The Dynamic Earth: NASA Observes Our Ever-Changing Planet

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Glossary

A

Aerosol
extremely small solid particles, or very small liquid droplets, suspended in a gas.

Albedo
the fraction of the total solar radiation incident on a target that is reflected by it.

Altimeter
an instrument to measure the distance between the instrument (e.g., on an aircraft or satellite) and a specified surface. That measurement, coupled with the knowledge of the position of the platform and sensor, enables determination of the surface topography.

Anomaly
the difference between the average measurement and an individual measurement.

B

Backscatter
the reflection of waves, particles, or signals in the direction from which they originated.

Biomass
the total dry organic matter or stored energy content of living organisms that is present at a specific time in a defined unit (ecosystem, crop, etc.) at or near the Earth's surface.

Biosphere
the global ecological system, encompassing all living beings.

C

Carbon cycle
the movement of carbon among all reservoirs (storages, especially the atmosphere, terrestrial biosphere, oceans, and sediments, the latter including fossil fuels).

Carbon dioxide
a chemical compound with formula CO_2. CO_2 is present in the atmosphere in low concentrations and is a greenhouse gas. Plants utilize CO_2 during photosynthesis, and animals exhale CO_2 during respiration.

Carbon emission
the emission of carbon, often limited to carbon dioxide, and often expressed in tons of carbon dioxide equivalent; used as the basis for carbon emissions trading and the control of greenhouse gas emissions.

Carbon monoxide
a chemical compound with the formula CO. It is a colorless, odorless, and tasteless gas, that results from the incomplete combustion of carbon-containing compounds, such as occurs in internal combustion engines.

Chlorophyll
the chemical compound present in plants that absorbs the energy from sunlight and uses it to create carbohydrates from carbon dioxide and water. This process, known as photosynthesis, sustains life in plants.

Chlorine monoxide
a chemical compound with the formula ClO. It is a primary chemical for destroying ozone and is highly reactive.

Chlorofluorocarbons (CFCs)
a family of inert, non-toxic, and easily liquefied chemicals used in refrigeration, air conditioning, packaging, and insulation, or as solvents or aerosol propellants. Because they are not destroyed in the lower atmosphere, they drift into the upper atmosphere, where, given suitable conditions, their chlorine compounds destroy ozone.

Climatology
the study of climate.

Cryosphere
the portion of the Earth that is in a frozen state, including snow, ice, and permafrost.

D

Dobson unit
a measurement unit often used in indicating the amount of ozone in the atmosphere, named after G. M. B. Dobson for his pioneering work on the stratospheric ozone layer in the 1920s. A Dobson measurement indicates how thick the layer of ozone would be if all the ozone in the column of the atmosphere at the point of the measurement were brought down to sea level. One Dobson unit corresponds to a thickness of 0.001 centimeters.

E

El Niño
an anomalous warming of ocean surface waters in the eastern tropical Pacific, generally brought on by the suppression of upwelling off the coasts of Ecuador and northern Peru, and along the equator east of the international dateline. El Niño conditions typically last for 12 to 18 months and occur every three to seven years. El Niño is accompanied by weather extremes in various parts of the world.

El Niño-Southern Oscillation (ENSO)
the term for the coupled ocean-atmosphere interactions in the tropical Pacific characterized by episodes of anomalously high sea surface temperatures in the equatorial and tropical eastern Pacific. It is associated with large swings in surface air pressure between the eastern and western tropical Pacific and is the most prominent source of interannual variability in weather and climate around the world.

Electromagnetic radiation
a self-propagating wave characterized by electric and magnetic elements.

F

Field of view
the area that a sensor views at a single moment in time.

Flux
the flow of a quantity, such as energy, mass, or momentum, per unit area per unit time.

Fossil fuel
any hydrocarbon deposit that can be burned for heat or power, such as petroleum, coal,

and natural gas.

G

Glacier
a large mass of ice that flows under the influence of gravity. Typically a glacier refers to a large body of ice that is smaller than an ice cap.

Greenhouse gas
those gases, such as water vapor, carbon dioxide, tropospheric ozone, nitrous oxide, methane, and chlorofluorocarbons, that are largely transparent to solar radiation but opaque to outgoing long-wave radiation. Their action is similar to that of glass in a greenhouse. Most of the incoming solar radiation is allowed through to the Earth's surface, but some of the outgoing longwave (infrared) radiation is absorbed and re-emitted by the greenhouse gases. The effect of this is to warm the surface and lower atmosphere of the Earth.

Ground track
the trajectory of a satellite projected onto the Earth directly beneath the orbit.

H

Hydrologic cycle
the circulation of water through the Earth's hydrosphere, driven by the energy from solar radiation.

I

Iceberg
a mass of fresh-water ice originally derived from a glacier, ice cap, or ice sheet and found in a body of liquid water, such as an ocean or lake.

Ice cap
a dome-shaped grounded ice mass that covers less than 50,000 square kilometers of land area (i.e., smaller than an ice sheet), but is in general sufficiently large to cover mountains rather than to be constrained by them.

Ice concentration
the percent areal coverage of sea ice over an ocean area; generally expressed as a

percentage or in tenths or eighths.

Ice sheet
a dome-shaped ice mass that covers more than 50,000 square kilometers of land area. The two remaining ice sheets on Earth today are the Antarctic and Greenland ice sheets. The Antarctic ice sheet is sometimes divided into the West Antarctic and East Antarctic ice sheets, the former being a marine ice sheet, grounded largely below sea level.

Infrared radiation
the portion of the electromagnetic spectrum with wavelengths between approximately 0.75 micrometers and one millimeter.

L

La Niña
an episode of strong trade winds and resulting strong upwelling and unusually low sea surface temperatures in the central and eastern areas of the tropical Pacific. These episodes are linked to particular sets of climate conditions elsewhere around the Earth. La Niña is essentially the opposite of El Niño.

Long-wave radiation
radiation with wavelengths greater than 4 micrometers; often used to define the radiation emitted from Earth into space.

M

Methane
a chemical compound with formula CH_4. It is the principal component of natural gas and is an important greenhouse gas.

Montreal Protocol
a major international agreement signed in September 1987, to limit further production of chemicals that contribute to the depletion of the stratospheric ozone layer.

N

Negative feedback
a response of a system or object to an event that serves to dampen the event itself, or dampen its impact. Thus, negative feedback can be considered to be a ‘stabilizing’ process. It contrasts with positive feedback.

Net primary production
the mass of organic, carbon-based material produced from carbon dioxide by organisms, minus that which is lost during respiration by the organisms; a measure of biological productivity and net carbon fixation. Measured per unit area and per unit time, e.g., kilograms of carbon per square meter per year.

Net radiation
the difference between the incoming and outgoing radiation. Between 40°N and 40°S the Earth experiences a net gain of energy. Poleward of 40°N and 40°S there is a net loss of radiation. There is therefore a transfer of energy from the tropical and subtropical regions to the cooler regions to compensate for this, via ocean currents and the atmosphere.

Nitrogen oxide
oxygen compounds of nitrogen that form a component of air pollutants produced by automobile manufacturers, smoke stacks, and other industrial emissions.

O

Ozone
a trace gas made up of three atoms of oxygen, with the formula O_3. In the stratosphere, it occurs naturally and provides a protective layer shielding the Earth from ultraviolet radiation and its otherwise harmful health effects on humans and the environment. In the troposphere, it is a chemical oxidant and major component of photochemical smog. Ozone is an effective greenhouse gas.

Ozone hole
a reduction in stratospheric ozone that, in recent decades, has occurred during spring over the Antarctic. Chlorine-containing molecules are formed during the dark winter on the surface of small polar stratospheric cloud particles that can only form in the intense cold of the polar winter. When the sunlight returns in spring, these chlorine-containing molecules release reactive chlorine that destroys the ozone. The chlorine is derived from chlorofluorocarbons that have previously been broken up in sunlit regions.

P

Permafrost
areas at, or close to, the Earth's surface that have been frozen for two or more years.

Photosynthesis
the synthesis of sugar, which plants use for energy, from light, carbon dioxide and water, with oxygen as a waste product. In plants, and some algae, the conversion of sunlight into chemical energy is achieved by chlorophyll.

Phytoplankton
that portion of the plankton community made up of microscopic plants that live in the ocean (e.g., algae and diatoms) and derive their energy from photosynthesis.

Pixel
a 'picture element,' corresponding to the basic building block of the image. In a digital image, the pixel is the smallest sample of an image and is characterized by an area and position.

Positive feedback
a response of a system or object to an event that serves to enhance the event itself, or enhance its impact. Thus, positive feedback can be considered to be an 'amplifying' process. It contrasts with negative feedback.

Precipitation
any form of water in liquid or solid form that is delivered to the surface of the Earth, including rain, sleet, hail, or snow.

R

Radar
a device or system consisting usually of a synchronized transmitter and receiver that emits radio waves (microwaves) and processes their reflections for display or analysis. The term is derived from the expression "Radio Detection and Ranging."

Radiant energy
the energy associated with, or transported by, electromagnetic waves.

Radiation
see electromagnetic radiation.

Radiogenic heat
the heat generated by the decay of radioactive isotopes within the Earth.

Radiometer
an instrument that is designed to accurately measure radiant energy.

Rainforest
forests growing under the influence of annual precipitation that exceeds 2 meters.

Reflectance
the ratio of reflected power to incident power.

Reflectivity
the intrinsic reflectance of a material, for example from a material sufficiently thick that the reflectance does not change with increasing thickness.

Remote sensing
the use of a sensor to detect and characterize a target at a distance. Earth remote sensing typically involves the use of satellites or aircraft, but ground-based remote sensing is also used to infer properties of the Earth's atmosphere by looking upward from the ground.

Resolution
a measurement of the level of detail that can be observed using a sensor, defined as the minimum distance of separation between two targets at which they can be distinguished.

S

Scan
as the satellite moves along its orbit, an imaging sensor achieves coverage of the surface in the direction perpendicular to the ground track by the use of a scan. The scan may, for example, be achieved by the use of mirrors that rotate to obtain light from different positions along the scan, or may be achieved by the use of a set of reception devices each directed towards different positions along the scan. The distance associated with the scan defines the image swath.

Sea ice
any ice formed from the freezing of seawater.

Shortwave radiation
radiation in the visible, near-infrared and ultraviolet parts of the electromagnetic spectrum, less than about 4 micrometers in wavelength.

Solar radiation
electromagnetic radiation emitted by the sun, about half of which is in the visible part of the electromagnetic spectrum.

Sounder
a device that measures the vertical properties of a medium, such as the atmosphere or ice, by sending sound or electromagnetic radiation into the medium and measuring the return signal, or by detecting the thermal emission of a medium at various infrared frequencies.

Stratosphere
the layer of the atmosphere immediately above the troposphere, extending from a height of about 10 to 17 kilometers, to a height of about 50 kilometers. The stratosphere is characterized by having temperature profiles in which the temperatures increase or stay constant with increasing height. The ozone layer is found here.

Swath
the area on the Earth's surface that is imaged by a satellite sensor as it moves along its orbit. The swath follows the direction of the satellite projected onto the Earth's surface, either below or to one side of the satellite. For sensors which scan, the width of the swath that is determined by a single scan.

T

Thermal radiation
the radiation emitted from a body as a result of its temperature.

Total ozone
the total amount of ozone in a vertical column from the surface to the top of the atmosphere.

U

Ultraviolet radiation
electromagnetic radiation in the wavelength band 0.01 to 0.38 micrometers. In the electromagnetic spectrum, ultraviolet radiation falls between X-ray radiation and visible radiation.

W

Water vapor
water present in the atmosphere in gaseous form.

References:

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