

APTI 423 – Master Glossary & Commonly Used Acronyms

A

ABL – Atmospheric Boundary Layer (ABL, also referred to as the Planetary Boundary Layer). The layer of the atmosphere that is significantly influenced by the characteristics of the surface.

AERMAP – Terrain preprocessor for AERMOD

AERMET – Meteorological data processor for AERMOD

AERMINUTE - ASOS one-minute meteorological preprocessor for AERMET. AERMINUTE processes 1-minute ASOS wind data to generate hourly average winds for input to AERMET in Stage 2

AERMOD - Gaussian based dispersion model. The AMS/EPA Regulatory Model.

AERSCREEN – Screening model for AERMOD

AERSURFACE – Surface characterization preprocessor for AERMOD.

Albedo – (α) The proportion of the incident light or radiation that is reflected by a surface, typically that of a planet or moon. Is the measure of the diffused reflection of solar radiation out of the total solar radiation and measured on a scale from 0, corresponding to a black body that absorbs all incident radiation, to 1, corresponding to a body that reflects all incident radiation.

AMS – American Meteorological Society

ASOS – Automated Surface Observation System (meteorological data)

Atmospheric Stability – Characterization of the state of the atmosphere’s ability to enhance (convective conditions) or suppress (stable conditions) turbulence generated by either wind shear or buoyancy effects.

B

B_o – Bowen Ratio is the ratio of the sensible heat flux to the latent heat flux at the surface ($B_o = H/L$)

BID – Buoyancy Induced Dispersion. Initial dispersion of a plume due to the temperature difference between the plume and the ambient air.

BPIPPRM – Building characterization preprocessor for AERMOD. Building profile input program for PRIME is the building Pre-processor program that provides the effective building dimensions to AERMOD that accounts for the influence of a building on the flow and dispersion of the plume.

Building Downwash – Influence of the presence of a building or structure on the flow and turbulence and, thus, the dispersion of a plume in the vicinity.

Bulk Richardson Number – (R_b) Stability parameter proportional to the ratio of the buoyancy and the square of the wind shear. Calculated from two levels of temperature and one level of wind. Used to estimate the temperature scale when cloud cover is unavailable.

C

C – Pollutant Concentration

Capping Inversion – Strongly stable layer found above the daytime mixed layer.

Cavity – Highly turbulent recirculating region just downwind of a building or structure (also known as the Near Wake).

CBL – Convective Boundary Layer

CMAQ – Community Multi-scale Air Quality model, a Eulerian atmospheric dispersion model, developed by the US EPA to address and deal with regional air pollution problems.

CNPY – Tree Canopy data

CO – Control – Titles, modeling options, pollutant IDs, averaging time (Also is abbreviation for Carbon Monoxide).

Commissioned ASOS Data – Contains full hours of 1-minute ASOS met data.

Convective Conditions – ($L < 0$) Turbulence is driven primarily by buoyancy due to surface heating from the sun. The Plume’s Horizontal Concentration distribution is assumed to be Gaussian. The plume’s vertical concentration distribution is a combination of a bi-Gaussian approach in the mixed layer and a penetrated plume above the mixed layer.

Convective Velocity Scale – (W^*) The characteristic velocity of large-scale turbulent eddies (thermals); on the order of 1 m/s (varies from 0.1 to about 2.0).

D

Datum – Geographic reference point for site locations.

DEM – Digital Elevation Model. Three-dimensional elevation data describing the terrain along the earth’s surface required by AERMAP to determine the hill height scale for each receptor.

DEM File – Files that contain either points (vector) or pixels (raster), with each point or pixel having an elevation value.

Direct Plume – In convective conditions, the part of the plume mass that has insufficient buoyancy to reach the top of the mixed layer.

Dividing Streamline Height – (H_c) In complex terrain in a stable atmospheric layer, the height above which plume material is contained in a flow with sufficient kinetic energy to overcome the stability and surmount the top of the local hill.

Downwash – Rapid mixing to the surface of an elevated pollutant plume due to the turbulent mixing and streamline deflections associated with the influence of a nearby building or structure on the ambient flow.

E

EBD – Equivalent Building Dimensions

Eddy – Circulating motion of air within a turbulent fluid.

Effective Parameters – Variables or parameters (e.g. wind speed, turbulence parameters) averaged in the vertical layer between the plume center and the receptor height at the downwind distance of the receptor.

EPA – Environmental Protection Agency (federal US EPA)

ERM – Effective Roughness Method

EV – Event Processing – Analysis of source contributions

F

Far Wake – Region within the disturbed flow around a building or structure outside of the cavity.

Friction Velocity - (u^*) Characteristic velocity of the mechanically induced turbulent eddies due to wind shear stress near the surface (on the order of 10% of the wind speed at 10m height).

FSL – Forecast Systems Laboratory

Fumigation (or Fumigation Condition) – Elevated plumes released into a stable layer at night will remain elevated and highly concentrated due to light winds and the stability of the atmosphere. As the convective boundary layer height grows in the morning and reaches the height of the concentrated plume, pollutant material will be mixed rapidly (fumigated) to the surface by convective turbulence.

G

Gaussian Plume – With the assumptions that the flow is steady over the modeling period, that the wind speed is much greater than the turbulent diffusion along the wind directions and that the flow is homogeneous, an analytical solution to the Fickian Diffusion equation can be found in the form of a Gaussian distribution in both the vertical and lateral directions.

GEP – Good Engineering Practice

GHG – Greenhouse Gas

GMT – Greenwich Mean Time

Ground Heat Flux - (G) On the order of 10% of the total net radiation. Heat absorbed by the soil that is not radiated.

GUI – Graphical User Interface

H

h_c – Hill Height Scale. Characterizes the height of the terrain that most dominates the flow in the vicinity of the receptor. Calculated by AERMAP with the Digital Elevation Data.

H_c – Effective Critical Dividing Streamline

H_{GEP} – Good Engineering Practice Stack Height

I

IBL – Internal Boundary Layer

Indirect Plume – In convective conditions, the part of the plume mass that has sufficient buoyancy to reach the top of the mixed layer where it will hesitate and spread laterally before beginning to mix back down into the mixed layer.

IFW – Ice Free Wind

Inversion – When the temperature increases with height (extremely stable, cooler air trapped by a layer of warmer air above it, virtually no vertical motion.) Very stable layer in the atmosphere where the temperature decreases at a rate greater than the adiabatic lapse rate, i.e. faster rate than $-9.8^{\circ}\text{K}/\text{km}$.

ISHD – Integrated Surface Hourly Data

J

JOB – Control file pathway that specifies where the AERMET messages are output.

K

K – Von Karmen Constant. A dimensionless empirical constant in the log wind profile equal to 0.4.

KABE – Allentown PA airport meteorology site.

L

L – Monin Obukhov Length. The height in the surface layer where turbulence produced by buoyancy is equal to that produced by wind shear. Serves as a stability parameter. In stable conditions, L is positive. In unstable (convective) conditions it is negative.

Latent Heat Flux – (L) the flux of energy from the Earth's surface to the atmosphere that is associated with evaporation or transpiration of water at the surface and subsequent condensation of water vapor in the troposphere. Usually denoted by LE to prevent confusion with Monin Obukhov Length which is also L.

Log Wind Profile – Logarithmic relationship between mean wind speed and height in the surface layer of the atmosphere.

M

MAKEMET – The MAKEMET program interfaces with AERSCREEN to generate a site-specific matrix of screening meteorological conditions based on user inputs for input into the AERMOD model.

ME – Meteorology – AERMET generated input files

Mechanical Mixed Layer - (z_{im}) for all stability conditions, the turbulent layer in the surface influence by wind shear due to drag at the surface (also known as mechanical mixing height).

Mechanical Turbulence – Atmospheric turbulence driven primarily by wind shear effects due to drag at the surface.

Mixed Layer – (z_{ic}) In convective conditions, the layer above the surface layer that is highly turbulent and pollution is well mixed do to the large convectively driven thermals (also known as the convective mixing height).

Mixing Height – (Z_i) The Mixing Height is the height of vertical mixing of air and suspended particles above the ground. The height is determined by the observation of the atmospheric temperature profile. A parcel of air rising from the surface of the Earth will rise at a given rate (called the dry-adiabatic lapse rate.)

MM5 – Mesoscale meteorological prognostic model

MMIF – Mesoscale Model Interface Program

Monin-Obukhov Length – (L) The height in the surface layer where turbulence produced by buoyancy is equal to that produced by wind shear. Serves as a stability parameter. In stable conditions, L is positive. In unstable (convective) conditions it is negative.

MPRV – Impervious surface data (from USGS)

MRLC – Multi-Resolution Land Characteristics (from USGS)

N

NAAQS – National Ambient Air Quality Standards

NCDC – National Climate Data Center

NED – National Elevation Data

NED File – Network Definition file is a software package used for building network simulators, stores the network topology structure, used for describing the logical structure of the network that will be simulated in the software.

Net Radiation – (R_N) The sum of the sensible, latent and ground heat fluxes.

Neutral Condition – When atmospheric conditions neither suppress nor encourage a parcel of air’s vertical movement.

NLCD – National Land Cover Dataset

NWS – National Weather Service

NO – Nitrous Oxide

NO₂ – Nitrogen Dioxide

NO_x – Nitrogen Oxides (AKA Oxides of Nitrogen)

O

OLM – Ozone Limiting Method

OU – Output – Options for printing AERMOD output

P

PBL – Planetary Boundary Layer. Same as Atmospheric Boundary Layer.
Penetrated Plume – In convective conditions, the part of the plume mass that has sufficient buoyancy to reach the top of the mixed layer and penetrate into the stable layer above where it will disperse initially within the stable layer before potentially mixing back down into the mixed layer.
PEMS – Predictive Emissions Monitoring Systems
Potential Temperature – (Θ) The temperature that a parcel of air would reach upon being brought adiabatically down to the near surface pressure level of 1000 mb.
PM – Particulate Matter (Suspended Particulate)
PM_{2.5} – Particulate Matter 2.5 Micron in Diameter and smaller
PM₁₀ – Particulate Matter 10 Micron in Diameter and smaller
ppb – Parts Per Billion
ppm – Parts Per Million
PRIME – Plume Rise Model Enhancements. The algorithm within AERMOD that computes the concentrations for receptors and sources within the disturbed flow around and downwind of a building or structure.
PVMRM – Plume Volume Molar Ratio Method for computing ozone.
Q
QA – Quality Assurance
R
r – Water Vapor Mixing Ratio
RE – Receptors – Discrete and gridded receptor locations and elevations.
RLINE (or R-LINE) – Research LINE is a Line Source dispersion model for Near-Surface Releases. R-LINE is a research grade dispersion model that is currently under development by US EP Office of Research and Development (ORD) for assessing and addressing emissions from roadways.
R_N – Net radiation at the surface
S
SBL – Stable Boundary Layer
SDTS – Spatial Data Transfer Standard
Sensible Heat Flux – (H) The conductive heat flux from the Earth’s surface to the atmosphere.
Similarity Theory – Empirical method defining universal relationships between non-dimensionalized variables in the atmosphere.
SIP – State Implementation Plan
SIZ – Structure Influence Zone

SO – Source – Source types, locations, and parameters/emissions, building parameters for downwash, and source groups
Solar Radiation (incoming) – (R) Solar radiation received at the surface.
Stability – The ability of atmosphere to either enhance or suppress vertical motion
Stable – Vertical movement is suppressed; a parcel tends to return to its original position (Lapse Rate > - 9.8 °K/Km)
Surface Heat Flux – (H) Transfer of heat energy from the surface to the adjacent air without a change in phase (e.g. without evaporation). Also known as sensible heat flux.
Stable Conditions – (L > 0)
Surface Roughness Length – (z_0) Characteristic length scale representing the roughness of the earth’s surface. Typically ranging from 0.001 for ice or smooth water to over a meter for suburban and urban areas.
T
Temperature Scale – (Θ^*) Characteristic temperature of the shear-induced turbulent eddies.
Turbulence – In general, irregular, random, chaotic notion resulting from varying size eddies of air
U
U – Wind Speed
U* – Friction Velocity (see above)
Unstable – Vertical movement is enhanced; a parcel tends to continue in the direction of its initial motion (Lapse Rate < - 9.8 °K/Km)
USGS – United States Geological Survey
UTM – Universal Transverse Mercator, a plane coordinate grid system named for the map projection on which it is based (Transverse Mercator). The UTM system consists of 60 zones, each 6-degrees of longitude in width.
V
Von Karmen Constant – (k) Dimensionless empirical constant in the log wind profile equal to 0.4.
VEE – Visible Emissions Evaluation
VOC – Volatile Organic Compound
W
W* – Convective Velocity Scale
Wind Shear – Variation in wind speed with height from the ground (or with distance from a solid surface such as a building side or top).
WRF – Weather Research and Forecasting Model (prognostic meteorological model)
Z

Z_i – Mixing Height (z_{ic} for convective and z_{im} for stable or mechanical)

Z_o – Surface Roughness Length

Symbols

α – Noontime Albedo

θ^* – Temperature Scale

θ_v – Temperature Scale