid can maintain a magnetic field over astronomical time scales. It is thought to be the source of the Earth's magnetic field, as well as the magnetic fields of other planets.

EBAF: Energy Balanced and Filled. This is a data product representing energy flow measurements made by the CERES satellite.

Ecocene: An informal name given to the current epoch in which humans are taking care of the Earth in a renewable way.

ENSO: El Niño Southern Oscillation. The **El Niño** is phase of the oscillation of the tropical Pacific Ocean when warm water builds up off the coast of South America. **La Niña** is the phase when water temperature is cold. The ENSO affects weather everywhere and is an example of how the Oceans can affect climates around the globe.

EPICA: EPICA is the European Project for Ice Coring in Antarctica. The EPICA dome-C ice core records temperatures over the past 800,000 years.

Evapotranspiration, sometimes **ET**: ET is the sum of evaporation and plant transpiration from the Earth's land and ocean surface to the atmosphere.

FAR, SAR, TAR: Generations of climate models with respectively finer grids. For details see http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch1s1-5-1.html

FRIRP: Front Range Infrastructure Resources Project. In 1996, the U.S. Geological Survey Director initiated a 5-year study to develop methods for assessing infrastructure resources and to characterize the location, distribution, and quality of the infrastructure resources of a part of the Colorado Front Range urban corridor between Denver and Fort Collins, Colorado. For publications see <http://minerals.cr.usgs.gov/projects/FRIRP/>

GCOM-W1: GCOM-W1 (Global Change Observation Mission - Water "SHIZUKU") is the first in the GCOM-W series. Its mission is to observe Earth's water cycle.

GCOS: Global Climate Observing System, usually referring to space based satellites.

Geo-engineering: Geo-engineering is the application of geosciences to modify and shape our interaction with the earth using mechanics, mathematics, physics, chemistry, and/or geology. It is used to describe human attempts to engineer the Earth's climate. An example is artificial weathering to remove CO₂ from the atmosphere.

GHG: Greenhouse gas

GOCART: Global Ozone Chemistry Aerosol Radiation and Transport
A model for the chemistry and atmospheric transport of sulfur and related aerosols

GOOS: Global Ocean Observing System

GSFC: NASA's Goddard Space Flight Center in Greenbelt MD, where most of the Earth orbiting satellites, both Earth and skyward looking, are managed.

Gyre: A gyre in oceanography is any large system of rotating ocean currents, particularly those involved with large wind movements. Gyres are caused by the Coriolis Effect; planetary vorticity along with horizontal and vertical friction, which determine the circulation patterns from the wind curl (torque). The term *gyre* can be used to refer to any type of vortex in the air or the sea, even one that is man-made, but it is most commonly used in oceanography to refer to the major ocean systems.

HDxx: A catalog of stars developed by Henry Draper that gives stellar spectroscopic definitions of 225,000 stars.

HR diagram: A plot developed by astronomers Hertzsprung and Russell in 1910 showing how the temperatures and luminosities of stars of different mass evolve.

Hyperthermia: The human body gets too hot.

Hypothermia: The human body gets too cold.

Hydrogen peroxide: O_2H_2

Insolation: Insolation (short for **incident** or **incoming solar radiation**) is the total amount of solar radiation energy received on a given surface area during a given time. It is also called solar irradiation.

IPCC: The Intergovernmental Panel on Climate Change.

ITCZ: The Inter-tropical Convergence Zone is that zone near the equator where the sun heats the atmosphere most strongly and the air rises, causing very large storms.

Kelvin: Temperature as measured from absolute zero (-272.15 °C). The word Kelvin does not require an indication of degrees.

Keystone Pipeline: This is a system of Pipelines in Canada and the US that moves oil from Canada to the Gulf coast and other processing plants in the US.

Laki or Lakagígar is an Icelandic volcanic system. (== a Mt Pinatubo every 3 days) The system erupted over an eight-month period between 1783 and 1784, pouring out an estimated 14 km³ (3.4 cu mi) of basalt lava and clouds of poisonous hydrofluoric acid and sulfur dioxide compounds that killed over 50% of Iceland's livestock population, leading to a famine that killed approximately 25% of the island's human population. It caused a drop in global temperatures, resulting in crop failures in Europe, disruption of the African and Indian monsoons, famine in Egypt, etc. and may have caused droughts in India. The eruption has been estimated to have killed over six million people globally.

Latent heat: The heat (or more properly energy) associated with a change of state, e.g., the energy (per unit mass) required to evaporate water, melt ice or absorbed in the conversion of water vapor to rain drops.

Landsat: Landsat satellites (now numbering 8) provide continuous space-based monitoring of Earth's land through moderate resolution imaging in the visible, near and far infrared.

Lidar: Lidar is a remote sensing technology that measures distance by illuminating a target with a laser and analyzing the reflected light.

MWP: Meltwater pulse caused by sudden releases of glacial melt water.

Millibar: A pressure unit in one thousandths of a bar. Since atmospheric pressure is about 1 bar at the surface of Earth, normally

millibars are used to indicate the pressure so that the changes are given in easily understood numbers.

MSA: methanesulfonic acid is a colorless liquid with the chemical formula $\text{CH}_3\text{SO}_3\text{H}$.

Mxx: The letter M followed by a number refers to an object in the sky from the Messier catalog created by Charles Messier in 1771 during his search for comets. These were objects that looked like but were not comets.

NAO: North Atlantic Oscillation. The NAO is the dominant mode of winter climate variability in the North Atlantic region ranging from central North America to Europe and much into Northern Asia. The NAO is a large scale seesaw in atmospheric mass between the subtropical high and the polar low. The corresponding index varies from year to year, but also exhibits a tendency to remain in one phase for intervals lasting several years.

NCAR: The National Center for Atmospheric Research located in Boulder, CO.

NGC: The New General Catalogue of Nebulae and Clusters of Stars. Originated in 1888 by John Dreyer, the NGC contains 7,840 objects, known as the NGC objects. It is one of the largest comprehensive catalogues, as it includes all types of deep space objects.

NICL: The National Ice Core Laboratory in Denver, CO.

NREL: The National Renewable Energy Laboratory in Golden, CO.

NH: northern hemisphere

NAO: North Atlantic Oscillation

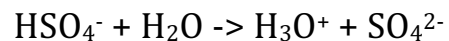
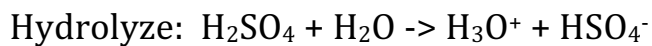
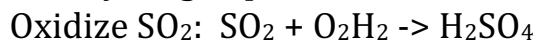
OCS (a compound with one oxygen, one carbon and one sulfur atom) carbonyl sulfide, OCS: emitted from oceans, volcanoes and deep sea vents

OCO: Orbiting Carbon Observatory will be used to study CO₂ concentrations and distributions in the atmosphere.

OHC: Oceanic Heat content

Orography: Study of the topographic relief of mountains. **Orographic lift** occurs when an air mass is forced upwards due to mountain terrain; this effect is also known as **Steigungsregen**.

Oxidizer: Hydrogen peroxide O₂H₂ is an oxidizer



PARASOL: The French built satellite PARASOL (**P**olarization & **A**nisotropy of **R**eflectances for **A**tmospheric **S**ciences coupled with **O**bservations from a **L**idar) studies the radiative and microphysical properties of clouds and aerosols.

Paleontology: The scientific study of life existent prior to, but sometimes including, the start of the most recent geological epoch (up to about 12,000 years ago).

Paleoclimatologist: A scientist who studies the climatic history of Earth.

PDO: Pacific Decadal Oscillation. Sea surface temperature cycles associated with ENSO and stochastic atmospheric forcing.

Pedosphere: The outermost layer of Earth composed of soil.

PETM: Paleocene-Eocene thermal maximum; an event of high temperature. The absolute age and duration of the event remain uncertain, but are close to 55.8 million years ago and ~170,000 years, respectively. This event probably provides our best past analog in which to understand impacts of a large increase in global temperature with a warming of 6°C (11°F). Increase took place over 20,000 years. This warming extended from the tropics to high latitudes and the deep ocean. Indeed, the PETM is probably the only example within the

Cenozoic Era (approximately the last 65 million years) wherein a mass of carbon comparable to projected anthropogenic emissions (>2000 Gt or Pg) rapidly entered these reservoirs. The source of the CO₂, and whether it was oxidized methane (CH₄), (CH₄ + OH -> CO₂ + H₂O) remain open issues; nonetheless, abundant evidence indicates nearly coeval changes in global warming and global carbon cycling, strongly suggesting a link between the two.

Phytoplankton: Small aquatic plants that drift in the ocean and live by photosynthesis as do land based plants. Dense growths can be seen from space as greenish colored water. They are the foundation of the oceanic food chain.

Pingo: A pingo, also called a **hydrolaccolith**, is a mound of earth-covered ice found in the Arctic and subarctic that can reach up to 70 meters (230 ft) in height and up to 600 m (2,000 ft) in diameter. The term originated as the Inuvialuktun word for a small hill. A pingo is a periglacial landform, which is defined as a nonglacial landform or process linked to colder climates.

Retrograde rotation: Rotation of a planet opposite to that expected from the motion of the planet around the sun.

Seiche: A standing wave in a partially bounded body of water. The lunar tides are in resonance with - the same as - the fundamental frequency (inverse of the wavelength) of the Bay of Fundy leading to the dramatic tides found therein.

SH: southern hemisphere

Spectrum: The distribution of electromagnetic radiation as a function of frequency (energy) or wavelength. The spectral intensity is a curve as a function of wavelength.

SST: Sea Surface Temperature

Stochastic processes: Processes that are the result of random variations with large statistical fluctuations. The stock market varies stochastically.

Stratosphere: The layer of atmosphere above the Tropopause that extends up to about 20 km altitude. The temperature increases with altitude in this layer of the atmosphere.

TAO: Tropical Atmosphere/Ocean. This is a series of buoys monitoring the tropical ocean atmosphere system that lead to predictions of El Niño, La Niña events.

TBE: Tick-borne encephalitis is a virus that affects the central nervous system and can result in meningitis and/or encephalitis. The disease is most prevalent in Eastern Europe and Southern Russia. The number of reported cases has been increasing in most countries. Mortality is 1-2%.

Thermohaline circulation: Ocean currents driven by wind and density gradients created by differences in ocean salinity and water temperature. It takes about 1000 years for water to make a complete circuit.

thermokarst lake: The term thermokarst lake, also called a thaw lake or cave-in lake, refers to a body of freshwater, usually shallow, that is formed in a depression by meltwater from thawing permafrost.

TOA: Top of Atmosphere

Tropopause: The boundary between the troposphere and the stratosphere. It is at an altitude of about 15 km between +/- 30 degrees latitude and decreases to below 10 km at the poles.

Trop or Troposphere: Lower part of the atmosphere where weather is generated and temperature decreases with increasing altitude.

vibrio parahaemolyticus: A strain of bacteria found in brackish water that causes gastrointestinal disease in humans. 2 of 3 cases caused as a result of hurricane Katrina resulted in death. Higher water temperatures favor the bacteria.

UCAR: University Corporation for Atmospheric Research in Boulder, CO.

Vostok: The name/location of a 420,000 year long ice core in Antarctica. This core revealed the past 4 ice ages.

ZPG: Zero population growth.