Common AQAST terms and acronyms defined (from A-Z)

A

A-train – See Afternoon Train.

Atmospheric Infrared Sounder (AIRS) – A satellite aboard the Aqua spacecraft that supports climate research and improves weather forecasting. It is the most advanced atmospheric sounding system developed for space to date. More information may be found at http://airs.jpl.nasa.gov/mission/description/.

Aerosol Optical Depth (AOD) – A numerical measurement of the transparency of aerosols, most commonly in visible wavelengths. A small number (less than 0.1) indicates a clear sky, whereas an AOD of 1 or greater is hazy. AOD is measured by satellites like MODIS. More information at http://1.usa.gov/xpPASQ.

Aerosols – Fine solid particles or liquid droplets suspended in a gas (similar to particulate matter, but includes liquid vapor). Clouds, smoke and smog are all aerosols. Also see primary and secondary aerosols.

Afternoon Train (A-train) – a constellation, or "train," of five observation satellites that orbit around the Earth one after the other. These satellites are Aqua, CloudSat, CALIPSO, PARASOL and Aura. They coordinate their measurements to tell scientists a more complete story about the makeup of the atmosphere, clouds, weather and climate change.

Air Quality Event – See Episode.

Air Quality Index (AQI) – A system for reporting and forecasting daily air quality. It keeps track of the major pollutants that threaten human health: ground-level ozone, particulate matter, carbon monoxide, sulfur dioxide and nitrogen dioxide.

Air Quality Managers – People who are employed in one of a variety of fields that relate to the management of air quality in a certain region. These may be engineers, policymakers, employees of state agencies, the EPA, etc.

Air Quality Metrics (AQM) – The measured values of certain chemicals in the air using certain set parameters in a given period of time.

Ambient – Ambient refers to that which is in the surrounding, outdoor air. It is measured separately from pollutant emissions sources.

Ames Alpha Jet Atmospheric eXperiment (AJAX) – A NASA-funded project that uses planes to measure ozone and greenhouse gases in California and Nevada.

Aqua – Part of the A-Train satellites and EOS, Aqua is a NASA satellite housing instruments that measure aerosols, vegetation, and air, land and water temperatures. Its primary focus, though, is data collection on the earth's water cycle (hence its name, the Latin word for water); this includes oceanic evaporation, soil moisture, clouds, precipitation, snow cover, and sea/land ice.

Arctic Research of the Composition of the Troposphere from Aircraft and Satellites

(ARCTAS) – NASA is studying the role of air pollution in the Arctic, a region sensitive to climate change, via the large, airborne ARCTAS field campaign.

Atmospheric Model version 3 (AM-3) – A chemistry-climate model developed at NOAA's Geophysical Fluid Dynamics Laboratory that is the atmospheric component of the CM3 global climate model. AM3 includes fully coupled stratosphere and troposphere chemistry, aerosol-cloud interactions change, and is coupled to a dynamic vegetation land model (LM3), with options to nudge the winds in AM3 to reanalysis fields or to couple AM3 to a full ocean model (coupled model version 3, CM3) or AM3 can be driven by sea surface temperatures and sea ice distributions from observations or other models. (Definition by Arlene Fiore.)

Aura – The Aura satellite is part of the A-Train and Earth Science Projects Division. It is a NASA satellite housing instruments that collect data from space to monitor the many natural processes that affect the Earth, such as ozone, air quality and climate. Aura is the Latin word for "breeze."

B

Background ozone – The level of ozone in an area if, hypothetically, human activity were not present. It is impossible to measure based directly on observations (since human activity is so widespread), so estimates rely on models. Background ozone levels vary depending on geographic location, altitude, season, and from year to year. It is an important value in terms of understanding climate and human health impacts.

Bay Area Air Quality Management District (BAAQMD) – A regional governmental agency that regulates sources of air pollution in the San Francisco Bay Area.

Benefits Mapping and Analysis Program (BenMAP) – A program developed by the EPA that uses (GIS) data to estimate the health and economic impacts in a population from changes in air quality. BenMAP is comprehensive but fairly simple to use; it can help estimate effects of pollution exposure, compare benefits of regulations, and perform "what if" type analyses.

Biogenic – Deriving from plants, trees and soils.

Biomass burning – the burning of living and dead vegetation (this can be a forest fire or manmade blaze).

Boundary Conditions (BC) – When a model has a limited spatial extent, there are boundaries, information spilling off the edges of the model's capabilities, which the model needs to account for. The upper boundary condition is usually the stratosphere, and the lower boundary condition is the surface of the Earth. In a regional model, there are also lateral boundary conditions — global models do not have lateral boundary conditions because the entire globe is covered. Lateral boundary conditions would represent information blowing into a regional model from wind.

C

Carbon Dioxide (CO2) – A greenhouse gas that cannot be seen from satellites. Natural sources of CO2 include volcanic activity, wildfires, and living aerobic organisms, while anthropogenic (human-made) sources include the burning of fossil fuels. Carbon "sinks" are things that soak up and store carbon dioxide, in a process called carbon sequestration — oceans and plants sequester carbon naturally, and humans can do so through a variety of "carbon capture" techniques.

Carbon Monoxide (CO) – A gas released by fires and fossil fuel burning, which makes it a good tracer of human activity from the atmosphere. CO can be seen from MOPPITT.

Coarse fraction – See PM10.

Community Atmosphere Model (CAM or CAMx) – Three-dimensional, regional air quality model developed by Environ consulting firm (environcorp.com). A precursor to CMAQ, a similar

model developed more recently by the EPA, CAM helps represent ozone, particulates and toxics in the air.

Community Multiscale Air Quality (CMAQ) monitoring system – A three-dimensional regional air quality model developed by the EPA.

Concentration – The amount of a specified substance (a chemical like Nitrogen, etc.) in a unit amount of another substance (e.g. the air in the troposphere).

Criteria Pollutants – Six substances controlled by the EPA's NAAQS standards. They include carbon monoxide, lead, particle pollution, ozone, nitrogen dioxide and sulfur dioxide.

Critical loads – A threshold used to estimate the point at which certain natural elements in the environment (oceans, forests, etc.) will be harmfully affected by pollution exposure. Below this threshold (the "critical load"), it is believed, pollutants will not have significant harmful impacts on the specified element. Exposure to more pollutants than the critical load, though, is thought to cause harm. The critical load value is estimated using calculations based on the best available science.

D

DISCOVER AQ – A NASA project designed to distinguish between pollution in the upper levels of the atmosphere and pollution closest to Earth's surface, in the air that humans breathe. DISCOVER-AQ stands for Deriving Information on Surface conditions from Column and Vertically Resolved Observations Relevant to Air Quality.

Diurnal – variation from night to day.

E

Earth Observing System (EOS) – EOS is a coordinated series of satellites designed by NASA to observe the globe and its processes over a long period of time. It helps scientists better understand the interactions between the Earth and its surface, ecosystems, atmosphere and oceans. (Read more at http://eospso.gsfc.nasa.gov/)

Emission Inventory – An estimate of emissions for a single chemical or multiple chemicals from a single emission sector (such as electricity), or from multiple emissions sectors, for some particular region of the Earth (e.g. a state, country, the entire globe).

Emissions – The flux of gasses and aerosols into the atmosphere. They may come from cars, power plants, trees, and airplanes, or even lightning, cows and termites.

Emissions Database for Global Atmospheric Research (EDGAR) – A global database developed in Europe that provides information on past and current manmade emissions of greenhouse gasses and air pollutants by location.

Emissions sector – Categories of sources from which greenhouse gasses and other materials are emitted. (Electricity, transportation, agriculture, industry, etc.)

Environmental Benefits Mapping and Analysis Program (BenMAP) – A program developed by the EPA that uses (GIS) data to estimate the health and economic impacts in a population from changes in air quality. BenMAP is comprehensive but fairly simple to use; it can help estimate effects of pollution exposure, compare benefits of regulations, and perform "what if" type analyses.

Environmental Protection Agency (EPA) – A federal agency that writes and enforces environmental regulations based on Congressional laws.

Episode/Air quality Event – An air quality event occurs when ambient air quality is affected more than usual, often by high winds, volcanic eruptions, large fires, seismic activity, or even fireworks.

Exceedance – When levels of a pollutant (such as surface ozone) increases in a certain area to the point that levels exceed national standards.

Exceptional Event – The EPA says an "exceptional event" is any unusual or naturally occurring events that can affect air quality but are not reasonably controllable using techniques that tribal, state or local air agencies may implement in order to attain and maintain the National Ambient Air Quality Standards.

Exposure Assessment – Public health research focused on quantifying the levels of air pollution to which populations are being exposed. It may be a global assessment, or populations of a certain place or demographic. It may also zero in on one segment of air pollution, like PM2.5 or NO2.

G

Geophysical Fluid Dynamics Laboratory (GFDL) – Located in Princeton, New Jersey, the GFDL is a research component of NOAA. Scientists at GFDL build mathematical models and computer simulations to better understand and foresee events in climate, the atmosphere and oceans.

GEOS-Chem – Some AQAST members are global scientists and others study small regions, so naturally they require different models. GEOS-Chem is a three-dimensional global chemical transport model driven by meteorological input from the Goddard Earth Observing System (GEOS). Model engineers at Harvard University manage and provide support for GEOS-Chem, where the model was developed. It works as a global version of CAMx or CMAQ.

Geostationary Operational Environmental Satellite (GOES) – A satellite that observes information regarding weather forecasting, severe storm tracking, and meteorology research. GOES is used by the National Weather Service as well as AQAST.

Geostationary satellite (Also geosynchronous satellite) – A satellite that orbits with the Earth, so that it can view the same part of the Earth at all times. So, this type of satellite has the same orbital period as the Earth. The benefit of these satellites for AQAST is that they can see how certain regions change over time.

Goddard Institute for Space Studies (GISS) – Located in New York City, GISS is a center for the research of natural and manmade changes that affect the global environment.

Goddard Space Flight Center (GSFC) – Located in Maryland, GSFC is a center for the research of the Earth, sun, solar system and other galaxies.

Ground-based data – Data that comes from satellites or other instruments based on Earth. These instruments are considered Suborbital Platforms, of which there are several varieties. An example of an application of ground-based data is the Air Quality System (AQS), which is an ambient air quality database managed by the EPA.

Ground-level Ozone – See Ozone.

I

In situ – Air that has not been transported by wind or changed by non-local emissions; in its original position. For example, when NOx forms in a tailpipe, measuring only the air in the tailpipe would be an in situ measurement.

Initial Conditions (IC) – Estimated values that are inputted into a model at the beginning of a simulation.

Intergovernmental Panel on Climate Change (IPCC) – An international group of scientists that summarize the state of knowledge on climate, climate change impacts, and climate change adaptation strategies every five years. The IPCC is now working on its fifth assessment report, called AR5, due to be completed by the end of 2013. Several AQAST members serve as lead authors of this report.

Investigator Projects (IP) – Individual AQAST members use core funding for a project.

L

Lake Michigan Air Directors Consortium (LADCO) – A regional planning organization that helps states in the upper Midwest with air quality management activities.
Lead (Pb) – A chemical element that can be poisonous if ingested.
Level 1 data products – Raw satellite irradiance data (how much a satellite can detect of certain properties at different wavelengths).
Level 2 data products – Swath-level (satellite's eye level) data on derived variables based on Level 1 data. Level 2 data products are more usable for air quality managers, and are often called "retrievals" because they depend on the interpretation of Level 1 products.
Level 3 data products – A global, gridded version of Level 2 data.
Low-level Ozone – See Ozone.

M

Multi-angle Imaging Spectroradiometer (MISR) – A sensor onboard the Terra satellite that measures Earth processes.
Model for OZone And Related chemical Tracers (MOZART) – A three-dimensional global atmospheric chemistry model. It works as a global version of CAMx or CMAQ. There are some AQAST members that are global scientists and others that study small regions, so they use different models.
Model of Emissions of Gases and Aerosols from Nature (MEGAN) – Model for calculating gas-phase chemicals and particles released from biogenic sources. For example, isoprene from trees. These models are helpful for AQAST members studying emissions from nature because they can vary depending on the present vegetation, land cover and climate (season and temperature), with higher emissions often occurring on warmer, sunnier days.
Moderate Resolution Imaging Spectroradiometer (MODIS) – An instrument onboard the Terra and Aqua satellites that measures many factors; primarily used at AQAST for its ability to measure Aerosol Optical Depth.
Measurements of Pollution in the Troposphere (MOPITT) – A sensor onboard the Terra satellite that measures Earth processes.

N

National Ambient Air Quality Standards (NAAQS) – Standards set by the EPA under the Clean Air Act to regulate certain pollutants that are considered to threaten public health and the environment. The six "criteria pollutants" under the NAAQS are carbon monoxide, lead, particle pollution, ozone, nitrogen dioxide and sulfur dioxide.
NASA Goddard Institute for Space Studies (GISS) – See GISS.
NASA Goddard Space Flight Center (GSFC) – See GSFC.
National Parks Service (NPS) – A federal department entrusted with preserving the national parks of the United States (and a partner of AQAST).
Network Common Data Format (netCDF) – A way of digitally organizing atmospheric data (or other types of data). It allows for the binary storage of very large datasets, so that information on variables and the time and space that those variables represent may be quickly stored in a clear, organized, accessible way.
Nitrogen Dioxide (NO2) – A chemical compound that is toxic when inhaled.
National Oceanic and Atmospheric Administration (NOAA) – A federal government agency that studies the oceans and atmosphere. It provides weather forecasts among other scientific public services, and includes the National Weather Service (NWS).
Northeast States for Coordinated Air Use Management (NESCAUM) – A regional planning organization.

NOx – A blanket term that includes NO and NO2, both of which are produced from nitrogen and oxygen reacting in the air from combustion. NOx can be higher in large cities because of the combustion from motor vehicle engines.

O

Ozone (O3) – Also called trioxygen, ozone is a molecule formed from ultraviolet light and electricity in the atmosphere. It is present in low concentrations throughout the Earth's atmosphere, about .6 parts per million (ppm). In the atmosphere, it filters out sunlight and prevents humans' DNA from burning up — whatever amount of sunlight that does make it through provides helpful Vitamin D. Ozone is different than low-level ozone (also called ground-level ozone or tropospheric ozone), which is a pollutant in the atmosphere that contributes to smog, health problems and damage to plants. Low-level ozone is not emitted from car engines or factories; it comes from photochemical reactions between NOx and volatile organic compounds (VOCs) in the presence of sunlight.

Ozone Monitoring Instrument (OMI) – An instrument onboard the Aura satellite that measures many factors; primarily used at AQAST for its ability to measure NO2.

Ozonesondes – A lightweight, airborne instrument that measures ozone in conjunction with a balloon (to lift it into the atmosphere) and a meteorological radiosonde (to measure temperature, pressure, altitude, etc. in the atmosphere) and transmits information to a receiver on the ground. The balloon will ascend to altitudes of about 115,000 feet before it bursts, according to NOAA. Photos may be found here: http://www.esrl.noaa.gov/gmd/ozwv/ozsondes/.

P

Particle pollution – see Particulate Matter

Particulate Matter (particle pollution, PM) – Similar to an aerosol but does not include liquids suspended in gas.

Parts per million (ppm) – A unit of measurement expressing a ratio of X parts per one million parts. It can represent volume when written as "ppmv."

Planetary Boundary Layer (PBL) – The layer of the atmosphere closest to the surface of the Earth. Air within the PBL tends to be "well-mixed" vertically, meaning that chemicals in the air are churning and moving around. This layer is most relevant to Air Quality Managers since studying the diurnal changes (from night to day) of PBL height is important to controlling surface air pollution.

PM10 – A type of particulate matter containing particles that have a diameter smaller than 10 microns (one-millionth of a meter). Usually blowing dust, sand or smoke. The difference between PM10 and PM2.5 is called the coarse fraction. The EPA regulates Ambient PM10 (in the air).

PM2.5 – A type of particulate matter containing particles that have a diameter smaller than 2.5 microns (one-millionth of a meter). A smaller and lighter subset of PM10, it travels longer distances in the atmosphere and is therefore harder to control. Includes gasses that react in the atmosphere and form particulate matter. The EPA regulates Ambient PM2.5 (in the air).

Polar orbiting satellites – Satellites that orbit the Earth around the poles, so that they may see each section of the Earth as it moves (picture a ball of string, where the string is being wound around vertically as the ball continues to move horizontally). Due to this motion, these types of satellites will see more information at the poles than anywhere else on the globe. After every few days, a polar orbiting satellite will have recorded information for the entire globe.

Primary aerosols – Aerosols that are directly emitted, like windborne dust, pollen, volcanic ash, or smoke from a forest fire or diesel engine.

R

Realtime Air Quality Modeling System (RAQMS) – An atmospheric chemistry model, developed and run by AQAST member Brad Pierce at the University of Wisconsin-Madison.

Region # – The EPA divides the U.S. into 10 different regions. View a map here: http://www.epa.gov/oust/regions/regmap.htm.

Regional Planning Organization (RPO) – An organization that helps groups of states with air quality management activities. These groups are supported by the states and do scientific assessment and policy analysis.

Retrievals – See Level 2 data products.

S

Secondary aerosols – Aerosols formed in the atmosphere through chemical reactions.

Spin-up Period – The length of time it takes a model to find actual, known values, at which point the estimated Initial Conditions plugged into a model at the start will become irrelevant and be replaced with the actual values. A global model may take one year, while a regional model may take only a few days because that is the amount of time it takes for air to move and replace these estimated IC values.

State Implementation Plan (SIP) – A state-level plan on how air quality managers will reduce emissions to achieve a compliance with EPA standards. States normally work with hired consultants to inform this plan, and modeling is a major part of the SIP process.

Stratosphere – The layer of the atmosphere above the troposphere. Transcontinental and transoceanic airplanes fly at the very bottom of the stratosphere. Many chemical processes and mixing occurs here, making the stratosphere interesting for air quality researchers.

Stratopheric intrusion – The process of stratospheric air entering, or intruding, into the troposphere. When this happens, stratospheric ozone may be introduced into the troposphere, so there is a chance it could affect surface ozone concentrations.

Suborbital data – Data collected from platforms like planes and stationary remote sensors on Earth's surface rather than satellites orbiting around the Earth in space.

Sulfur Dioxide (SO2) – A chemical compound caused by coal and fossil fuel burning in industrial factories. It is also emitted from volcanoes. SO2 is a precursor to acid rain and is known to have adverse effects on plants and human health when inhaled.

Sulfur Transport and dEposition Model (STEM) – A three-dimensional atmospheric chemistry model, developed at the University of Iowa by AQAST member Greg Carmichael's group.

T

Terra – The flagship satellite of NASA's Earth Observing System. It is named for the Latin word for Earth and has been collecting data about Earth's climate since 1999. Terra has five sensors onboard (ASTER, CERES, MISR, MODIS and MOPITT) that study the interactions between land, oceans and the sun.

Texas Commission on Environmental Quality (TCEQ) – A state-level planning agency.

Tiger Teams – Groups formed by AQAST members to collaborate skills and research on an air quality management need. Members must formulate a proposal for Tiger Team projects, and may use supplementary funding to address the need.

Trioxygen (O3) – See Ozone.

Troposphere – The layer of the atmosphere closest to Earth's surface, containing the weather that humans experience. It is 11 miles at its thickest points, and contains 99% of the atmosphere's total water vapor and aerosols. The troposphere contains the Planetary Boundary

Layer.

Tropospheric Emission Spectrometer (TES) – Pronounced "Tees," TES is an instrument that measures many components of the troposphere like carbon monoxide, carbon dioxide and ozone. TES is aboard the Aura satellite.

Tropospheric Ozone – See Ozone.

True color image – A composite of images taken of the Earth from space that show true-to-life coloring, rather than changed to represent some set of information, such as temperature or presence of chemicals.

V

Volatile Organic Compounds (VOCs) – Gasses emitted from certain liquids or solids (e.g. paint, glue, cleaning fluids, varnish, pesticides, ink, etc.) that are harmful to human health. VOCs can be released from these materials while in use or even while sitting in storage. In sunlight, VOCs react with the sun to produce low-level ozone (pollutant responsible for smog).

W

Wavelength – A wavelength is the distance between two crests or two troughs in a recurring pattern of waves. Waves occur in different types of light and sound.

Western Regional Air Partnership (WRAP) – A regional planning organization in the Western U.S.

Western United States (WUS) – Generally considered to be the continental United States, to the west of about 100 degrees W latitude (may vary by study).

Wisconsin DNR – A state-level planning agency.

Wisconsin Horizontal Interpolation Program for Satellites (WHIPS) – A publicly-available software for allocating Level 2 data products onto a custom grid; developed by an undergraduate researcher at the University of Wisconsin.

WRF-Chem – A three-dimensional, regional atmospheric chemistry model. It is unique among the models used by AQAST members in that it not only measures how weather impacts chemical properties and transport in the atmosphere, but also includes the impact of chemicals in the atmosphere on weather. For example, on a windy day, particles will move (weather impacting chemicals). This then influences where clouds form (chemicals impacting weather).

Send changes and suggestions for new glossary terms to taholloway@wisc.edu.