

GLOSSARY

Ablation – Loss of snow and ice, primarily by melting and calving.

Abrupt climate change – A large-scale change in the climate system that takes place over a few decades or less, persists (or is anticipated to persist) for at least a few decades, and causes substantial disruptions in human and natural systems.

Albedo – The fraction of solar radiation reflected by a surface or object, often expressed as a percentage.

Anthropogenic – Resulting from or produced by human beings.

Atlantic Meridional Overturning Circulation (AMOC) – A northward flow of warm, salty water in the upper layers of the Atlantic, and a southward flow of colder water in the deep Atlantic.

Clathrate – A substance in which a chemical lattice or cage of one type of molecule traps another type of molecule.

Climate system – The climate system is the highly complex system consisting of five major components: the atmosphere, the hydrosphere, the cryosphere, the land surface, and the biosphere, and the interactions between them. The climate system evolves in time under the influence of its own internal dynamics and because of external forcings such as volcanic eruptions, solar variations, and anthropogenic forcings such as the changing composition of the atmosphere and land use change.

Climate feedback – An interaction mechanism between processes in the climate system is called a climate 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.

Climate model – A numerical representation of the climate system based on the physical, chemical, and biological properties of its components, their interactions and feedback processes, and accounting for all or some of its known properties.

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.

Downscaling – A method that derives local- to regional-scale (10 to 100 km) information from larger scale models or data analyses.

El Niño Southern Oscillation (ENSO) – The term El Niño was initially used to describe a warm-water current that periodically flows along the coast of Ecuador and Perú, disrupting the local fishery. It has since become identified with a basin-wide warming of the tropical Pacific Ocean east of the dateline. This oceanic event is associated with a fluctuation of a global-scale tropical and subtropical surface pressure pattern called the Southern Oscillation. This coupled atmosphere-ocean phenomenon, with preferred time scales of 2 to about 7 years, is collectively known as the El Niño Southern Oscillation (ENSO). It is often measured by the surface pressure anomaly difference between Darwin and Tahiti and the sea surface temperatures in the central and eastern equatorial Pacific. During an ENSO event, the prevailing trade winds weaken, reducing upwelling and altering ocean currents such that the sea surface temperatures warm, further weakening the trade winds. This event has a great impact on the wind, sea surface temperature, and precipitation patterns in the tropical Pacific. It has climatic effects throughout the Pacific region and in many other parts of the world, through global teleconnections. The cold phase of ENSO is called La Niña.

Forcing – Any mechanism that causes the climate system to change or respond.

Greenhouse gases (GHG) – Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation emitted by the Earth's surface, the atmosphere itself, and by clouds. This property causes the greenhouse effect. Water vapor (H₂O), carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄), and ozone (O₃) are the primary greenhouse gases in the Earth's atmosphere. Moreover, there are a number of entirely human-made greenhouse gases in the atmosphere, such as the halocarbons and other chlorine- and bromine-containing substances, dealt with under the Montreal Protocol. Beside CO₂, N₂O, and CH₄, the Kyoto Protocol deals with the greenhouse gases sulfur hexafluoride (SF₆), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).

Holocene Epoch – The geological epoch extending back approximately 11,500 years from the present.

Ice sheet – Glaciers of near-continental extent and of which there are at present two, the Antarctic Ice Sheet and the Greenland Ice Sheet.

La Niña – The cold phase of the El Niño Southern Oscillation (ENSO).

Mass Balance – The net glacier and ice-sheet annual gain or loss of ice/snow.

Medieval Warm Period – An interval between *A.D.* 900 and *A.D.* 1300 in which some Northern Hemisphere regions were warmer than during the Little Ice Age that followed.

Megadrought – Prolonged (multi-decadal) droughts such as those documented for the Medieval Period.

Methane – Methane (CH₄) is the second most important greenhouse gas that humans directly influence, carbon dioxide (CO₂) being first.

Methane hydrate – A solid in which methane molecules are trapped in a lattice of water molecules. On Earth, methane hydrate forms under high pressure–low temperature conditions in the presence of sufficient methane.

Paleoclimate – Climate during periods prior to the development of measuring instruments, including historic and geologic time, for which only proxy climate records are available.

Permafrost – Ground (soil or rock and included ice and organic material) that remains at or below 0 °C for at least 2 consecutive years.

Proxy – A local record (*e.g.*, pollen, tree rings) that is interpreted, using physical and biophysical principles, to represent some combination of climate-related variations back in time. Climate-related data derived in this way are referred to as proxy data. Examples of proxies include pollen analysis, tree ring records, characteristics of corals, and various data derived from ice cores.

Radiative forcing – A change in the net radiation at the top of the troposphere caused by a change in the solar radiation, the infrared radiation, or other changes that affect the radiation energy absorbed by the surface (*e.g.*, changes in surface reflection properties), resulting in a radiation imbalance. A positive radiative forcing tends to warm the surface on average, whereas a negative radiative forcing tends to cool it. Changes in GHG concentrations represent a radiative forcing through their absorption and emission of infrared radiation.

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 surface temperature (SST) – The temperature in the top few meters of the ocean, measured by ships, buoys, and drifters.

Sink – Any process, activity, or mechanism that removes a greenhouse gas, an aerosol, or a precursor of a greenhouse gas or aerosol from the atmosphere.

Thermohaline circulation (THC) – Currents driven by fluxes of heat and fresh water across the sea surface and subsequent interior mixing of heat and salt. The terms Atlantic Meridional Overturning Circulation (AMOC) and Thermohaline Circulation are often used interchangeably but have distinctly different meanings. The AMOC, by itself, does not include any information on what drives the circulation (see AMOC definition above). In contrast, THC implies a specific driving mechanism related to creation and destruction of buoyancy.

Tropopause – That area of the atmosphere between the troposphere and the stratosphere.

ACRONYMS

AABW	Antarctic Bottom Water	GRIP	Greenland Ice Core Project
ACC	Antarctic Circumpolar Current	GSOP	Global Synthesis and Observations Panel
AGCM	Atmospheric General Circulation Model	HSZ	Hydrate stability zone
ALT	active layer thickness	ICESat	Ice, Cloud, and Land Elevation Satellite
AMO	Atlantic Multidecadal Oscillation	InSAR	Interferometric Synthetic Aperture Radar
AMOC	Atlantic Meridional Overturning Circulation	IPCC	Intergovernmental Panel on Climate Change
AOGCM	Atmosphere-Ocean General Circulation Model	IR	infrared
AOVGCM	Atmosphere-Ocean-Vegetation General Circulation Model	ISOMIP	Ice Shelf–Ocean Model Inter-comparison Project
AR4	Fourth Assessment Report, IPCC	ITCZ	Intertropical Convergence Zone
ATM	Airborne laser altimetry	LGM	Last Glacial Maximum
AVGCM	Atmosphere-Vegetation General Circulation Model	LIG	last interglaciation period
BSR	bottom-simulating reflector	LIS	Laurentide Ice Sheet
CCD	carbonate compensation depth	LSW	Labrador Sea water
CCSM	Community Climate System Model	mascon	mass concentration
CCSP	Climate Change Science Program	MCA	Medieval Climate Anomaly
CLIVAR	Climate Variability and Predictability	MDR	main development region
COGA	Climatological Ocean Global Atmosphere	MIS	Marine Isotope Stage
COHMAP	Cooperative Holocene Mapping Project	ML	mixed layer
D/H	Isotopic ratio of deuterium to hydrogen	MOC	Meridional Overturning Circulation
D-O	Dansgaard-Oeschger	MWP	Medieval Warm Period; meltwater pulse
DWF	deep water formation	NADA	North American Drought Atlas
EDGAR	Emission Database for Global Atmospheric Research	NADW	North Atlantic Deep Water
EGVM	Equilibrium Global Vegetation Model	NAM	Northern Annular Mode
EMIC	Earth System Model of Intermediate Complexity	NAO	North Atlantic Oscillation
ENSO	El Niño Southern Oscillation	NCAR CCM3	National Center for Atmospheric Research Community Climate System Model 3
EPICA	European Project for Ice Coring in Antarctica	NOAA	National Oceanic and Atmospheric Administration
ESRL	Earth System Research Laboratory	NRC	National Research Council
GCM	General Circulation Model	PDB	Pee Dee Belemnite
GFDL	Geophysical Fluid Dynamics Laboratory	PDO	Pacific Decadal Oscillation
GHCN	Global Historical Climatology Network	PDSI	Palmer Drought Severity Index
GHG	greenhouse gases	P-E	Precipitation minus evapotranspiration
GIA	glacial-isostatic adjustment	PETM	Paleocene-Eocene Thermal Maximum
GIN	Greenland-Iceland-Norwegian	PMIP	Paleoclimate Modeling Intercomparison Project
GISP2	Greenland Ice Sheet Project 2	POGA	Pacific Ocean Global Atmosphere
GNAIW	Glacial North Atlantic Intermediate Water	POGA-ML	Pacific Ocean Global Atmosphere Mixed Layer Ocean
GOGA	Global Ocean Global Atmosphere	RCM	Regional Climate Model
GRACE	Gravity Recovery and Climate Experiment	RF	radiative forcing
		RSL	relative sea level
		SAP	Synthesis and Assessment Product

SICI	Small Ice Cap Instability
SLE	sea level equivalent
SLP	sea level pressure
SLR	sea level rise
SMOW	Standard Mean Ocean Water
SRALT	satellite radar altimetry
SST	sea surface temperature
TAGA	Tropical Atlantic Global Atmosphere
THC	Thermohaline Circulation
TNA	Tropical North Atlantic
UNFCCC	United Nations Framework Convention on Climate Change
USGS	U.S. Geological Survey
VOC	Volatile Organic Carbon
WAIS	West Antarctic Ice Sheet
WDCGG	World Data Centre for Greenhouse Gases
WGMS	World Glacier Monitoring Service
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment

ABBREVIATIONS

a	year
BP	before present
dS/dt	surface elevation change with time
g	gram
G	giga
Gt	gigaton (one billion metric tons)
GtC	gigatons of carbon
hPa	hectoPascal
ka, kyr	thousand years (ago)
kg	kilogram
km	kilometer
m	meter
Mg	megagram; magnesium
mm	millimeters
Pa	Pascal
pCO ₂	atmospheric partial pressure of CO ₂
ppb	parts per billion
ppm	parts per million
ppmV	parts per million as measured in volume
PW	petawatt
s	second
s.d.	standard deviation
Sv	sverdrup
T	tera
Tg	teragram
W	watt
yr	year
µm	micrometer
‰	per mil