

GLOSSARY

(Note: Terms in *italic* in each paragraph are defined elsewhere in this glossary.)

Absorption

the process in which incident radiant energy is retained by a substance.

Absorption coefficient

fraction of incident radiant energy removed by *absorption* per length of travel of radiation through the substance.

Active remote sensing

a remote sensing system that transmits its own energy source, then measures the properties of the returned signal. Contrasted with *passive remote sensing*.

Adiabatic equilibrium

a vertical distribution of temperature and pressure in an atmosphere in hydrostatic equilibrium such that an air parcel displaced adiabatically will continue to possess the same temperature and pressure as its surroundings, so that no restoring force acts on a parcel displaced vertically.

Aerosol

a colloidal suspension of liquid or solid particles (in air).

Aerosol asymmetry factor (also called asymmetry parameter, g)

the mean cosine of the scattering angle, found by integration over the complete scattering *phase function* of aerosol; $g = 1$ denotes completely forward scattering and $g = 0$ denotes symmetric scattering. For spherical particles, the asymmetry parameter is related to particle size in a systematic way: the larger the particle size, the more the scattering in the forward hemisphere.

Aerosol direct radiative effect

change in radiative flux due to aerosol scattering and absorption with the presence of aerosol relative to the absence of aerosol.

Aerosol hemispheric backscatter fraction (b)

the fraction of the scattered intensity that is redirected into the backward hemisphere relative to the incident light; can be determined from measurements made with an integrating nephelometer. The larger the particle size, the smaller the b .

Aerosol indirect effects

processes referring to the influence of aerosol on cloud droplet concentration or radiative properties. Effects include the effect of aerosols on cloud droplet size and therefore its brightness (also known as the “cloud albedo effect”, “first aerosol indirect effect”, or “Twomey effect”); and the effect of cloud droplet size on precipitation efficiency and possibly cloud lifetime (also known as the “second aerosol indirect effect” or “Albrecht effect”).

Aerosol mass extinction (scattering, absorption) efficiency

the aerosol *extinction (scattering, absorption) coefficient* per aerosol mass concentration, with a commonly used unit of $\text{m}^2 \text{g}^{-1}$.

Aerosol optical depth

the (wavelength dependent) negative logarithm of the fraction of radiation (or light) that is extinguished (or *scattered* or *absorbed*) by *aerosol* particles on a vertical path, typically from the surface (or some specified altitude) to the top of the atmosphere. Alternatively and equivalently: The (dimensionless) line integral of the *absorption coefficient* (due to aerosol particles), or of the *scattering coefficient* (due to aerosol particles), or of the sum of the two (*extinction coefficient* due to aerosol particles), along such a vertical path. Indicative of the amount of aerosol in the column, and specifically relates to the magnitude of interaction between the aerosols and *shortwave* or *longwave radiation*.

Aerosol phase function

the angular distribution of radiation scattered by aerosol particle or by particles comprising an *aerosol*. In practice, the phase function is parameterized with *asymmetry factor* (or *asymmetry parameter*). Aerosol phase function is related to *aerosol hemispheric backscatter fraction (b)* and aerosol particle size: the larger the particle size, the more the forward *scattering* (i.e. larger g and smaller b).

Aerosol radiative forcing

the net energy flux (downwelling minus upwelling) difference between an initial and a perturbed aerosol loading state, at a specified level in the atmosphere. (Other quantities, such as solar radiation, are assumed to be the same.) This difference is defined such that a negative aerosol forcing implies that the change in aerosols relative to the initial state exerts a cooling in-



fluence, whereas a positive forcing would mean the change in aerosols exerts a warming influence. The aerosol radiative forcing must be qualified by specifying the initial and perturbed aerosol states for which the radiative flux difference is calculated, the altitude at which the quantity is assessed, the wavelength regime considered, the temporal averaging, the cloud conditions, and whether total or only human-induced contributions are considered (see Chapter 1, Section 1.2).

Aerosol radiative forcing efficiency

aerosol direct radiative forcing per aerosol optical depth (usually at 550 nm). It is governed mainly by aerosol size distribution and chemical composition (determining the aerosol *single-scattering albedo* and *phase function*), surface reflectivity, and solar irradiance.

Aerosol semi-direct effect

the processes by which *aerosols* change the local temperature and moisture (e.g., by direct radiative heating and changing the heat releases from surface) and thus the local relative humidity, which leads to changes in cloud liquid water and perhaps cloud cover.

Aerosol single-scattering albedo (SSA)

a ratio of the *scattering coefficient* to the *extinction coefficient* of an aerosol particle or of the particulate matter of an aerosol. More absorbing aerosols and smaller particles have lower SSA.

Aerosol size distribution

probability distribution function of the number concentration, surface area, or volume of the particles comprising an aerosol, per interval (or logarithmic interval) of radius, diameter, or volume.

Albedo

the ratio of reflected flux density to incident flux density, referenced to some surface; might be Earth surface, top of the atmosphere.

Ångström exponent (\AA)

exponent that expresses the spectral dependence of *aerosol optical depth* (τ) (or *scattering coefficient*, *absorption coefficient*, etc.) with the wavelength of light (λ) as inverse power law: $\tau \propto \lambda^{-\text{\AA}}$. The Ångström exponent is inversely related to the average size of aerosol particles: the smaller the particles, the larger the exponent.

Anisotropic

not having the same properties in all directions.

Atmospheric boundary layer (abbreviated **ABL**; also called planetary boundary layer—**PBL**)

the bottom layer of the troposphere that is in contact with the surface of the earth. It is often turbulent and is capped

by a statically stable layer of air or temperature inversion. The ABL depth (i.e., the inversion height) is variable in time and space, ranging from tens of meters in strongly statically stable situations, to several kilometers in convective conditions over deserts.

Bidirectional reflectance distribution function (BRDF)

a relationship describing the reflected radiance from a given region as a function of both incident and viewing directions. It is equal to the reflected *radiance* divided by the incident *irradiance* from a single direction.

Clear-sky radiative forcing

radiative forcing (of gases or aerosols) in the absence of clouds. Distinguished from total-sky or all-sky *radiative forcing*, which include both cloud-free and cloudy regions.

Climate sensitivity

the change in global mean near-surface temperature per unit of *radiative forcing*; when unqualified typically refers to equilibrium sensitivity; transient sensitivity denotes time-dependent change in response to a specified temporal profile.

Cloud albedo

the fraction of solar radiation incident at the top of cloud that is reflected by clouds in the atmosphere or some subset of the atmosphere.

Cloud condensation nuclei (abbreviated **CCN**)

aerosol particles that can serve as seed particles of atmospheric cloud droplets, that is, particles on which water condenses (activates) at *supersaturations* typical of atmospheric cloud formation (fraction of one percent to a few percent, depending on cloud type); may be specified as function of supersaturation.

Cloud resolving model

a numerical model that resolves cloud-scale (and mesoscale) circulations in three (or sometimes two) spatial dimensions. Usually run with horizontal resolution of 5 km or less.

Coalescence

the merging of two or more droplets of precipitation (or aerosol particles; also denoted coagulation) into a single droplet or particle.

Condensation

in general, the physical process (phase transition) by which a vapor becomes a liquid or solid; the opposite of *evaporation*.

Condensation nucleus (abbreviated **CN**)

an aerosol particle forming a center for *condensation* under extremely high *supersaturations* (up to 400% for water, but below that required to activate small ions).



Data assimilation

the combining of diverse data, possibly sampled at different times and intervals and different locations, into a unified and physically consistent description of a physical system, such as the state of the atmosphere.

Diffuse radiation

radiation that comes from some continuous range of directions. This includes radiation that has been scattered at least once, and emission from nonpoint sources.

Dry deposition

the process by which atmospheric gases and particles are transferred to the surface as a result of random turbulent air, impaction, and /or gravitational settling.

Earth Observing System (abbreviated EOS)

a major NASA initiative to develop and deploy state-of-the-art *remote sensing* instruments for global studies of the land surface, biosphere, solid earth, atmosphere, oceans, and cryosphere. The first EOS satellite, Terra, was launched in December 1999. Other EOS satellites include Aqua, Aura, ICESat, among others.

Emission of radiation

the generation and sending out of radiant energy. The emission of radiation by natural emitters is accompanied by a loss of energy and is considered separately from the processes of *absorption* or *scattering*.

Emission of gases or particles

the introduction of gaseous or particulate matter into the atmosphere by natural or human activities, e.g., bubble bursting of *whitecaps*, agriculture or wild fires, volcanic eruptions, and industrial processes.

Equilibrium vapor pressure

the pressure of a vapor in equilibrium with its condensed phase (liquid or solid).

Evaporation (also called vaporization)

physical process (phase transition) by which a liquid is transformed to the gaseous state; the opposite of *condensation*.

External mixture (referring to an *aerosol*; contrasted with *internal mixture*)

an aerosol in which different particles (or in some usages, different particles in the same size range) exhibit different compositions.

Extinction (sometimes called attenuation)

the process of removal of radiant energy from an incident beam by the processes of *absorption* and/or *scattering* and consisting of the totality of this removal.

Extinction coefficient

fraction of incident radiant energy removed by extinction per length of travel of radiation through the substance.

General circulation model (abbreviated GCM)

a time-dependent numerical model of the entire global atmosphere or ocean or both. The acronym GCM is often applied to Global Climate Model.

Geostationary satellite

a satellite to be placed into a circular orbit in a plane aligned with Earth's equator, and at an altitude of approximately 36,000 km such that the orbital period of the satellite is exactly equal to Earth's period of rotation (approximately 24 hours). The satellite appears stationary with respect to a fixed point on the rotating Earth.

Hygroscopicity

the relative ability of a substance (as an *aerosol*) to adsorb water vapor from its surroundings and ultimately dissolve. Frequently reported as ratio of some property of particle or of particulate phase of an aerosol (e.g., diameter, mean diameter) as function of *relative humidity* to that at low relative humidity.

Ice nucleus (abbreviated IN)

any particle that serves as a nucleus leading to the formation of ice crystals without regard to the particular physical processes involved in the nucleation.

In situ

a method of obtaining information about properties of an object (e.g., *aerosol*, cloud) through direct contact with that object, as opposed to *remote sensing*.

Internal mixture (referring to an *aerosol*; contrasted with external mixture)

an aerosol consisting of a mixture of two or more substances, for which all particles exhibit the same composition (or in some usage, the requirement of identical composition is limited to all particles in a given size range). Typically an internal mixture has a higher *absorption coefficient* than an external mixture.

Irradiance (also called radiant flux density)

a radiometric term for the rate at which radiant energy in a radiation field is transferred across a unit area of a surface (real or imaginary) in a hemisphere of directions. In general, irradiance depends on the orientation of the surface. The radiant energy may be confined to a narrow range of frequencies (spectral or monochromatic irradiance) or integrated over a broad range of frequencies.



Large eddy simulation (LES)

A three dimensional numerical simulation of turbulent flow in which large eddies (with scales on the order of hundreds of meters) are resolved and the effects of the subgrid-scale eddies are parameterized. The typical model grid-size is < 100 m and modeling domains are on the order of 10 km. Because they resolve cloud-scale dynamics, large eddy simulations are powerful tools for studying the effects of aerosol on cloud microphysics and dynamics.

Lidar (light detection and ranging)

a technique for detecting and characterizing objects by transmitting pulses of laser light and analyzing the portion of the signal that is reflected and returned to the sensor.

Liquid water path

line integral of the mass concentration of the liquid water droplets in the atmosphere along a specified path, typically along the path above a point on the Earth surface to the top of the atmosphere.

Longwave radiation (also known as terrestrial radiation or thermal infrared radiation)

electromagnetic radiation at wavelengths greater than 4 μm , typically for temperatures characteristic of Earth's surface or atmosphere. In practice, radiation originating by *emission* from Earth and its atmosphere, including clouds; contrasted with *shortwave radiation*.

Low Earth orbit (LEO)

an orbit (of satellite) typically between 300 and 2000 kilometers above Earth.

Mass spectrometer

instrument that fragments and ionizes a chemical substance or mixture by and characterizes composition by amounts of ions as function of molecular weight.

Nucleation

the process of initiation of a new phase in a supercooled (for liquid) or supersaturated (for solution or vapor) environment; the initiation of a phase change of a substance to a lower thermodynamic energy state (vapor to liquid condensation, vapor to solid deposition, liquid to solid freezing).

Optical depth

the *optical thickness* measured vertically above some given altitude. Optical depth is dimensionless and may be applied to Rayleigh scattering optical depth, aerosol *extinction* (or *scattering*, or *absorption*) *optical depth*.

Optical thickness

line integral of *extinction* (or *scattering* or *absorption*) *coefficient* along a path. Dimensionless.

Passive remote sensing

a remote sensing system that relies on the emission (transmission) of natural levels of radiation from (through) the target. Contrasted with *active remote sensing*.

Phase function

probability distribution function of the angular distribution of the intensity of radiation scattered (by a molecule, gas, particle or aerosol) relative to the direction of the incident beam. See also *Aerosol phase function*.

Polarization

a state in which rays of light exhibit different properties in different directions as measured azimuthally about the direction of propagation of the radiation, especially the state in which all the electromagnetic vibration takes place in a single plane (plane polarization).

Polarimeter

instrument that measures the polarization of incoming light often used in the characterization of light scattered by atmospheric aerosols.

Primary trace atmospheric gases or particles

substances which are directly emitted into the atmosphere from Earth surface, vegetation or natural or human activity, e.g., bubble bursting of *whitecaps*, fires, and industrial processes; contrasted with *secondary* substances.

Radar (radio detection and ranging)

similar to lidar, but using radiation in microwave range.

Radiance

a radiometric term for the rate at which radiant energy in a set of directions confined to a small unit solid angle around a particular direction is transferred across unit area of a surface (real or imaginary) projected onto this direction, per unit solid angle of incident direction.

Radiative forcing

the net energy flux (downwelling minus upwelling) difference between an initial and a perturbed state of atmospheric constituents, such as carbon dioxide or aerosols, at a specified level in the atmosphere; applies also to perturbation in reflected radiation at Earth's surface due to change in albedo. See also *Aerosol radiative forcing*.

Radiative heating

the process by which temperature of an object (or volume of space that encompasses a gas or aerosol) increases in response to an excess of absorbed radiation over emitted radiation.



Radiometer

instrument that measures the intensity of radiant energy radiated by an object at a given wavelength; may or may not resolve by wavelength.

Refractive index (of a medium)

the real part is a measure for how much the speed of light (or other waves such as sound waves) is reduced inside the medium relative to speed of light in vacuum, and the imaginary part is a measure of the amount of *absorption* when the electromagnetic wave propagates through the medium.

Relative humidity

the ratio of the vapor pressure of water to its saturation vapor pressure at the same temperature.

Remote sensing: a method of obtaining information about properties of an object (e.g., aerosol, cloud) without coming into physical contact with that object; opposed to *in situ*.

Saturation

the condition in which the vapor pressure (of a liquid substance; for atmospheric application, water) is equal to the *equilibrium vapor pressure* of the substance over a plane surface of the pure liquid substance, sometimes similarly for ice; similarly for a solute in contact with a solution.

Scattering

in a broad sense, the process by which matter is excited to radiate by an external source of electromagnetic radiation. By this definition, reflection, refraction, and even diffraction of electromagnetic waves are subsumed under *scattering*. Often the term scattered radiation is applied to that radiation observed in directions other than that of the source and may also be applied to acoustic and other waves.

Scattering coefficient

fraction of incident radiant energy removed by *scattering* per length of travel of radiation through the substance.

Secondary trace atmospheric gases or particles

formed in the atmosphere by chemical reaction, new particle formation, etc.; contrasted with *primary* substances, which are directly emitted into the atmosphere.

Secondary organic aerosols (SOA)

organic *aerosol* particles formed in the atmosphere by chemical reactions from gas-phase precursors.

Shortwave radiation

radiation in the visible and near-visible portions of the electromagnetic spectrum (roughly 0.3 to 4.0 μm in wavelength) which range encompasses the great majority of solar radiation and little longwave (terrestrial thermal) radiation; contrasted with *longwave (terrestrial) radiation*.

Single scattering albedo (SSA)

the ratio of light scattering to total light extinction (sum of *scattering* and *absorption*); for *aerosols*, generally restricted to scattering and extinction by the aerosol particles. More absorbing aerosols have lower SSA; a value of unity indicates that the particles are not absorbing.

Solar zenith angle

angle between the vector of Sun and the zenith.

Spectrometer

instrument that measures light received in terms of the intensity at constituent wavelengths, used for example to determine chemical makeup, temperature profiles, and other properties of atmosphere. See also *Mass spectrometer*.

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.

Sunglint

a phenomenon that occurs when the sun reflects off the surface of the ocean at the same angle that a satellite sensor is viewing the surface.

Supersaturation

the condition existing in a given portion of the atmosphere (or other space) when the *relative humidity* is greater than 100%, that is, when it contains more water vapor than is needed to produce *saturation* with respect to a plane surface of pure water or pure ice.

Surface albedo

the ratio, often expressed as a percentage, of the amount of electromagnetic radiation reflected by Earth's surface to the amount incident upon it. In general, surface albedo depends on wavelength and the directionality of the incident radiation; hence whether incident radiation is direct or diffuse, cf., *bidirectional reflectance distribution function (BRDF)*. Value varies with wavelength and with the surface composition. For example, the surface albedo of snow and ice vary from 80% to 90% in the mid-visible, and that of bare ground from 10% to 20%.



Troposphere

the portion of the atmosphere from the earth’s surface to the tropopause; that is, the lowest 10-20 kilometers of the atmosphere, depending on latitude and season; most weather occurs in troposphere.

Transient climate response

The time-dependent surface temperature response to a gradually evolving forcing.

Wet scavenging or wet deposition

removal of trace substances from the air by either rain or snow. May refer to in-cloud scavenging, uptake of trace substances into cloud water followed by precipitation, or to below-cloud scavenging, uptake of material below cloud by falling precipitation and subsequent delivery to Earth’s surface.

Whitecap

a patch of white water formed at the crest of a wave as it breaks, due to air being mixed into the water.

Major reference: *Glossary of Meteorology*, 2nd edition, American Meteorological Society.



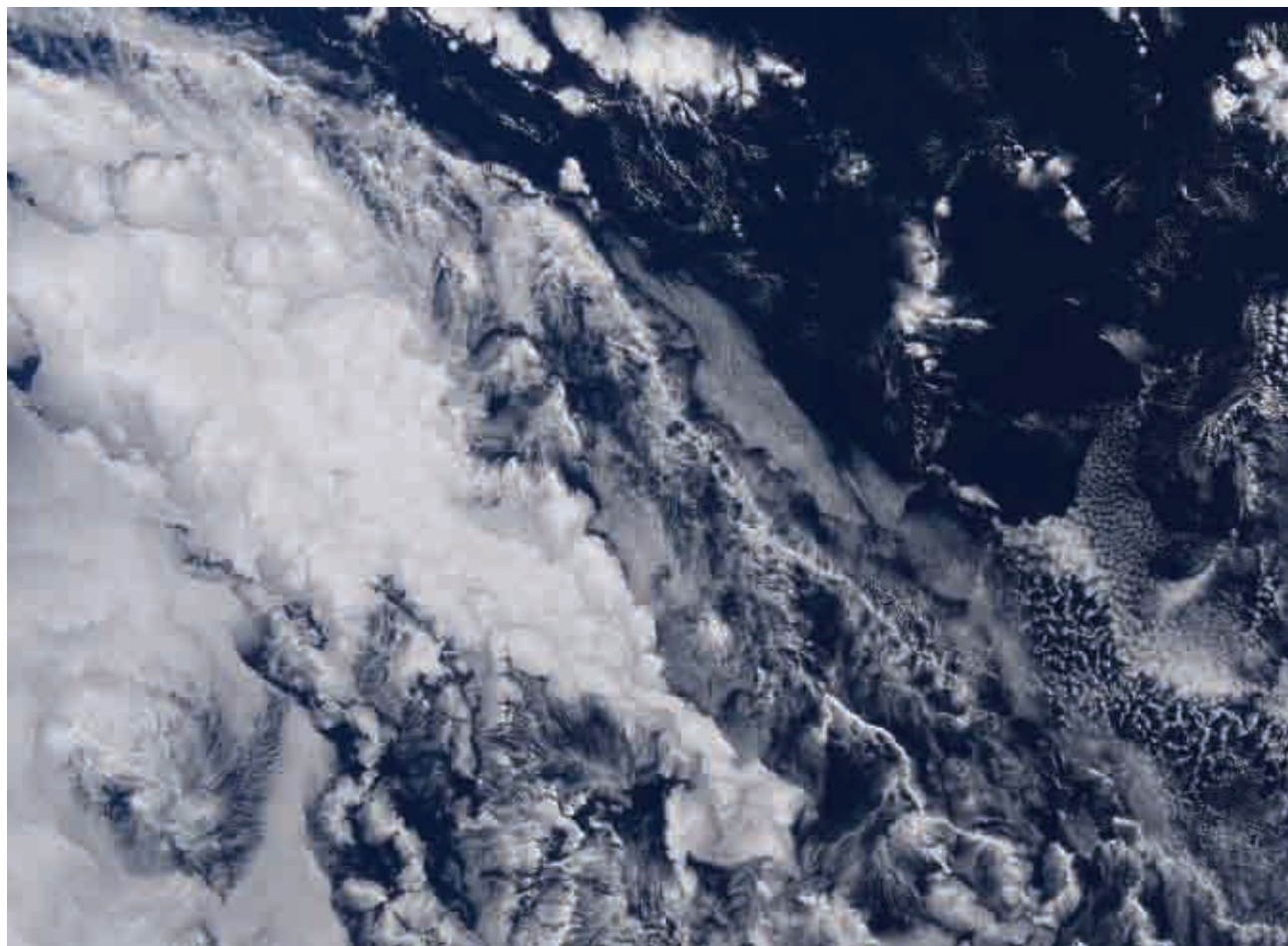
ACRONYMS

A	Surface albedo (broadband)
Å	Ångström exponent
ABC	Asian Brown Cloud
ACE	Aerosol Characterization Experiment
AD-Net	Asian Dust Network
ADEOS	Advanced Earth Observation Satellite
ADM	Angular Dependence Models
AeroCom	Aerosol Comparisons between Observations and Models
AERONET	Aerosol Robotic Network
AI	Aerosol Index
AIOP	Aerosol Intensive Operative Period
ANL	Argonne National Laboratory (DOE)
AOD (τ)	Aerosol Optical Depth
AOT	Aerosol Optical Thickness
APS	Aerosol Polarimetry Sensor
AR4	Forth Assessment Report, IPCC
ARCTAS	Arctic Research of the Composition of the Troposphere from Aircraft and Satellites
ARM	Atmospheric Radiation Measurements
AVHRR	Advanced Very High Resolution Radiometer
A-Train	Constellation of six afternoon overpass satellites
BASE-A	Biomass Burning Airborne and Spaceborne Experiment Amazon and Brazil
BC	Black Carbon
BNL	Brookhaven National Laboratory (DOE)
BRDF	Bidirectional Reflectance Distribution Function
CALIOP	Cloud and Aerosol Lidar with Orthogonal Polarization
CALIPSO	Cloud Aerosol Infrared Pathfinder Satellite Observations
CAPMoN	Canadian Air and Precipitation Monitoring Network
CCN	Cloud Condensation Nuclei
CCRI	Climate Change Research Initiative
CCSP	Climate Change <i>Science</i> , Program
CDNC	Cloud Droplet Number Concentration
CERES	Clouds and the Earth’s Radiant Energy System
CLAMS	Chesapeake Lighthouse and Aircraft Measurements for Satellite campaign
CTM	Chemistry and Transport Model
DABEX	Dust And Biomass-burning Experiment
DOE	Department of Energy
DRF	Direct Radiative Forcing (aerosol)
EANET	Acid Deposition Monitoring Network in East Asia
EARLINET	European Aerosol Research Lidar Network
EarthCARE	Earth Clouds, Aerosols, and Radiation Explorer

EAST-AIRE	East Asian Studies of Tropospheric Aerosols: An International Regional Experiment	LMDZ	Laboratoire de Météorologie Dynamique with Zoom, France
EMEP	European Monitoring and Evaluation Programme	LOA	Laboratoire d'Optique Atmosphérique, France
EOS	Earth Observing System	LOSU	Level of Scientific Understanding
EP	Earth Pathfinder	LSCE	Laboratoire des Sciences du Climat et de l'Environnement, France
EPA	Environmental Protection Agency	LWC	Liquid Water Content
ERBE	Earth Radiation Budget Experiment	LWP	Liquid Water Path
ESRL	Earth System Research Laboratory (NOAA)	MAN	Maritime Aerosol Network
<i>Eτ</i>	Aerosol Forcing Efficiency (RF normalized by AOD)	MEE	Mass Extinction Efficiency
FAR	IPCC First Assessment Report (1990)	MILAGRO	Megacity Initiative: Local and Global Research Observations
FT	Free Troposphere	MFRSR	Multifilter Rotating Shadowband Radiometer
<i>g</i>	Particle scattering asymmetry factor	MINOS	Mediterranean Intensive Oxidant Study
GAW	Global Atmospheric Watch	MISR	Multi-angle Imaging SpectroRadiometer
GCM	General Circulation Model, Global Climate Model	MODIS	Moderate Resolution Imaging Spectroradiometer
GEOS	Goddard Earth Observing System	MOZART	Model for Ozone and Related chemical Tracers
GFDL	Geophysical Fluid Dynamics Laboratory (NOAA)	MPLNET	Micro Pulse Lidar Network
GHGs	Greenhouse Gases	NASA	National Aeronautics and Space Administration
GISS	Goddard Institute for Space Studies (NASA)	NASDA	NAtional Space Development Agency, Japan
GLAS	Geoscience Laser Altimeter System	NEAQS	New England Air Quality Study
GMI	Global Modeling Initiative	NOAA	National Oceanography and Atmosphere Administration
GOCART	Goddard Chemistry Aerosol Radiation and Transport (model)	NPOESS	National Polar-orbiting Operational Environmental Satellite System
GOES	Geostationary Operational Environmental Satellite	NPP	NPOESS Preparatory Project
GoMACCS	Gulf of Mexico Atmospheric Composition and Climate Study	NPS	National Park Services
GSFC	Goddard Space Flight Center (NASA)	NRC	National Research Council
HSRL	High-Spectral-Resolution Lidar	OC	Organic Carbon
ICARTT	International Consortium for Atmospheric Research on Transport and Transformation	OMI	Ozone Monitoring Instrument
ICESat	Ice, Cloud, and Land Elevation Satellite	PARASOL	Polarization and Anisotropy of Reflectance for Atmospheric Science, coupled with Observations from a Lidar
IMPROVE	Interagency Monitoring of Protected Visual Environment	PDF	Probability Distribution Function
INCA	Interactions between Chemistry and Aerosol (LMDz model)	PEM-West	Western Pacific Exploratory Mission
INDOEX	Indian Ocean Experiment	PM	Particulate Matter (aerosols)
INTEX-NA	Intercontinental Transport Experiment - North America	PMEL	Pacific Marine Environmental Laboratory (NOAA)
INTEX-B	Intercontinental Transport Experiment - Phase B	POLDER	Polarization and Directionality of the Earth's Reflectance
IPCC	Intergovernmental Panel on Climate Change	POM	Particulate Organic Matter
IR	Infrared radiation	PRIDE	Puerto Rico Dust Experiment
LBA	Large-Scale Biosphere-Atmosphere Experiment in Amazon	REALM	Regional East Atmospheric Lidar Mesonet
LES	Large Eddy Simulation	RF	Radiative Forcing, aerosol
LITE	Lidar In-space Technology Experiment	RH	Relative Humidity
		RTM	Radiative Transfer Model
		SAFARI	South Africa Regional Science, Experiment



SAMUM	Saharan Mineral Dust Experiment	SZA	Solar Zenith Angle
SAP	Synthesis and Assessment Product (CCSP)	TAR	Third Assessment Report, IPCC
SAR	IPCC Second Assessment Report (1995)	TARFOX	Tropospheric Aerosol Radiative Forcing Observational Experiment
SCAR-A	Smoke, Clouds, and Radiation - America	TCR	Transient Climate sensitivity Range
SCAR-B	Smoke, Clouds, and Radiation - Brazil	TexAQS	Texas Air Quality Study
SeaWiFS	Sea-viewing Wide Field-of-view Sensor	TOA	Top of the Atmosphere
SGP	Southern Great Plain, ARM site in Oklahoma	TOMS	Total Ozone Mapping Spectrometer
SHADE	Saharan Dust Experiment	TRACE-A	Transport and Chemical Evolution over the Atlantic
SMOCC	Smoke, Aerosols, Clouds, Rainfall and Climate	TRACE-P	Transport and Chemical Evolution over the Pacific
SOA	Secondary Organic Aerosol	UAE2	United Arab Emirates Unified Aerosol Experiment
SPRINTARS	Spectral Radiation-Transport Model for Aerosol Species	UMBC	University of Maryland at Baltimore County
SSA	Single-Scattering Albedo	UV	Ultraviolet radiation
SST	Sea Surface Temperature	VOC	Volatile Organic Compounds
STEM	Sulfate Transport and Deposition Model	WMO	World Meteorological Organization
SURFRAD	NOAA's national surface radiation budget network		



Assessing the environmental impact of cloud fields becomes even more complicated when the contributions of aerosol particles in and around the cloud particles are also considered. Image from MODIS. Credit: NASA.

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Agricultural practices also affect air quality, such as leaving bare soil exposed to wind erosion, and burning agricultural waste. Photo taken from the NASA DC-8 aircraft during ARCTAS-CARB field experiment in June 2008 over California. Credit: Mian Chin, NASA.

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Cover/Title Page/Table of Contents:

Image 1: Fire in the savanna grasslands of Kruger National Park, South Africa, during the international Southern African Fire-Atmosphere Research Initiative (SAFARI) Experiment, September 1992. Due to extensive and frequent burning of the savanna grass, Africa is the “fire center” of the world. Credit: Joel S. Levine, NASA.

Image 2: Urban pollution in Hong Kong, May 2007. The persistent pollution haze significantly reduces the visibility. Credit: Mian Chin, NASA.

Image 3: Dust storms of northwest Africa captured by Sea-viewing Wide Field-of-view Sensor (SeaWiFS) on February 28, 2000. Credit: SeaWiFS Project at NASA Goddard Space Flight Center.

Image 4: Breaking ocean waves – a source of sea salt aerosols. Credit: Mian Chin, NASA.

Image 5: Clouds at sunset. Clouds and aerosols scatter the sun’s rays very effectively when the sun is low in the sky, creating the bright colors of sunrise and sunset. Credit: Mian Chin, NASA.

Image 6: Ship tracks appear when clouds are formed or modified by aerosols released in exhaust from ship smokestacks. Image from MODIS. Credit: NASA.

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