
Coastline, Nauru

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Federated States of Micronesia

Glossary

A

Anthropogenic

Resulting from or produced by human beings.

Anthropogenic emissions

Emissions of greenhouse gases, greenhouse gas precursors, and aerosols associated with human activities, including the burning of fossil fuels, deforestation, land-use changes, livestock, fertilisation, etc.

Anthropogenic forcing – see also Forcing

A forcing that is caused by human activities including changes in greenhouse gas and aerosol concentrations and land-use changes.

Anomaly

In climate science, a deviation from the normal value of a variable. It is usually the deviation of a variable from the average value at a specific place and time.

Aragonite saturation state – see also Ocean acidification

Aragonite is a form of calcium carbonate that makes up the shells and skeletons of key organisms in reef ecosystems, including reef-building corals. The saturation state of aragonite in seawater (known as Ω) is a measure of the potential for the mineral to form or to dissolve. When the $\Omega = 1$, the seawater is in equilibrium with respect to aragonite, so aragonite does not dissolve or precipitate. When $\Omega > 1$ seawater is supersaturated with respect to aragonite and aragonite will precipitate, and when $\Omega < 1$ aragonite will dissolve. Aragonite saturations states above about 4 are considered optimal conditions for healthy coral reef ecosystems, with values below 3.5 becoming increasingly marginal for supporting healthy coral reef growth.

Attribution

Attribution is the process of identifying the most likely causes for the detected changes in the climate.

B

Bias – see **Model bias**

C

Carbon cycle

The term used to describe the flow of carbon (in various forms, e.g. as carbon dioxide) through the atmosphere, ocean, terrestrial biosphere and lithosphere.

Climate

Climate in a wider sense is the state, including a statistical description, of the climate system. Climate in a narrow sense is usually defined as the average weather, (or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities), over a period of time ranging from months to thousands or millions of years. The relevant quantities are most often surface variables such as temperature, precipitation and wind. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization. In various parts of this publication different averaging periods, such as a period of 20 years, are also used.

Climate change – see also Climate variability

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.

This definition is the same as the one used by the Intergovernmental Panel on Climate Change and differs from that used by the United Nations Framework Convention on Climate Change which makes a distinction between climate change attributable to human activities and climate variability attributable to natural causes.

Climate model – see **Global climate model**

Climate model drift – see **Model drift**

Climate projection

A projection of the response of the climate system to emission or concentration scenarios of greenhouse gases and aerosols, or radiative forcing scenarios, often based upon simulations by climate models. Climate projections are distinguished from climate predictions in order to emphasise that climate projections depend upon the emission/concentration/radiative forcing scenario used, which are based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realised and are therefore subject to substantial uncertainty.

Climate variability – see also **Patterns of 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).

Climatology

The description and scientific study of **climate**.

CMIP3

Coupled Model Intercomparison Project (Phase 3) is a set of climate model experiments from 17 groups in 12 countries with 24 models. Climate model output from simulations of the past, present and future climate was collected by Program for Climate Model Diagnosis and Intercomparison at Lawrence Livermore National Laboratory in the US, during 2005 and 2006. The resulting CMIP3 dataset was used to inform the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

CMIP5

The fifth phase of the Coupled Model Intercomparison Project (CMIP5). In September 2008, 20 climate modelling groups from around the world, agreed to develop a new set of coordinated climate model experiments which will provide a wider range of emissions scenarios, and improved models and simulations for the 5th Assessment Report of the Intergovernmental Panel on Climate Change.

Cold Tongue – see **Equatorial Cold Tongue**

Convection

Vertical motion driven by buoyancy forces arising from static instability, usually caused by near surface warming in the case of the atmosphere, and by near-surface cooling or increases in salinity in the case of the ocean.

Convergence

In meteorology where winds flow from different directions toward each other, thus meeting at one point or along one line. Similarly, in oceanography, where water currents flow toward each other and meet. Horizontal convergence usually forces vertical motion to occur, such as **convection**.

Coriolis Effect

Air or water that is in motion is deflected to the right (of the direction of flow) in the Northern Hemisphere and to the left (of the direction of flow) in the Southern Hemisphere as a result of the rotation of the Earth. The Coriolis Effect is largest at the poles and diminishes to zero at the equator.

D

Downscaling

Downscaling refers to techniques that derive small-scale (at a single location or region) information from data on larger spatial scales, such as **Global Climate Model** output. Two main methods are generally applied: **dynamical downscaling** (using fine-resolution global or regional climate models) and **statistical downscaling** (using statistical relationships).

Dynamical downscaling

Dynamical downscaling uses a finer resolution atmospheric climate model, driven by large-scale data from a **global climate model** to derive local or regional scale information. The fine resolution model provides better representation of topography and land/sea boundaries. This method is computationally intensive and the results are strongly dependent on the choice of both the global climate model and the atmospheric model.

Statistical downscaling

Statistical downscaling techniques develop statistical relationships that link the large-scale climate variables with local-scale or regional climate variables. This technique maintains important information regarding locally observed historical trends and variability, while also introducing important aspects of change from the **global climate models**.

Driver (of climate change)

Any natural or human-induced factor that directly or indirectly causes a change.

Dynamic response (of ice sheets)

Rapid disintegration of ice sheets through dynamic processes.

E

Ekman Currents

Wind driven currents in the upper few tens of metres of the ocean that flow at 90 degrees to the right of the wind direction in the Northern Hemisphere and to the left in the Southern Hemisphere.

El Niño – see also **El Niño-Southern Oscillation, La Niña**

This is the warm phase of the **El Niño-Southern Oscillation**. El Niño events occur on average once every two to seven years. They are associated with basin-wide warming of the tropical Pacific Ocean east of the dateline and a weakening of the **Walker Circulation**.

Canonical El Niño – see also **El Niño, La Niña, El Niño Modoki**

This is characterised by warming of waters in the central and eastern Pacific Ocean and cooling in a horse-shoe pattern in the western Pacific Ocean.

El Niño Modoki

El Niño Modoki, also called the Central Pacific El Niño, is a recurring pattern of variability in the tropical Pacific, in which the maximum warming occurs in the central tropical Pacific rather than in the east. This represents a variation on the Canonical El Niño.

ENSO Modoki Index (EMI)

This is the difference between the sea-surface temperature anomalies averaged over the central equatorial Pacific and the out-of-phase variations in the far eastern and far western Pacific.

El Niño-Southern Oscillation (ENSO) – see also El Niño, La Niña

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 naturally occurring coupled atmosphere-ocean phenomenon, with time scales of approximately two to seven years, is known as the El Niño-Southern Oscillation (ENSO). The state of ENSO is often measured by the Southern Oscillation Index (SOI) and 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. The cold phase of ENSO is called La Niña.

Ensemble

An ensemble refers to a group of model simulations used for climate projections. It may refer either to a group of simulations from different models; or to a group of simulations run on the same model but using slightly different starting conditions.

Equatorial Cold Tongue

This is a region of relatively cool surface water in the equatorial eastern Pacific Ocean and along the west coast of South America.

Equinox

The times of the year when the Sun crosses the plane of the Earth's equator, occurring around March 21 and September 22 and making the length of night and day approximately equal all over the Earth.

Evapotranspiration – see Potential evapotranspiration

External forcing – see Forcing

Extreme weather event

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 10^{th} or 90^{th} percentile of the observed probability density function.

F

Flux adjustment

In order to prevent drift in climate simulations older climate models and a minority of the CMIP3 models use flux adjustment. Flux adjustment involves making small corrections to heat, freshwater and momentum transfers between ocean and atmosphere models, in order to make sure that the climate remains relatively stable.

Forcing – see also Anthropogenic forcing, Natural forcing

An agent that causes a change in the climate system. External forcing refers to agents outside the climate system, such as changes in greenhouse gases or solar variations. Internal forcing refers to natural climate variations, such as the Interdecadal Pacific Oscillation. Radiative forcing refers specifically to external forcings that change the net radiation at the tropopause.

G

Global Climate Model (GCM)

This is 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. Coupled Atmosphere-Ocean General Circulation Models provide a representation of the climate system that is near the most comprehensive end of the spectrum currently available. There is an evolution towards more complex models with interactive chemistry and biology.

Global surface temperature

The global surface temperature is an estimate of the global mean surface air temperature. However, for changes over time, only anomalies, as departures from a climatology, are used, most commonly based on the area-weighted global average of the sea-surface temperature anomaly and land surface air temperature anomaly.

Gridded data – see also Reanalysis

A set of climate data that are given for the same time or average period on a regular grid in space. Data at each grid point represent the average value over a grid box whose size is determined by the spacing between the grid points (also called the grid resolution). Global climate model and reanalysis data are produced as gridded data.

H

Hadley Circulation

The major vertical movement of heated equatorial air and its north-south transfer into the mid latitudes, first proposed by George Hadley in 1735 as an explanation for the trade winds. It consists of the equatorward movement of the trade winds between about latitude 30° and the equator in each hemisphere, with rising wind components near the equator, poleward flow aloft, and, finally, descending components at about latitude 30° again.

Halosteric – see also Steric

Sea-level changes induced by changes in water density are called steric. Density changes induced by salinity changes are called halosteric.

Holocene

The last 12 000 years of geological time.

Homogenisation

Observed climate variables sometimes show sudden shifts in the average values or variability. Not all of these shifts are caused by real changes in climate. Non-climate related shifts can be due to changes in instrumentation, observation site, surrounding environment and observation practices, or other factors.

Homogenous – see also Homogenisation

Climate data homogenisation aims to adjust data if necessary, so that all variations in the data series are caused by real changes in the climate, and not due to changes in the way the data have been recorded.

Humidity – see Relative humidity

I

Ice discharge (dynamical)

Discharge of ice from ice sheets or ice caps caused by the dynamics of the ice sheet or ice cap (e.g. in the form of glacier flow, ice streams and calving icebergs) rather than by melt or runoff.

Ice sheet mass balance – see Mass balance

Indian Ocean Dipole (IOD)

The Indian Ocean Dipole (IOD) is a coupled ocean and atmosphere phenomenon in the equatorial Indian Ocean that affects the climate of countries that surround the Indian Ocean basin, particularly rainfall. The IOD is commonly measured by the Indian Ocean Dipole (IOD) Index.

Indian Ocean Dipole (IOD) Index

The IOD index measures the difference in sea-surface temperatures between the western tropical Indian Ocean (50°E to 70°E and 10°S to 10°N) and the eastern tropical Indian Ocean (90°E to 110°E and 10°S to 0°S).

Index

A number representing a measure of a particular feature of the climate system at a given time, varying with time and used as some measure of variability.

Indices – see Index

Insolation

The amount of solar radiation reaching the Earth at a given location in a given time.

Interannual

From year to year.

Interdecadal Pacific Oscillation (IPO) – see also Pacific Decadal Oscillation (PDO)

The Interdecadal Pacific Oscillation (IPO) is a natural recurring pattern of variability in tropical Pacific Ocean sea-surface temperatures occurring on periods of about 15 years and longer. While defined differently the IPO and PDO (Pacific Decadal Oscillation) describe essentially the same variability.

Interdecadal Pacific Oscillation (IPO) Index

A measure of the strength and phase of the Interdecadal Pacific Oscillation pattern.

Internal forcing – see Forcing

Intertropical Convergence Zone (ITCZ)

An east-west band of low-level wind convergence near the equator where the Southeast trade winds of the Southern Hemisphere meet the Northeast trade winds of the Northern Hemisphere. It is co-located with the ascending branch of the Hadley Circulation and has a associated band of heavy rainfall as the winds converge and moist air is forced upward.

L

La Niña – see also El Niño, El Niño–Southern Oscillation

The most common of several names given to cold phase of the El Niño–Southern Oscillation. La Niña is the counterpart to the El Niño warm event, although La Niña events tend to be somewhat less regular in their behaviour and duration. La Niña is associated with large-scale cooling of the surface waters of the eastern tropical Pacific Ocean and a strengthening of the Walker Circulation.

M

Madden Julian Oscillation

The Madden Julian Oscillation (MJO) is a global-scale feature of the tropical atmosphere that is characterized as an eastward moving pulse of cloud and rainfall near the equator that typically recurs every 30 to 60 days, but it is not always present.

Maritime Continent

The Maritime Continent consists of parts of Southeast Asia and the islands of Indonesia and the Philippines on the western equatorial edge of the Pacific, and includes large areas of ocean as well as the islands.

Mass balance (of ice sheets)

The mass balance is the net gain or loss of ice and snow for an ice sheet. It is related to difference between snow accumulation versus melt, runoff and iceberg calving.

Mean High Water (MHW)

The average of all high waters observed over a sufficiently long period.

Mean Higher High Water (MHHW)

The mean of the higher of the two daily high waters over a period of time.

Mean sea level – see also Relative sea level, Sea level change/rise

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.

Meridional – see also Zonal

In meteorology, a flow in a direction that is parallel to a line of longitude; along a meridian; northerly or southerly; as opposed to zonal.

Model bias

Model biases are spurious differences between climate model simulations and observations. These may be caused by a number of factors including a lack of model resolution or an insufficiently realistic representation of certain physical processes. Systematic biases are errors that are common to a majority the climate models.

Model drift

Model drift refers to spurious trends in climate simulations that are not caused by changing external drivers (such as increased greenhouse gases or changes in solar radiation). Instead these spurious trends arise as a result of the way that models are initialised or imperfections in the representation of physical processes. Under many circumstances drift only introduces a small error in the estimation of climate trends however it must be accounted for where it is large.

Model skill

Model skill is a measure of how well a climate model can realistically represent the climate system.

Multivariate ENSO Index (MEI)

A measure used to describe ENSO combining six observed variables over the tropical Pacific. These six variables are: sea-level pressure, zonal and meridional components of the surface wind, sea-surface temperature, surface-air temperature, and total cloudiness fraction of the sky.

N

Natural forcing – see also Forcing

A forcing in the climate system due to natural causes as opposed to anthropogenic forcing, Natural forcing includes changes in solar output, the Earth's orbit and volcanic eruptions.

NINO3 index

An average of sea-surface temperature anomalies in the Pacific Ocean over the area 5°N to 5°S, 150°W to 90°W.

NINO3.4 index

An average sea-surface temperature anomaly in the central Pacific (latitude 5°N to 5°S; longitude 170°W to 120°W).

NINO4 index

An average of sea-surface temperature anomalies in the Pacific Ocean over the area 5°N to 5°S, 160°E to 150°W.

O

Ocean acidification – see also Aragonite saturation state

Ocean acidification is the name given to the ongoing decrease in the pH of the Earth's oceans, caused by their uptake of anthropogenic carbon dioxide from the atmosphere. When carbon dioxide dissolves in the ocean it lowers the pH, making the ocean more acidic.

Oceanic NINO3.4 Index (ONI)

An average of sea-surface temperatures anomalies in the Niño 3.4 region (latitude 5°N to 5°S; longitude 120° to 170°W).

P

Pacific Climate Change Science Program (PCCSP)

A collaborative research partnership between Australian Government agencies, 14 Pacific island countries and East Timor, and regional and international organisations.

Pacific Climate Change Science Program (PCCSP) Region

The region defined by the coordinates: 25°S–20°N and 120°E–150°W (excluding the Australian region south of 10°S and west of 155°E).

Pacific Decadal Oscillation (PDO)

A naturally recurring pattern of variability in the tropical and northern Pacific characterised by warming and cooling sea-surface temperature, similar to that of ENSO, although broader in a north-south direction. Oscillations in the PDO take multiple decades usually 20–30 years.

Parameterisation

Representing in an approximate form processes that cannot be explicitly resolved at the spatial or temporal resolution of the model (e.g. cloud formation, ocean eddies).

Patterns of variability – see also Climate variability

Natural variability of the climate system, in particular on seasonal and longer time scales, predominantly occurs with preferred spatial patterns and time scales, through the dynamical characteristics of the atmospheric circulation and through interactions with the land and sea surfaces. Examples include the El Niño-Southern Oscillation.

pH

A measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity. The pH scale ranges from 0 to 14.

Potential evapotranspiration

Evapotranspiration is the sum of evaporation from the land surface (e.g. from the soil and bodies of water such as lakes and rivers) and transpiration from vegetation. Potential evapotranspiration is defined as the evapotranspiration that would take place if there was an unlimited water supply. It is a representation of the environmental demand for evapotranspiration.

Probability Distribution Function (PDF)

A PDF describes the likelihood that a certain event or outcome will occur based on prior experience. For example a PDF of daily temperatures would provide information on how likely it is to have an extremely hot or cold temperature.

Pycnocline

Moving downward through the ocean, the pycnocline is the region where there is a rapid increase in density with depth. It acts as a barrier to mixing between deep and surface waters.

R

Radiative forcing – see Forcing

Reanalysis – see also Gridded data

An analysis combining many irregular meteorological or oceanographic observations from close to the same time into a physically consistent, complete gridded data set for a given time and usually for the whole globe.

Relative humidity

Relative humidity is defined as the amount of water vapour in the air, relative to the maximum amount of water vapour that the air is able to hold, without it condensing (expressed as a percentage).

Relative sea level is sea level measured by a tide gauge with respect to the land upon which it is situated.

Relative sea-level rise – see also Mean sea level, Sea level change/rise

Relative sea level rise occurs where there is a local increase in the level of the ocean relative to the land, which might be due to ocean rise and/or land level subsidence.

Rossby wave

Also known as a planetary wave, it is a large, slow-moving, planetary-scale wave generated in the troposphere by ocean-land temperature contrasts and topographic forcing (winds flowing over mountains), and affected by the Coriolis Effect due to the earth's rotation. Rossby waves are also observed in the ocean.

S

Sea level change/rise – see also Mean sea level, Relative sea-level rise, Thermal expansion

Sea level can change, both globally and locally, due to; (1) changes in the shape of the ocean basins; (2) changes in the total mass of water and, (3) changes in water density.

Factors leading to sea level rise under global warming include both increases in the total mass of water from the melting of land-based snow and ice, and changes in water density from an increase in ocean water temperatures and salinity changes.

Sea-surface temperature

The temperature of the ocean surface. The term sea-surface temperature is generally representative of the upper few metres of the ocean as opposed to the skin temperature, which is the temperature of the upper few centimetres.

Solstice

The times of the year when the Sun is at its greatest distance from the equator, occurring around June 21, when the Sun reaches its northernmost point on the celestial sphere, or around December 22, when it reaches its southernmost point.

Southern Annular Mode (SAM)

The Southern Annular Mode (SAM) is the most important recurring pattern of natural variability in the Southern Hemisphere outside of the tropics. Oscillations in the SAM are associated with shifts in the position and strength of the mid-latitude westerly winds.

Southern Annual Mode (SAM) Index

Index measuring the difference in surface pressure between latitudes 40ºS and 65ºS. A positive SAM index corresponds to a southward movement and intensification of the sub-tropical westerly winds.

Southern Oscillation – see also **El Niño-Southern Oscillation**

Fluctuation of a global-scale tropical and subtropical surface pressure pattern.

Southern Oscillation Index (SOI)

The Southern Oscillation Index (SOI) is calculated from the monthly or seasonal fluctuations in the air pressure difference between Tahiti and Darwin.

South Pacific Convergence Zone (SPCZ)

A persistent and greatly elongated zone of low-level convergence extending from approximately 140°E near the equator to approximately 120°W at 30°S. The zone is not quite linear, but is oriented more west to east near the equator and has a more diagonal orientation (northwest to southeast) at higher latitudes.

SPCZ Position Index

The SPCZ Position Index is a measure of SPCZ location and is calculated as the normalised November-April difference in 9am (local time) in mean sea-level pressure between Suva and Apia. The SPCZ Position Index defines the latitude of the SPCZ between longitudes 180°W and 170°W.

Standardised Precipitation Index (SPI)

The Standardised Precipitation Index (SPI) is an index based on the probability of recording a given amount of precipitation. The probabilities are standardized so that an index of zero indicates the median precipitation amount. The index is negative for drought, and positive for wet conditions.

Statistical downscaling – see **Downscaling**

Steric – see also **Halosteric, Thermosteric**

Steric effects refer to the expansion and contraction of sea water.

Storm surge

The temporary increased height of the sea above the level expected from tidal variation alone at that time and place due to extreme meteorological conditions.

Stratosphere

The region of the atmosphere extending from the top of the troposphere at heights of roughly 10–17 km, to the base of the mesosphere at a height of roughly 50 km.

Sub-tropical High Pressure System

Areas of raised surface pressure between latitudes 20° and 40°.

T

Thermal Expansion – see also **Sea level change/rise, Mean sea level**

The increase in volume (and decrease in density) that results from warming water.

Thermocline

Moving downward through the ocean, the region where there is a rapid reduction in temperature with depth. The thermocline separates warm surface waters from cold deep waters.

Thermosteric – see also **Steric**

The expansion or contraction of sea water due to heating or cooling.

Time-series

The values of a variable generated successively in time. Graphically, a time series is usually plotted with time on the horizontal axis (x-axis), and the values of the variable on the vertical axis (y-axis).

Trade winds

The wind system, occupying most of the tropics that blow from the subtropical high pressure areas toward the equator.

Tropical cyclone

A tropical cyclone is a tropical depression of sufficient intensity to produce sustained gale force winds (at least 63 km per hour). A severe tropical cyclone produces sustained hurricane force winds (at least 118 km per hour). Severe tropical cyclones correspond to the hurricanes or typhoons of other parts of the world.

Troposphere

The lowest part of the atmosphere from the surface to about 10 km in altitude in mid-latitudes (ranging from 9 km in high latitudes to 16 km in the tropics on average), where clouds and weather phenomena occur.

Trough

An elongated region of low atmospheric pressure.

W

Walker Circulation

The Walker Circulation is the east-west circulation of air, oriented along the Equator, across the Pacific region.

Warm Pool (also known as **West Pacific Warm Pool** and **Indo-Pacific Warm Pool**)

An extensive pool of the world's warmest water, with temperatures exceeding 28–29°C extending from the central Pacific to the far eastern Indian Ocean. The PCCSP focuses on the region of the Warm Pool to the east of 120°E.

West Pacific Monsoon

A monsoon is a tropical and subtropical seasonal reversal of both surface winds and associated rainfall, caused by differential heating between a continental scale land mass and the adjacent ocean. The Western Pacific Monsoon is the eastern edge of the Indonesian or Maritime Continent Monsoon, and the southern extension of the larger Asian-Australian Monsoon system.

Z

Zonal – see also Meridional

In meteorology, latitudinal, that is, easterly or westerly; opposed to meridional.

Market, Vanuatu

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