Practical Guide for the NASA ESDS Atmospheric Composition Variable Standard Names Convention *Controlled Vocabulary*

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1 Overview

In the ICARTT V2.0 file format standard an additional variable definition, called a standard variable name, is now required in an effort to improve usability, standardization, and machine-readability. The standard variable name is designed to be a tag used along with the PI-generated data product variable short name. This document provides a set of guidelines for constructing standard variable names for different types of measurements conducted during suborbital field studies and provides lists of controlled vocabulary that cover the current list of measurements conducted during the suborbital field studies on atmospheric composition.

The atmospheric composition variable standard names are constructed using four required components, each governed by controlled vocabulary: measurement category (MeasurementCategory), core name (CoreName), acquisition method (AcquisitionMethod), and descriptive attributes (DescriptiveAttributes), with each component separated by an underscore:

Atmospheric Composition Variable Standard Name = MeasurementCategory_CoreName_AcquisitionMethod_DescriptiveAttributes

This structure is designed to enable FAIR principles through data discovery, distribution, interoperability, and use, by accurately describing all variables from different measurements and/or instruments while using a consistent and predictable format. For data discovery, the MeasurementCategory and CoreName (i.e., CoreName themselves and respective definitions) can be used to conduct a broad search to identify all measurements of the same physical quantity from different instruments and/or field studies. The acquisition method then identifies the sampling technique used for the measurement, enhancing the data's reusability, while the DescriptiveAttributes can be used to narrow down the search for data of interest. As discussed in later sections, the number and nature of DescriptiveAttributes are dependent on the type of measurement. The DescriptiveAttributes provide necessary description to support research use while also enhancing the data's reusability. The standard name is meant to be interpreted as a whole for research use. For each of these components, a list of controlled vocabulary exists to maintain interoperability.

1.1 MeasurementCategory

MeasurementCategory broadly groups all standard names into one of thirteen categories based on shared properties and/or types of measurements (Gas, AerComp, AerMP, AerOpt, CldComp, CldMicro, CldMacro, CldOpt, Met, GasJValue, AquJValue, Platform, and Rad). By dividing variables into thirteen categories, the standard name can represent each group with a clearly defined set of descriptive attributes and vocabularies. The types and/or number of attributes have

been tailored to each type of measurement (e.g., aerosol particle optical property vs. aerosol particle composition) or medium (e.g., trace gas vs. aerosol particle); therefore, MeasurementCategory is defined by the measurement medium and type of measurements. The format for every standard name within a MeasurementCategory is consistent (i.e., they have the same number and type of descriptive attributes). For example, all 'Gas' standard names follow the format, Gas_CoreName_AcquisitionMethod_MeasurementSpecificity_Reporting, whereas all meteorology standard names have the following format, Met_CoreName_AcquisitionMethod_None. Additionally, the MeasurementCategory provides uniqueness when using only CoreNames could be ambiguous (e.g., a particle number concentration could be describing cloud or aerosol particles). See Table 1 for a full description of each MeasurementCategory. The variable standard names for each MeasurementCategory are introduced in Section 2.

Table 1: MeasurementCategory

MeasurementCategory	**Description**	**Number of Descriptive Attributes**
Gas	Abundance, relative abundance, or properties of specific trace gas compounds or a group of trace gases measured or reported as one lumped quantity	2
AerMP (Aerosol Microphysical Properties)	Aerosol microphysical properties of particles not segregated by chemical composition, e.g., abundance, relative abundance, size, and size distribution	4
AerComp (Aerosol Particle Composition)	Aerosol chemical (or composition) properties (including as a function of particle size), i.e., abundance or relative abundance of the chemical components, bulk chemical characteristics, and mixing state	3
AerOpt (Aerosol Optical Properties)	Intensive and extensive optical properties and optical hygroscopicity of all sampled aerosol particles or a subgroup of aerosol particles	4
CldComp (Cloud Particle Composition)	Cloud particle chemical composition, ratio of compositions, and chemical characteristics	3

CldMicro (Cloud Microphysical Properties)	Cloud particle abundance, size, and size distribution as well as phase information	3
CldMacro (Cloud Macrophysical Properties)	Cloud macrophysical properties, e.g., spatial coverage	0*
CldOpt (Cloud Optical Properties)	Intensive and extensive optical properties of cloud particles	1
Met	Meteorology parameters	0*
GasJValue	Gas phase photolytic rate coefficients	3
AquJValue	Aqueous phase photolytic rate coefficients	3
Platform	Measurement platform (e.g., aircraft, ship, motor vehicles) position, attitude, and navigational parameters	0*
Rad (Radiation Measurements)	Radiance, irradiance, and actinic flux measurements	1

* While no descriptive attributes exist for these measurement categories, '_None' must be used in place of the DescriptiveAttribute.

1.2 CoreName

The CoreName is a component of the standard name that provides the unambiguous identification of the measurand. Depending on the MeasurementCategory, the reported measurement and representative CoreName can be either an identifier of a trace gas or related property, an aerosol property, cloud property, radiation flux, meteorological parameter, or a measurement platform location and attitude. In some cases, the CoreNames chosen are those that have been commonly used in literature, such as Noy, whereas other times they're an abbreviated version of the physical quantity, such as AOD (Aerosol Optical Depth). As described previously, the terms commonly used in literature are sometimes unlikely to be understood by users outside of the subject area. To enhance the usability, a brief definition is provided along with each CoreName. This description-definition provides additional information for when the core name chosen isn't explicit in what it means.

1.3 AcquisitionMethod

The AcquisitionMethod refers to the sampling technique of the measurement. Four acquisition methods are available to choose from as part of the standard name (Table 2). The modes chosen are similar to the ESA Atmospheric Validation Data Centre (EVDC) acquisition method metadata attributes, which are InSitu, Numerical Simulation, Remote Sensing, and Sample. The complete list is given in Table 2.

Table 2: Controlled Vocabulary for AcquisitionMethod

AcquisitionMethod	Description
InSitu	Sampling in close proximity of the instrument or the sampling platform
VertCol	Measurement of a remotely sensed vertically integrated column, where the column measured is nominally perpendicular to the earth's surface
SlantCol	Measurement of a remotely sensed vertically integrated column, where the column measured is not nominally perpendicular to the earth's surface (e.g., the instrument is sun-tracking)
Profile	Measurement of vertically resolved profile

1.4 DescriptiveAttributes

The descriptive attributes are components of the standard name that provide measurement and/or data reporting information relevant for data use and faceted data search, particularly when comparing results obtained with other methods of observations. The number and types of descriptive attributes are measurement-dependent, but consistent within each MeasurementCategory (Table 1). For example, all trace gas standard names have two required descriptive attributes, MeasurementSpecificity and Reporting, whereas all aerosol optical property standard names have four required descriptive attributes, wavelength (WL), MeasurementRH, SizeRange, and Reporting. Within each of these descriptive attribute fields, e.g., WL, SizeRange, etc., a controlled list of terminology can be used. While some of the descriptive attribute categories overlap, e.g., Reporting, which is a descriptive attribute for Gas, aerosols, and clouds, the list of controlled terms within that attribute is different. The use of the Reporting attribute reflects the practice that one measurement can be reported in different ways for different applications. For certain measurements, DescriptiveAttributes may not be necessary. In this case, "None" will be used as the value for this attribute.

The following sections detail the controlled vocabulary for CoreNames and DescriptiveAttributes pertaining to each MeasurementCategory.

2 Standard Variable Names

2.1 Trace Gas Standard Names

The MeasurementCategory for trace gas is "Gas". The associated descriptive attributes are "MeasurementSpecificity" and "Reporting". The "MeasurementSpecificity" attribute specifies whether the CoreName represents a single species (S), combination of multiple species (M), or is not applicable (NA) for a gas phase reaction rate or ratio of species. The "Reporting" attribute describes the way a trace gas is reported, which are defined in Table 3. When reporting in standard temperature and pressure (STP), the temperature and pressure conditions under which the measurement is reported must be noted in the header or metadata of the data file, as "standard temperature" varies across the research community.

Table 3: Trace Gas Measurement Reporting Attributes

Reporting Attributes	**Description**
DVMR	Volumetric mixing ratio with respect to dry air (i.e., no water vapor)
AVMR	Volumetric mixing ratio with respect to ambient (i.e., dry air and water vapor) air
DMF	Molar fraction with respect to dry air
AMF	Molar fraction with respect to ambient (i.e., dry air and water vapor) air
ConcSTP	Number or mass concentration reported at standard temperature and pressure
ConcAMB	Number or mass concentration reported at ambient temperature and pressure
CNDAMB	Column integrated number density reported at ambient temperature and pressure
d13C	Deviations in the $^{13}C/^{12}C$ Stable Carbon Isotope Ratio relative to a standard
d14C	Deviations in the $^{14}C/^{12}C$ Carbon Isotope Ratio relative to a standard
dD	Deviations in the D/H Stable Hydrogen Isotope Ratio relative to a standard
d18O	Deviations in the $^{18}O/^{16}O$ Stable Oxygen Isotope Ratio relative to a standard
None	

The CoreNames for trace gas measurements are given in Table 4. The names of specific species are a combination of chemical formulas and chemical names. The chemical names used for volatile organic carbon species follow a standard nomenclature, which has been agreed upon by multiple measurement groups. In addition, these names are linked, when applicable, to Chemical Abstracts Service (CAS) numbers, which are unique for each chemical compound. Each CoreName has a corresponding MeasurementSpecificity (S, M, or NA) to define whether the CoreName represents a specific chemical compound or group of compounds as some instruments do not have sufficient selectivity to determine individual trace gas species. These data are reported as the sum of multiple species or a group of species. For these lumped measurements, the core names are either those used in literature (e.g., NOy, PNs) or a combination of names for specific compounds (e.g., iButeneAnd1Butene for the sum of Isobutene and 1-Butene) included.

The following examples provide the controlled vocabulary options for AcquisitionMethod, MeasurementSpecificity, and Reporting attribute that can be used in a trace gas variable standard name.

Trace Gases
Gas_CoreName_AcquisitionMethod_MeasurementSpecificity_Reporting
AcquisitionMethod = InSitu, VertCol, SlantCol, Profile
MeasurementSpecificity* = S (single species), M (multiple species), NA (not applicable)
Reporting = DVMR, AVMR, DMF, AMF, ConcSTP, ConcAMB, CNDAMB, d13C, d14C, dD, d18O
*Measurement Specificity corresponding to each CoreName can be found in Table 4

Example for an in-situ measurement of CO2 gas reported in molar fraction with respect to dry air: Gas_CO2_InSitu_S_DMF

Example for an in-situ measurement of total reactive nitrogen species reported in volumetric mixing ratio with respect to ambient air: Gas_NOy_InSitu_M_AVMR

Example for a remote sensing measurement of slant column NO2 gas reported column number density with respect to ambient air: Gas_NO2_SlantColumn_S_CNDAMB

Table 4 provides a list of trace gas CoreNames, along with definition, chemical formula, CAS number, and MeasurementSpecificity. For convenience, 7 subgroups are used to categorize the variables: Oxygen Species, Hydrogen Species and Radicals; Nitrogen Species; Sulfur Species; Halogens and Halogenates; Hydrocarbons: Alkanes, Alkenes, and Alkynes; Hydrocarbons: Aromatics; and Oxygenated Inorganic and Volatile Organic Carbon Species, similar to the terms used in the Global Change Master Directory (GCMD).

Table 4: Trace Gas CoreNames and Definitions

CoreName	**Definition**	**Chemical Formula**	**CAS Number**	**Specificity**
Oxygen Species, Hydrogen Species and Radicals				
H2	Hydrogen	H2	1333-74-0	S
O2	Oxygen	O2	7782-44-7	S
O2toN2ratio	Ratio of Oxygen to Nitrogen	N/A	N/A	NA
APO	Atmospheric Potential Oxygen (O2 + 1.1 x (CO2 - 350))	N/A	N/A	NA
HO2	Hydroperoxy radical	HO2	3170-83-0	S
CH3O2	Methylperoxy radical	CH3O2	2143-58-0	S
RO2	Sum of Organic Peroxy radicals	N/A	N/A	M

CoreName	Definition	Chemical Formula	CAS Number	Specificity
HO2AndRO2	Sum of Hydroperoxy radical and Organic Peroxy radicals	N/A	N/A	M
OH	Hydroxyl radical	OH	3352-57-6	S
OHR	OH Reactivity - proxy for OH loss frequency or a measure of OH oxidation capacity	N/A	N/A	NA
H2O2	Hydrogen peroxide	H2O2	7722-84-1	S
O3	Ozone	O3	10028-15-6	S
O1D	O(1D)	O		S
O3P	O(3P)	O		S
H	Hydrogen atom	H	12385-13-6	S
HCO	Formyl radical	HCO	2597-44-6	S
CH3	Methyl radical	CH3	2229-07-4	S
CH3O	Methoxy radical	CH3O	2143-68-2	S
C2H5O	Ethoxy radical	C2H5O	2154-50-9	S
CH3COO2	Peroxyacetyl radical	C2H3O3	36709-10-1	S
CH3COO	Acetoxy radical	C2H3O2	N/A	S
CH3CH2	Ethyl radical	C2H5	2025-56-1	S
CH3CO	Acetyl radical	C2H3O	3170-69-2	S
Nitrogen Species				
NH3	Ammonia	NH3	7664-41-7	S
NF3	Nitrogen trifluoride	NF3	7783-54-2	S
N2O	Nitrous oxide	N2O	10024-97-2	S
NO	Nitric oxide	NO	10102-43-9	S
NO2	Nitrogen dioxide	NO2	10102-44-0	S
NO3	Nitrate radical	NO3	12033-49-7	S
N2O5	Nitrogen pentoxide	N2O5	10102-03-01	S
HNO2	Nitrous acid	HNO2	7782-77-6	S

CoreName	Definition	Chemical Formula	CAS Number	Specificity
HNO3	Nitric acid	HNO3	7697-37-2	S
HNO4	Peroxynitric acid	HNO4	26404-66-0	S
HCN	Hydrogen cyanide	HCN	74-90-8	S
ClCN	Cyanogen Chloride	ClCN	506-77-4	S
CH3CN	Acetonitrile	C2H3N	75-05-8	S
HNCO	Isocyanic acid	HNCO	75-13-8	S
Acrylonitrile	Acrylonitrile	C3H3N	107-13-1	S
MeAcrylonitrile	Methylacrylonitrile	C4H5N	126-98-7	S
PropNitrile	Propanenitrile	C3H5N	107-12-0	S
BenzNitrile	Benzonitrile	C7H5N	100-47-0	S
Pyrrole	Pyrrole	C4H5N	109-97-7	S
C4H5N	Sum of C4H5N isomers	C4H5N	N/A	M
Pyridine	Pyridine	C5H5N	110-86-1	S
Nitromethane	Nitromethane	CH3NO2	75-52-5	S
ClNO2	Nitryl chloride	ClNO2	13444-90-1	S
ClONO2	Chlorine nitrate	ClNO3	14545-72-3	S
MeONO2	Methyl nitrate	CH3NO3	598-58-3	S
EthONO2	Ethyl nitrate	C2H5NO3	625-58-1	S
nPropONO2	n-Propyl nitrate	C3H7NO3	627-13-4	S
iPropONO2	Isopropyl nitrate	C3H7NO3	1712-64-7	S
nButONO2	n-Butyl nitrate	C4H9NO3	928-45-0	S
x2ButONO2	2-Butyl nitrate	C4H9NO3	924-52-7	S
iButONO2	Isobutyl nitrate	C4H9NO3	543-29-3	S
iButONO2And2ButONO2	Sum of Isobutyl nitrate and 2-Butyl nitrate	C4H9NO3	N/A	M
tButONO2	t-Butyl nitrate	C4H9NO3	0926-05-06	S
nPentONO2	n-Pentyl nitrate	C5H11NO3	1002-16-0	S
x2PentONO2	2-Pentyl nitrate	C5H11NO3	21981-48-6	S

CoreName	Definition	Chemical Formula	CAS Number	Specificity
x3PentONO2	3-Pentyl nitrate	C5H11NO3	N/A	S
iPentONO2	Isopentyl nitrate	C5H11NO3	543-87-3	S
x3Me2ButONO2	3-Methyl-2-butyl nitrate	C5H11NO3	N/A	S
x2OxoEthONO2	2-Oxoethyl nitrate	C2H3NO4	72673-15-5	S
AcetylONO2	Acetyl nitrate	C2H3NO4	591-09-3	S
PAN	Peroxyacetyl nitrate	C2H3NO5	2278-22-0	S
APAN	Peroxyacryloyl nitrate	C3H3NO5	N/A	S
PPN	Peroxylpropionyl nitrate	C3H5NO5	5796-89-4	S
PBN	Peroxybutyryl nitrate	C4H7NO5	N/A	S
PiBN	Peroxyisobutyric nitrate	C4H7NO5	N/A	S
PPeN	Peroxypentyryl nitrate	C5H9NO5	N/A	M
PBzN	Peroxybenzoyl nitrate	C7H5NO5	N/A	S
MoPN	Methoxy Peroxyacetyl nitrate	C2H6NO6	N/A	S
MPAN	Peroxymethacryloyl nitrate	C4H5NO5	N/A	S
PNs	Sum of Peroxynitrates	N/A	N/A	M
ANs	Sum of Akylnitrates	N/A	N/A	M
NOx	Nitrogen oxides (NO + NO_2)	N/A	N/A	M
NOy	Total Reactive Nitrogen	N/A	N/A	M
NOyasNO2	Total Reactive Nitrogen Converted to NO_2	N/A	N/A	M
NOyasNO	Total Reactive Nitrogen Converted to NO	N/A	N/A	M
x2HydEthONO2	2-Hydroxyethyl nitrate	C2H5NO4	16051-48-2	S
C3H7NO4	Sum of C3H7NO4 Hydroxy nitrates	C3H7NO4	N/A	M
C3H5NO4	Sum of C3H5NO4 Carbonyl nitrates	C3H5NO4	N/A	M
C4H7NO4	Sum of C4H7NO4 Isomers	C4H7NO4	N/A	M
C4H7NO5	Sum of Isomers, including C4 Hydroxy Carbonyl Nitrates	C4H7NO5	N/A	M

CoreName	Definition	Chemical Formula	CAS Number	Specificity
C4H9NO4	Sum of C4H9NO4 Hydroxy nitrates	C4H9NO4	N/A	M
ISOPN	Sum of Isoprene Hydroxy Nitrate Isomers	C5H9NO4	N/A	M
C5H9NO5	Sum of C5H9NO5 Isomers, including Hydroperoxy Nitrates of Isoprene	C5H9NO5	N/A	M
NitroCatechol	Nitrocatechol, aka 4-nitrocatechol	C6H5NO4	3316-09-04	S
NitroGuaiacol	Nitroguaiacol, including 4-Nitroguaiacol and 5-Nitroguaiacol	C7H7NO4	N/A	M
x4NitroGuaiacol	4-Nitroguaiacol	C7H7NO4	3251-56-7	S
x5NitroGuaiacol	5-Nitroguaiacol	C7H7NO4	636-93-1	S
Silicon Species				
C10H30O5Si5	Decamethylcyclopentasiloxane	C10H30O5Si5	541-02-6	S
Sulfur Species				
CS2	Carbon disulfide	CS2	75-15-0	S
CH3SH	Methanethiol	CH4S	74-93-1	S
DMS	Dimethyl sulfide	C2H6S	75-18-3	S
DMDS	Dimethyl disulfide	C2H6S2	624-92-0	S
DMSO	Dimethyl sulfoxide	C2H6OS	67-68-5	S
DMSO2	Dimethyl sulfone	C2H6O2S	67-71-0	S
H2SO4	Sulfuric acid	H2SO4	7664-93-9	S
MSA	Methanesulfonic acid	CH4O3S	75-75-2	S
OCS	Carbonyl sulfide	OCS	463-58-1	S
SF6	Sulfur hexafluoride	SF6	2551-62-4	S
C2H4O3S	Sum of C2H4O3S isomers	C2H4O3S	N/A	M
SO2F2	Sulfuryl fluoride	SO2F2	2699-79-8	S

CoreName	Definition	Chemical Formula	CAS Number	Specificity
SO2	Sulfur dioxide	SO2	7446-09-05	S
HPMTF	Hydroperoxymethyl thioformate	C2H3O3S	N/A	S
Halogens and Halogenates				
Cl	Chlorine atom	Cl	22537-15-1	S
HCl	Hydrogen chloride	HCl	7647-01-0	S
Cl2	Chlorine	Cl2	7782-50-5	S
ClO	Chlorine monoxide	ClO	14989-30-1	S
HOCl	Hypochlorous acid	HOCl	7790-92-3	S
Br	Bromine atom	Br	10097-32-2	S
HBr	Hydrogen bromide	HBr	10035-10-6	S
Br2	Bromine	Br2	7726-95-6	S
BrCl	Bromine chloride	BrCl	13863-41-7	S
BrO	Bromine monoxide	BrO	15656-19-6	S
BrONO	Bromine nitrite	BrNO2	N/A	S
BrONO2	Bromine nitrate	BrNO3	40423-14-1	S
BrNO2	Bromine nitrite	BrNO2	N/A	S
HOBr	Hypobromous acid	HOBr	13517-11-8	S
Br2AndHOBr	Sum of HOBr and Br2	N/A	N/A	M
Br2O	Dibromine monoxide	Br2O	21308-80-5	S
BrCN	Cyanogen Bromide	BrCN	506-68-3	S
I	Iodine atom	I	14362-44-8	S
I2	Iodine	I2	7553-56-2	S
IO	Iodine monoxide	IO	14696-98-1	S
HOI	Hypoiodous acid	HIO	14332-21-9	S
CH3COOCl	Chloroacetic acid	C2H3ClO2	79-11-8	S
CH3Cl	Chloromethane	CH3Cl	74-87-3	S

CoreName	Definition	Chemical Formula	CAS Number	Specificity
CH2Cl2	Dichloromethane	CH2Cl2	75-09-2	S
CHCl3	Chloroform	CHCl3	67-66-3	S
CCl4	Tetrachloromethane	CCl4	56-23-5	S
C2H5Cl	Chloroethane	C2H5Cl	75-00-3	S
CH3CHCl2	1,1-Dichloroethane	C2H4Cl2	75-34-3	S
CH2ClCH2Cl	1,2-Dichloroethane	C2H4Cl2	107-06-02	S
CH3CCl3	Methyl chloroform; 1,1,1-Trichloroethane	C2H3Cl3	71-55-6	S
CHCl2CH2Cl	1,1,2-Trichloroethane	C2H3Cl3	79-00-5	S
CHCl2CHCl2	1,1,2,2-Tetrachloroethane	C2H2Cl4	79-34-5	S
C2H3Cl	Chloroethene	C2H3Cl	75-01-4	S
tCHClCHCl	trans-1,2-Dichloroethene	C2H2Cl2	156-60-5	S
cCHClCHCl	cis-1,2-Dichloroethene	C2H2Cl2	156-59-2	S
CCl2CH2	1,1-Dichloroethene	C2H2Cl2	75-35-4	S
C2HCl3	Trichloroethene	C2HCl3	79-01-6	S
C2Cl4	Tetrachloroethene	C2Cl4	127-18-4	S
x12DiClPropane	1,2-Dichloropropane	C3H6Cl2	78-87-5	S
x123TriClPropane	1,2,3-Trichloropropane	C3H5Cl3	96-18-4	S
x13DiClPropene	1,3-Dichloropropene	C3H4Cl2	542-75-6	S
x23DiCl1Propene	2,3-Dichloro-1-propene	C3H4Cl2	78-88-6	S
HexClButadiene	Hexachlorobutadiene	C4Cl6	87-68-3	S
ClBenzene	Chlorobenzene	C6H5Cl	108-90-7	S
pDiClBenzene	1,4-Dichlorobenzene	C6H4Cl2	106-46-7	S
mDiClBenzene	1,3-Dichlorobenzene	C6H4Cl2	541-73-1	S
oDiClBenzene	1,2-Dichlorobenzene-	C6H4Cl2	95-50-1	S
x124TriClBenzene	1,2,4-Trichlorobenzene	C6H3Cl3	120-82-1	S
x123TriClBenzene	1,2,3-Trichlorobenzene	C6H3Cl3	87-61-6	S
x135TriClBenzene	1,3,5-Trichlorobenzene	C6H3Cl3	108-70-3	S

CoreName	Definition	Chemical Formula	CAS Number	Specificity
aClToluene	Benzyl chloride	C7H7Cl	100-44-7	S
oClToluene	1-Chloro-2-methylbenzene	C7H7Cl	95-49-8	S
pClToluene	1-Chloro-4-methylbenzene	C7H7Cl	95-49-8	S
mClToluene	1-Chloro-3-methylbenzene	C7H7Cl	108-41-8	S
CH3Br	Bromomethane	CH3Br	74-83-9	S
CH2Br2	Dibromomethane	CH2Br2	74-95-3	S
CHBr3	Bromoform	CHBr3	75-25-2	S
C2H5Br	Bromoethane	C2H5Br	74-96-4	S
CH2BrCH2Br	1,2-Dibromoethane	C2H4Br2	106-93-4	S
nC3H7Br	n-Propyl bromide	C3H7Br	106-94-5	S
BrBenzene	Bromobenzene	C6H5Br	108-86-1	S
CH3I	Iodomethane	CH3I	74-88-4	S
CH2I2	Diiodomethane	CH2I2	75-11-6	S
C2H5I	Iodoethane	C2H5I	75-03-6	S
CH2BrCl	Bromochloromethane	CH2BrCl	74-97-5	S
CHBr2Cl	Dibromochloromethane	CHBr2Cl	124-48-1	S
CHBrCl2	Bromodichloromethane	CHBrCl2	75-27-4	S
CH2BrCHBrCH2Cl	1,2-Dibromo-3-chloropropane	C3H5Br2Cl	96-12-8	S
CH2ClI	Chloroiodomethane	CH2ClI	593-71-5	S
CH2BrI	Bromoiodomethane	CH2BrI	557-68-6	S
CFC11	Trichlorofluoromethane	CCl3F	75-69-4	S
CFC12	Dichlorodifluoromethane	CCl2F2	75-71-8	S
CFC13	Chlorotrifluoromethane	CClF3	75-72-9	S
CF4	Tetrafluoromethane	CF4	75-73-0	S
CFC112	Tetrachloro-1,2-difluoroethane	C2Cl4F2	76-12-0	S
CFC112a	Tetrachloro-2,2-difluoroethane	C2Cl4F2	76-11-9	S
CFC113	1,1,2-Trichlorotrifluoroethane	C2Cl3F3	76-13-1	S

CoreName	Definition	Chemical Formula	CAS Number	Specificity
CFC114	1,2-Dichlorotetrafluoroethane	C2Cl2F4	76-14-2	S
CFC115	Chloropentafluoroethane	C2ClF5	76-15-3	S
C2F6	Hexafluoroethane	C2F6	76-16-4	S
PCBTF	1-Chloro-4-(trifluoromethyl)benzene	C7H4ClF3	98-56-6	S
H1202	Dibromodifluoromethane	CBr2F2	75-61-6	S
H1211	Bromochlorodifluoromethane	CBrClF2	353-59-3	S
H1301	Bromotrifluoromethane	CBrF3	75-63-8	S
H2402	1,2-Dibromotetrafluoroethane	C2Br2F4	124-73-2	S
HCFC123	1,1-Dichloro-2,2,2-trifluoroethane	C2HCl2F3	306-83-2	S
HCFC124	1-Chloro-1,2,2,2-tetrafluoroethane	C2HClF4	2837-89-0	S
HCFC141b	1,1-Dichloro-1-fluoroethane	C2H3Cl2F	1717-00-6	S
HCFC142b	1-Chloro-1,1-difluoroethane	C2H3ClF2	75-68-3	S
HCFC133a	1-Chloro-2,2,2-trifluoroethane	C2H2ClF3	75-88-7	S
HCFC21	Dichlorofluoromethane	CHCl2F	75-43-4	S
HCFC22	Chlorodifluoromethane	CHClF2	75-45-6	S
HFC125	Pentafluoroethane	C2HF5	354-33-6	S
HFC134a	1,1,1,2-Tetrafluoroethane	C2H2F4	811-97-2	S
HFC143a	1,1,1-Trifluoroethane	C2H3F3	420-46-2	S
HFC152a	1,1-Difluoroethane	C2H4F2	75-37-6	S
C3F8	Octafluoropropane	C3F8	76-19-7	S
HFC23	Trifluoromethane	CHF3	75-46-7	S
HFC227ea	1,1,1,2,3,3,3-Heptafluoropropane	C3HF7	431-89-0	S
HFC32	Difluoromethane	CH2F2	75-10-5	S
HFC245fa	1,1,1,3,3-Pentafluoropropane	C3H3F5	460-73-1	S
HFC236fa	1,1,1,3,3,3-Hexafluoropropane	C3H2F6	690-39-1	S
HFC365mfc	1,1,1,3,3-Pentafluorobutane	C4H5F5	406-58-6	S

CoreName	Definition	Chemical Formula	CAS Number	Specificity
CycC4F8	Octafluorocyclobutane	C4F8	115-25-3	S
Hydrocarbons: Alkanes, Alkenes, and Alkynes				
CH4	Methane	CH4	74-82-8	S
x13CH4	^{13}CH4-Methane	^{13}CH4	14762-74-4	S
x14CH4	^{14}CH4-Methane	^{14}CH4	2772-68-1	S
CH3D	CH3D-Methane	CH3D	676-49-3	S
Ethane	Ethane	C2H6	74-84-0	S
Ethene	Ethene	C2H4	74-85-1	S
Ethyne	Ethyne	C2H2	74-86-2	S
Propane	Propane	C3H8	74-98-6	S
Propene	Propene	C3H6	0115-07-01	S
Propyne	Propyne	C3H4	74-99-7	S
Propadiene	Propadiene	C3H4	463-49-0	S
nButane	n-Butane	C4H10	106-97-8	S
iButane	Isobutane	C4H10	75-28-5	S
iButene	Isobutene	C4H8	0115-11-7	S
x1Butene	1-Butene	C4H8	106-98-9	S
iButeneAnd1Butene	Sum of Isobutene and 1-Butene	C4H8	N/A	M
c2Butene	cis-2-Butene	C4H8	590-18-1	S
t2Butene	trans-2-Butene	C4H8	624-64-6	S
CycButane	Cyclobutane	C4H8	287-23-0	S
x13Butadiene	1,3-Butadiene	C4H6	106-99-0	S
x12Butadiene	1,2-Butadiene	C4H6	590-19-2	S
x1Butyne	1-Butyne	C4H6	107-00-6	S
x2Butyne	2-Butyne	C4H6	503-17-3	S
x1Buten3yne	1-Buten-3-yne	C4H4	689-97-4	S
x13Butadiyne	1,3-Butadiyne	C4H2	460-12-8	S

CoreName	Definition	Chemical Formula	CAS Number	Specificity
nPentane	n-Pentane	C5H12	109-66-0	S
iPentane	Isopentane	C5H12	78-78-4	S
Neopentane	Neopentane	C5H12	463-82-1	S
x1Pentene	1-Pentene	C5H10	109-67-1	S
c2Pentene	cis-2-Pentene	C5H10	627-20-3	S
t2Pentene	trans-2-Pentene	C5H10	0646-04-08	S
x2Me1Butene	2-Methyl-1-butene	C5H10	563-46-2	S
x3Me1Butene	3-Methyl-1-butene	C5H10	563-45-1	S
x2Me2Butene	2-Methyl-2-butene	C5H10	513-35-9	S
CycPentane	Cyclopentane	C5H10	287-92-3	S
CycPentene	Cyclopentene	C5H8	142-29-0	S
Z13Pentadiene	(Z)-1,3-Pentadiene	C5H8	1574-41-0	S
E13Pentadiene	(E)-1,3-Pentadiene	C5H8	2004-70-8	S
x13Pentadienes	Sum of (E)-1,3-Pentadiene and (Z)-1,3-Pentadiene	C5H8	504-60-9	M
Isoprene	Isoprene	C5H8	78-79-5	S
IsopreneAndFuran	Sum of Isoprene and Furan	N/A	N/A	M
nHexane	n-Hexane	C6H14	110-54-3	S
x2MePentane	2-Methylpentane	C6H14	107-83-5	S
x3MePentane	3-Methylpentane	C6H14	96-14-0	S
MePentanes	Sum of 2-Methylpentane and 3-Methylpentane	C6H14	N/A	M
x22DimeButane	2,2-Dimethylbutane	C6H14	75-83-2	S
x23DimeButane	2,3-Dimethylbutane	C6H14	79-29-8	S
x1Hexene	1-Hexene	C6H12	592-41-6	S
x2Me1Pentene	2-Methyl-1-pentene	C6H12	763-29-1	S
x32Me1Pentene	3-Methyl-1-pentene	C6H12	760-20-3	S
x4Me1Pentene	4-Methyl-1-pentene	C6H12	691-37-2	S
x3Me1PenteneAnd4Me1	Sum of 3-Methyl-1-pentene and	C6H12	N/A	M

CoreName	Definition	Chemical Formula	CAS Number	Specificity
Pentene	4-Methyl-1-pentene			
x2Me2Pentene	2-Methyl-2-pentene	C6H12	625-27-4	S
Z3Me2Pentene	(Z)-3-Methyl-2-pentene	C6H12	922-62-3	S
E3Me2Pentene	(E)-3-Methyl-2-pentene	C6H12	616-12-6	S
x3Me2Pentenes	Sum of (Z)-3-Methyl-2-pentene and (E)-3-Methyl-2-pentene	C6H12	922-61-2	M
Z4Me2Pentene	(Z)-4-Methyl-2-pentene	C6H12	691-38-3	S
E4Me2Pentene	(E)-4-Methyl-2-pentene	C6H12	674-76-0	S
x4Me2Pentenes	Sum of (Z)-4-Methyl-2-pentene and (E)-4-Methyl-2-pentene	C6H12	4461-48-7	M
CycHexane	Cyclohexane	C6H12	110-82-7	S
MeCycPentane	Methylcyclopentane	C6H12	96-37-7	S
nHeptane	n-Heptane	C7H16	142-82-5	S
x2MeHexane	2-Methylhexane	C7H16	591-76-4	S
x3MeHexane	3-Methylhexane	C7H16	589-34-4	S
x22DimePentane	2,2-Dimethylpentane	C7H16	590-35-2	S
x23DimePentane	2,3-Dimethylpentane	C7H16	565-59-3	S
x24DimePentane	2,4-Dimethylpentane	C7H16	108-08-07	S
x33DimePentane	3,3-Dimethylpentane	C7H16	562-49-2	S
x1Heptene	1-Heptene	C7H14	592-76-7	S
MeCycHexane	Methylcyclohexane	C7H14	108-87-2	S
nOctane	n-Octane	C8H18	111-65-9	S
x224TrimePentane	2,2,4-Trimethylpentane	C8H18	540-84-1	S
x234TrimePentane	2,3,4-Trimethylpentane	C8H18	565-75-3	S
x2MeHeptane	2-Methylheptane	C8H18	592-27-8	S
x3MeHeptane	3-Methylheptane	C8H18	589-81-1	S
x1Octene	1-Octene	C8H16	111-66-0	S
nNonane	n-Nonane	C9H20	111-84-2	S
x1Nonene	1-Nonene	C9H18	124-11-8	S

CoreName	Definition	Chemical Formula	CAS Number	Specificity
aPinene	alpha-Pinene	C10H16	80-56-8	S
bPinene	beta-Pinene	C10H16	127-91-3	S
Camphene	Camphene	C10H16	79-92-5	S
Tricyclene	Tricyclene	C10H16	508-32-7	S
aTerpinene	alpha-Terpinene	C10H16	99-86-5	S
gTerpinene	gamma-Terpinene	C10H16	99-85-4	S
Myrcene	Myrcene	C10H16	123-35-3	S
Limonene	Sum of D-Limonene and L-Limonene	C10H16	138-86-3	M
LimoneneAndD3Carene	Sum of Limonene and Δ3-Carene	C10H16	N/A	M
bPineneAndMyrcene	Sum of beta-Pinene and Myrcene	C10H16	N/A	M
Sabinene	Sabinene	C10H16	3387-41-5	S
dLimonene	D-Limonene	C10H16	5989-27-5	S
Terpinolene	Terpinolene	C10H16	586-62-9	S
Monoterpenes	Sum of Monoterpenes	C10H16	N/A	M
nDecane	n-Decane	C10H22	124-18-5	S
x1Decene	1-Decene	C10H20	872-05-9	S
nUndecane	n-Undecane	C11H24	1120-21-4	S
nDodecane	nDodecane	C12H26	112-40-3	S
Dodecane	Sum of all dodecane isomers	C12H26	N/A	M
aCedrene	alpha-cedrene	C15H24	469-61-4	S
aHumulene	alpha-Humulene	C15H24	6753-98-6	S
Hydrocarbons: Aromatics and Oxygenated Aromatics				
Benzene	Benzene	C6H6	71-43-2	S
Toluene	Toluene	C7H8	108-88-3	S
oXylene	o-Xylene	C8H10	95-47-6	S

CoreName	Definition	Chemical Formula	CAS Number	Specificity
mXylene	m-Xylene	C8H10	108-38-3	S
pXylene	p-Xylene	C8H10	106-42-3	S
EthBenzene	Ethylbenzene	C8H10	100-41-4	S
mpXylene	Sum of m-Xylene and p-Xylene	C8H10	N/A	M
EthBenzAndmpXylene	Sum of Ethylbenzene and mp-Xylene	C8H10	N/A	M
C8Aromatics	Sum of C8-Aromatics	C8H10	N/A	M
Styrene	Styrene	C8H8	100-42-5	S
Ethynylbenzene	Ethynylbenzene	C8H6	536-74-3	S
C9Aromatics	Sum of C9-Aromatics	C9H12	N/A	M
nPropBenzene	n-Propylbenzene	C9H12	103-65-1	S
iPropBenzene	Isopropylbenzene	C9H12	98-82-8	S
x123TrimeBenzene	1,2,3-Trimethylbenzene	C9H12	526-73-8	S
x124TrimeBenzene	1,2,4-Trimethylbenzene	C9H12	95-63-6	S
x135TrimeBenzene	1,3,5-Trimethylbenzene	C9H12	108-67-8	S
x2EthToluene	2-Ethyltoluene	C9H12	611-14-3	S
x3EthToluene	3-Ethyltoluene	C9H12	620-14-4	S
x4EthToluene	4-Ethyltoluene	C9H12	622-96-8	S
pCymene	para-Cymene	C10H14	99-87-6	S
C10Aromatics	Sum of C10-Aromatics	C10H14	N/A	M
tButBenzene	tert-Butylbenzene	C10H14	98-06-6	S
nButBenzene	n-Butylbenzene	C10H14	104-51-8	S
mDiethBenzene	1,3-Diethylbenzene	C10H14	141-93-5	S
pDiethBenzene	1,4-Diethylbenzene	C10H14	105-05-05	S
oDiethBenzene	1,2-Diethylbenzene	C10H14	135-01-03	S
C11Aromatics	Sum of C11-Aromatics	C11H16	N/A	M
Naphthalene	Naphthalene	C10H8	91-20-3	S
Benzaldehyde	Benzaldehyde	C7H6O	100-52-7	S

CoreName	Definition	Chemical Formula	CAS Number	Specificity
DHT	Sum of Dihydroxytoluene Isomers	C7H8O2	N/A	M
Phenol	Phenol	C6H5OH	108-95-2	S
Cresols	Sum of Cresol Isomers (Hydroxytoluenes)	C7H8O	N/A	M
Creosol	Creosol	C8H10O2	93-51-6	S
Oxygenated Inorganic and Volatile Organic Carbon Species				
CO	Carbon monoxide	CO	630-08-0	S
CO2	Carbon dioxide	CO2	124-38-9	S
x13CO2	13CO2-Carbon dioxide	^{13}CO2	1111-72-4	S
x14CO2	14CO2-Carbon dioxide	^{14}CO2	51-90-1	S
x18OCO	18OCO-Carbon dioxide	^{18}OCO	N/A	S
C3O2	Carbon suboxide	C3O2	504-64-3	S
CHOCHO	Glyoxal	C2H2O2	107-22-2	S
CH3COCHO	Methyl glyoxal	C3H4O2	78-98-8	S
CH3OH	Methanol	CH4O	67-56-1	S
CH2O	Formaldehyde	CH2O	50-00-0	S
CH3OOH	Methyl hydroperoxide	CH4O2	3031-73-0	S
HMHP	Hydroxymethyl hydroperoxide	CH4O3	15932-89-5	S
HCOOH	Formic acid	CH2O2	64-18-6	S
C2H5OH	Ethanol	C2H6O	64-17-5	S
CH3CHO	Acetaldehyde	C2H4O	75-07-0	S
EtO	Ethylene Oxide	C2H4O	75-21-8	S
Glycolaldehyde	Glycolaldehyde	C2H4O2	141-46-8	S
CH3COOH	Acetic acid	C2H4O2	64-19-7	S
CH3COOHAndGlycolaldehyde	Sum of Acetic Acid and Glycolaldehyde	C2H4O2	N/A	M
MeFormate	Methyl Formate	C2H4O2	107-31-3	S

CoreName	Definition	Chemical Formula	CAS Number	Specificity
HAA	Hydroxyacetic acid; Glycolic acid	C2H4O3	79-14-1	S
PAA	Peracetic Acid	C2H4O3	79-21-0	S
iPropanol	Isopropanol	C3H8O	67-63-0	S
Propanal	Propanal	C3H6O	123-38-6	S
Acetone	Acetone	C3H6O	67-64-1	S
AcetoneAndPropanal	Sum of Acetone and Propanal	C3H6O	N/A	M
Acrolein	Acrolein	C3H4O	107-02-08	S
C3H6O2	Sum of C3H6O2 Isomers, including Hydroxyacetone	C3H6O2	N/A	M
EthFormate	Ethyl Formate	C3H6O2	109-94-4	S
MeAcetate	Methyl acetate	C3H6O2	79-20-9	S
C2H5COOH	Propanoic acid	C3H6O2	79-09-4	S
C3H6O3	Sum of C3H6O3 Isomers, including Hydroperoxy Acetone	C3H6O3	N/A	M
Butanal	Butanal	C4H8O	123-72-8	S
iButanal	Isobutanal	C4H8O	78-84-2	S
MEK	Methyl Ethyl Ketone	C4H8O	78-93-3	S
THF	Tetrahydrofuran	C4H8O	109-99-9	S
ButanalAndMEK	Sum of Butanal and MEK	C4H8O	N/A	M
C4Carbonyls	Sum of C4-Carbonyls	C4H8O	N/A	M
EthAcetate	Ethyl acetate	C4H8O2	141-78-6	S
MePropionate	Methyl propionate	C4H8O2	554-12-1	S
x14Dioxane	1,4-Dioxane	C4H8O2	123-91-1	S
C4H8O3	Sum of C4H8O3 Isomers, including C4 Dihydroxy Carbonyls	C4H8O3	N/A	M
MAC	Methacrolein	C4H6O	78-85-3	S
MVK	Methyl Vinyl Ketone	C4H6O	78-94-4	S
MVKAndMAC	Sum of MVK and Methacrolein	C4H6O	N/A	M

CoreName	Definition	Chemical Formula	CAS Number	Specificity
E2Butenal	(E)-2-Butenal, trans-Crotonaldehyde	C4H6O	123-73-9	S
Z2Butenal	(Z)-2-Butenal, cis-Crotonaldehyde	C4H6O	15798-64-8	S
x2Butenals	Sum of (Z)- and (E)-2-Butenal isomers, Crotonaldehyde	C4H6O	4170-30-3	M
x23Butanedione	2,3-Butanedione	C4H6O2	431-03-8	S
C4H6O3	Sum of C4H6O3 Isomers, including C4 Hydroxy Dicarbonyls	C4H6O3	N/A	M
Furan	Furan	C4H4O	110-00-9	S
x2Furanone	2-Furanone, including 2(5H)Furanone and 2(3H)Furanone	C4H4O2	N/A	M
x23HFuranone	2(3H)-Furanone	C4H4O2	20825-71-2	S
x25HFuranone	2(5H)-Furanone	C4H4O2	497-23-4	S
SuccinicAnhyd	Succinic anhydride	C4H4O3	108-30-5	S
C4H4O3	Sum of C4H4O3 Isomers	C4H4O3	N/A	M
MaleicAnhyd	Maleic anhydride	C4H2O3	108-31-6	S
MTBE	Methyl Tert-Butyl Ether	C5H12O	1634-04-04	S
MBO	2-Methyl-3-buten-2-ol	C5H10O	115-18-4	S
Pentanal	Pentanal	C5H10O	110-62-3	S
x2Pentanone	2-Pentanone	C5H10O	107-87-9	S
x3Pentanone	3-Pentanone	C5H10O	96-22-0	S
C5Carbonyls	Sum of C5-Carbonyls	C5H10O	N/A	M
ISOPOOHAndIEPOX	Sum of ISOPOOH and IEPOX	C5H10O3	N/A	M
IEPOX	Sum of Isoprene Epoxy Diol Isomers	C5H10O3	N/A	M
ISOPOOH	Sum of Isoprene Hydroxy Hydroperoxide Isomers	C5H10O3	N/A	M
C5H8O3	Sum of C5O3H8 Compounds, including HPALDs Isomers	C5H8O3	N/A	M

CoreName	Definition	Chemical Formula	CAS Number	Specificity
x2MeFuran	2-Methylfuran	C5H6O	534-22-5	S
x3MeFuran	3-Methylfuran	C5H6O	930-27-8	S
x2MeFuranAnd3MeFuran	Sum of 2-methylfuran 3-methylfuran and fragments	C5H6O	N/A	M
Furfural	Furfural	C5H4O2	98-01-1	S
x3Furaldehyde	3-Furaldehyde	C5H4O2	498-60-2	S
HPALDs	Sum of HPALDs	C5H8O3	N/A	M
Hexanal	Hexanal	C6H12O	66-25-1	S
x2Hexanone	2-Hexanone	C6H12O	591-78-6	S
x3Hexanone	3-Hexanone	C6H12O	589-38-8	S
C6Carbonyls	Sum of C6-Carbonyls	C6H12O	N/A	M
CycHexanone	Cyclohexanone	C6H10O	108-94-1	S
C6H10O5	Sum of Levoglucosan and other C6H10O5 species	C6H10O5	N/A	M
DimeFurans	Sum of Dimethylfurans	C6H8O	N/A	M
x25DimeFuran	2,5-dimethylfuran	C6H8O	625-86-5	S
x24DimeFuran	2,4-dimethylfuran	C6H8O	3710-43-8	S
x23DimeFuran	2,3-Dimethylfuran	C6H8O	14920-89-9	S
x2EthFuran	2-Ethylfuran	C6H8O	3208-16-0	S
x3EthFuran	3-Ethylfuran	C6H8O	67363-95-5	S
Phenol	Phenol	C6H6O	108-95-2	S
x2EthenylFuran	2-Ethenylfuran	C6H6O	1487-18-9	S
x3EthenylFuran	3-Ethenylfuran	C6H6O	67364-02-7	S
C6H6O	Sum of Phenol and other C6H6O species	C6H6O	N/A	M
x5MeFurfural	5-methylfurfural	C6H6O2	620-02-0	S
Catechol	Catechol	C6H6O2	120-80-9	S
C6H6O2	Sum of Catechol and other C6H6O2 species	C6H6O2	N/A	M
C6H4O3	Hydroxybenzoquinone –	C6H4O3	N/A	M

CoreName	Definition	Chemical Formula	CAS Number	Specificity
	including any compounds that can be viewed as derivatives of a benzoquinone			
Anisole	Anisole	C7H8O	100-66-3	S
C7H8O	Sum of C7H8O Isomers	C7H8O	N/A	M
Guaiacol	Guaiacol	C7H8O2	90-05-1	S
BenzFuran	Benzofuran	C8H6O	271-89-6	S
Syringol	Syringol	C8H10O3	91-10-1	S
C9H14O4	Sum of Pinic Acid and other C9H14O4 species	C9H14O4	N/A	M
C10H16O3	Sum of Pinonic Acid and other C10H16O3 species	C10H16O3	N/A	M
Linalool	Linalool	C10H18O	78-70-6	S
Terpineol	Terpineol	C10H18O	8006-39-1	S
aTerpineol	alpha-Terpineol	C10H18O	98-55-5	S
Geraniol	Geraniol	C10H18O	N/A	M
tGeraniol	trans-Geraniol	C10H18O	106-24-1	S
cGeraniol	cis-Geraniol	C10H18O	106-25-2	S
SabineneHydrate	Sabinene hydrate	C10H18O	546-79-2	S
Borneol	Borneol	C10H18O	N/A	M
Pulegone	Pulegone	C10H16O	89-82-7	S
LFenchone	L-Fenchone	C10H16O	7787-20-4	S
Fenchol	Fenchol	C10H16O	2217-02-09	S
Camphor	Camphor	C10H16O	N/A	M
Guaiol	Guaiol	C15H26O	489-86-1	S
tNeroidol	trans-Neroidol	C15H26O	40716-66-3	S

2.2 Aerosol Particle Standard Names

Aerosol particles have been divided into three MeasurementCategories: “AerMP”, “AerComp”, or “AerOpt” for aerosol particle microphysical properties, aerosol particle composition, and aerosol particle optical properties, respectively. Within each of these category groups, measurements of the same type (i.e, microphysical properties, particle composition, or optical

properties) have the same number of descriptive attributes. AerMP has four DescriptiveAttributes: MeasurementRH, SizingTechnique, SizeRange, and Reporting; AerComp has three DescriptiveAttributes: SizingTechnique, SizeRange, and Reporting; and AerOpt has four DescriptiveAttributes: MeasurementRH, WL, SizeRange, and Reporting. Within each of these DescriptiveAttribute fields, a controlled list of terminology exists. See Tables 5, 6, 7, 8, and 9 for complete lists and descriptions. The CoreNames for aerosol variables are listed in Table 10 for microphysical properties, Table 11 for aerosol composition, and Table 12 for aerosol optical properties.

For aerosol particle microphysical and optical measurements, relative humidity (RH) conditions are important because water vapor can condense onto the particle and change its size and optical properties. In-situ aerosol particle measurements can be made or calculated at different RH levels. Table 5 defines the three possible modes of aerosol particle measurements related to relative humidity levels (MeasurementRH): RHd, RHa, and RHsp. If "RHsp" is used, the relative humidity at which the measurement is reported must be documented in the variable description.

Table 5: List of Possible Aerosol Particle Measurement RH values

MeasurementRH	**Description**
RHd	Variable reported at a reduced relative humidity, typically less than 40%
RHa	Variable reported at ambient relative humidity
RHsp	Variable reported at a specified relative humidity
None	Not applicable to variable

SizingTechnique is an important descriptive attribute because the measurement of the size of a single particle can vary when using different techniques (based on the properties of the particle, such as its composition, shape, and density). Each technique has inherent assumptions, limitations, and operable ranges that are vital for proper interpretation and comparison of the data. Table 6 defines the values of "SizingTechnique" representing the different measurement techniques for particle size determination. If the SizingTechnique is "None", the SizeRange used must be "Bulk", which is typically for measurements that are not size resolved.

Table 6: List of Aerosol Particle SizingTechniques

SizingTechnique	**Description**
Mobility	The electrical mobility diameter is the diameter of a sphere with the same migration velocity in a constant electric field as the particle of interest (i.e., migration velocity in a constant electric field; DeCarlo et al., 2004)
Optical	Size measurement made using the intensity of light scattered by a particle, related to particle size using a prescribed

	refractive index and assumed spherical shape
Aerodynamic	The aerodynamic diameter is defined as the diameter of a sphere with standard density that settles at the same terminal velocity as the particle of interest (DeCarlo et al., 2004)
VacuumAerodynamic	The vacuum aerodynamic diameter is measured in a free-molecular flow regime (that is, in conditions where the ratio of the mean free path of the gas molecules to the size of the particle >> 1); DeCarlo et al., 2004)
LII	LII (Laser-induced incandescence) size is the refractory black carbon size derived from mass measurement and assumptions of void free density (1.8 g/cc) and spherical shape. Refractory black carbon mass is determined from incandescent light intensity at vaporization temperature
Imaging	Measurement of a particle's size using an image
Geometric	Geometric size derived from direct measurement(s)
Kelvin	Kelvin size refers to the smallest size at which condensation occurs at a particular supersaturation, as the saturation vapor pressure is dependent on the particle radius of curvature. Kelvin size is determined by varying the supersaturation of a vapor and counting the number droplets that activate
None	No specific size determination – Bulk measurement

The “SizeRange” delineates the range of particle sizes being measured. There are six possible SizeRanges that can be used: Nucl, Accu, Coarse, Bulk, PMx, and XtoY, where X and Y can be Nucl, Accu, or Coarse, e.g., NucltoAccu (Table 7). When “Bulk” is used, SizingTechnique must be “None”.

Table 7: Summary of Aerosol Particle Size Ranges

SizeRange	**Description**
Nucl	Nucleation-mode aerosol particles: 0.001-0.1 um diameter
Accu	Accumulation-mode aerosol particles: 0.1-1 um diameter
Coarse	Coarse-mode aerosol particles: greater than 1 um diameter
Bulk	Measurement not size resolved
PMx	Particles with diameter under X um diameter, e.g., PM2.5

SizeRange	Description
XtoY	Size Range from X to Y, e.g., NucltoAccu

Aerosol particle optical properties are functions of wavelengths (WL) of light. Therefore, a measurement of aerosol particle optical properties is made at one or more specific wavelength(s). Table 8 lists the values for "WL" attributes, specifying the wavelength ranges within which instruments commonly operate.

Table 8: List of Wavelength Ranges for Aerosol Particle Optical Property Measurements

WL	Description
UV	Ultraviolet: 10- 400 nm
Blue	450 – 495 nm
Green	495 – 570 nm
Red	620 – 700 nm
IR	Infrared: 700 – 10^6 nm
XtoY	Wavelength range from X to Y E.g., BluetoRed

Lastly, aerosol particle standard names have a DescriptiveAttribute to indicate the reporting method used. Each of the three aerosol MeasurementCategories have different reporting attributes based on the measurement reporting needs of that category. For example, aerosol particle chemical compositions can be reported as mass concentrations at either standard temperature and pressure (STP) or ambient temperature and pressure (AMB), mass fractions, number fractions, or number concentrations. In comparison, aerosol particle microphysical and optical properties can be reported at either STP, AMB, or specific environment (EnvSp). When reporting in STP, the temperature and pressure conditions under which the measurement is reported must be noted in the header or metadata of the data file, as "standard temperature" varies across the research community. Similarly, if the reporting attribute is "EnvSp", the specific environment temperature and pressure must be referenced in the header or variable description. For variables that are dimensionless (e.g., fRH, SSA) the reporting attribute is "None". See Table 9 for an explanation of each of these options.

Table 9: Reporting Attribute Values for Aerosol Particle Measurements

MeasurementCategory	Reporting	Description
AerComp	MassSTP	Mass concentration reported at standard temperature and pressure
AerComp	MassAMB	Mass concentration reported at ambient temperature and pressure

MeasurementCategory	Reporting	Description
AerComp	MassFrac	Mass Fraction - Ratio of a constituent mass to the total aerosol particle mass concentration
AerComp	NumFrac	Number Fraction - Ratio of a constituent number to the total aerosol particle number concentration
AerComp	NumConcSTP	Number concentration of particle constituent at standard temperature and pressure
AerComp	NumConcAMB	Number concentration of particle constituent at ambient temperature and pressure
AerMP, AerOpt	STP	Aerosol particle properties reported at standard temperature and pressure
AerMP, AerOpt	AMB	Aerosol particle properties reported at ambient temperature and pressure
AerMP, AerOpt	None	For dimensionless variables
AerMP, AerOpt	EnvSp	Aerosol particle properties reported in a specific environment (e.g., mobile vehicle) with specified temperature and pressure

2.2.1 Aerosol Particle Microphysical Property Standard Names

The MeasurementCategory for aerosol microphysical properties is "AerMP". Aerosol microphysical property standard names have four descriptive attributes to adequately define the measurements for use: MeasurementRH (Table 5), SizingTechnique (Table 6), SizeRange (Table 7), and Reporting (Table 9). Table 10 provides the controlled vocabulary for aerosol microphysical property CoreNames and definitions.

The following example provides the controlled vocabulary options for the AcquisitionMethod (Table 2) and DescriptiveAttributes.

Aerosol Particle Microphysical Properties:
AerMP_CoreName_AcquisitionMethod_MeasurementRH_SizingTechnique_SizeRange_Reporting
AcquisitionMethod = InSitu, VertCol, SlantCol, Profile
MeasurementRH = RHd, RHa, RHsp, None
SizingTechnique = Mobility, Optical, Aerodynamic, VacuumAerodynamic, LII, Imaging, Geometric, Kelvin, None
SizeRange = Nucl, Accu, Coarse, Bulk, PM1, PMx, XtoY
Reporting = STP, AMB, None, EnvSp

Example of an in-situ measurement of aerosol particle number size distribution reported at reduced relative humidity derived from an aerodynamic sizing technique for coarse-mode aerosols at standard temperature and pressure:
AerMP_NumSizeDist_InSitu_RHd_Aerodynamic_Coarse_STP

Table 10: Aerosol Microphysical Property Measurement CoreNames

MeasurementCategory	**CoreName**	**Definition**
AerMP	NumConc	Number Concentration of Aerosol Particles
AerMP	NonVolatileNumConc	Non-Volatile Number Concentration of Aerosol Particles
AerMP	SurfAreaConc	Surface Area Concentration of Aerosol Particles
AerMP	NonVolatileSurfAreaConc	Non-Volatile Surface Area Concentration of Aerosol Particles
AerMP	VolConc	Volume Concentration of Aerosol Particles
AerMP	NonVolatileVolConc	Non-Volatile Volume Concentration of Aerosol Particles
AerMP	CCN	Cloud Condensation Nuclei Number Concentration
AerMP	CCNtoCNRatio	Cloud Condensation Nuclei to Condensation Nuclei Ratio
AerMP	INP	Ice Nucleating Particles
AerMP	gRH	Aerosol Particle Size Growth Factor
AerMP	MassSizeDist	Mass Size Distribution i.e., mass concentration expressed as a function of aerosol particle size.
AerMP	MassConc	Mass Concentration of Aerosol Particles
AerMP	NonVolatileMassSizeDist	Non-Volatile Mass Concentration Size Distribution of Aerosol Particles
AerMP	NumSizeDist	Number Concentration Size Distribution of Aerosol Particles
AerMP	NonVolatileNumSizeDist	Non-Volatile Number Size Distribution of Aerosol Particles
AerMP	SurfAreaSizeDist	Surface Area Concentration Size Distribution of Aerosol Particles
AerMP	NonVolatileSurfAreaSizeDist	Non-Volatile Surface Area

MeasurementCategory	CoreName	Definition
		Concentration Size Distribution
AerMP	VolSizeDist	Volume Concentration Size Distribution of Aerosol Particles
AerMP	NonVolatileVolSizeDist	Non-Volatile Volume Concentration Size Distribution of Aerosol Particles
AerMP	EffSize	Aerosol Particle Effective Size – Surface Area Weighted Average Size
AerMP	EffVar	Aerosol Particle Effective Variance – Width of Aerosol Size Distribution
AerMP	MeanSize	Aerosol Particle Mean Size (Radius or Diameter)
AerMP	MedianSize	Aerosol Particle Median Size (Radius or Diameter)
AerMP	MeanVolumeSize	Aerosol Particle Mean Size (Radius or Diameter) weighted by Volume
AerMP	MedianVolumeSize	Aerosol Particle Median Size (Radius or Diameter) weighted by Volume
AerMP	BCFracIM	Black Carbon Faction of Internally Mixed
AerMP	BCCoatThick	Black Carbon Coating Thickness

2.2.2 Aerosol Particle Chemical Composition Standard Names

The MeasurementCategory for aerosol composition measurements is "AerComp". Aerosol chemical composition standard names have three descriptive attributes: SizingTechnique (Table 6), SizeRange (Table 7), and Reporting (Table 9). Table 11 provides the controlled vocabulary for aerosol composition CoreNames and definitions.

The following example provides the controlled vocabulary options for AcquisitionMethod (Table 2) and DescriptiveAttributes.

Aerosol Particle Chemical Composition:
AerComp_CoreName_AcquisitionMethod_SizingTechnique_SizeRange_Reporting
AcquisitionMethod = InSitu, VertCol, SlantCol, Profile
SizingTechnique = Mobility, Optical, Aerodynamic, VacuumAerodynamic, LII, Imaging, Geometric, Kelvin, None
SizeRange = Nucl, Accu, Coarse, Bulk, PM1, PMx, XtoY
Reporting = MassSTP, MassAMB, MassFrac, NumFrac, NumConcSTP, NumConcAMB

Example of an in-situ measurement of organic aerosols particles derived using a vacuum aerodynamic technique for accumulation-mode aerosol particles reported as mass concentration

at standard temperature and pressure:
AerComp_OrganicAerosol_InSitu_VacuumAerodynamic_Accu_MassSTP

Example of an in-situ measurement of bulk sea salt particles reported in number fraction:
AerComp_Seasalt_InSitu_None_Bulk_NumFrac

Table 11: List of Aerosol Chemical Composition Measurement CoreNames

MeasurementCategory	**CoreName**	**Definition**
AerComp	Acidity	Aerosol Particle Acidity
AerComp	BC	Particulate Black Carbon
AerComp	BCMassSizeDist	Particulate Black Carbon Mass Size Distribution
AerComp	BCNumSizeDist	Particulate Black Carbon Number Size Distribution
AerComp	Bromide	Particulate Bromide Ion
AerComp	Calcium	Particulate Calcium Ion
AerComp	Chloride	Particulate Chloride Ion
AerComp	Potassium	Particulate Potassium Ion
AerComp	Magnesium	Particulate Magnesium Ion
AerComp	Iodine	Particulate Iodide Ion, including iodide, iodate, and organic-bound iodine
AerComp	Sodium	Particulate Sodium Ion
AerComp	Nitrite	Particulate Nitrite Ion
AerComp	Nitrate	Particulate Nitrate Ion
AerComp	OrganicAerosol	Particulate organic matter, including carbon and all other elements (e.g., H, O, N) in organic molecules
AerComp	OrganicCarbon	Carbon contained in particulate organic matter, not including the mass of other elements in the organic molecules (e.g., H, O, N)
AerComp	HtoORatio	Hydrogen to Oxygen Ratio in Organic particulate matter
AerComp	Oxalate	Particulate Oxalate Ion
AerComp	Sulfate	Particulate Sulfate Ion

MeasurementCategory	CoreName	Definition
AerComp	SulfateSizeDist	Particulate Sulfate Ion as a function of particle size
AerComp	Dimethylamine	Particulate Dimethylamine
AerComp	TotalMass	Total Particulate Mass - Sum of individual composition measurements
AerComp	WSOC	Particulate Water Soluble Organic Carbon, a subset of OrganicAerosol and OrganicCarbon, including only the mass of carbon (and not H, O, N) in the water-soluble molecules
AerComp	Ammonium	Particulate Ammonium Ion
AerComp	Acid	Particulate Aerosol Acid
AerComp	NegativeIon	Total Particulate Negative Ions
AerComp	PositiveIon	Total Particulate Positive Ions
AerComp	BBParticles	Biomass Burning Particles
AerComp	Mineral	Mineral Particles
AerComp	Seasalt	Sea Salt Particles
AerComp	Soot	Soot Particles from combustion processes
AerComp	Beryllium7	Particulate Beryllium7
AerComp	Lead210	Particulate Lead210
AerComp	MSA	Particulate Methanesulfonic Acid Mass
AerComp	ClO4	Particulate Perchlorate Mass
AerComp	AmmBalance	Molar ratio of Ammonium to other inorganic ions in Particulate Matter
AerComp	Density	Particulate Matter Density
AerComp	OADensity	Particulate Organic Matter Density
AerComp	OAtoOC	Ratio of Organic Particulate Matter to Organic Carbon (OC)
AerComp	OSc	Particulate Carbon Oxidation State
AerComp	OrgNitrFraction	Particulate Fraction of nitrate coming from organic nitrates

MeasurementCategory	CoreName	Definition
AerComp	BioAerosol	Particulate Biological Aerosol

2.2.3 Aerosol Particle Optical Property Standard Names

The MeasurementCategory for aerosol optical property measurements is "AerOpt". Aerosol optical property standard names have four descriptive attributes to adequately define the measurements for use: WL (Table 8), MeasurementRH (Table 5), SizeRange (Table 7), and Reporting (Table 9). Table 12 provides the controlled vocabulary for aerosol optical property CoreNames and definitions.

The following example provides the controlled vocabulary options for AcquisitionMethod (Table 2) and DescriptiveAttributes.

Aerosol Particle Optical Properties:
AerOpt_CoreName_AcquisitionMethod_WL_MeasurementRH_SizeRange_Reporting
AcquisitionMethod = InSitu, VertCol, SlantCol, Profile
WL = UV, Blue, Green, Red, IR, XtoY
MeasurementRH = RHd, RHa, RHsp, None
SizeRange = Nucl, Accu, Coarse, Bulk, PM1, PMx, XtoY
Reporting = STP, AMB, None, EnvSp

Example of an in-situ measurement of absorption measured at a red wavelength under reduced humidity conditions with a bulk aerosol particle size range reported in ambient conditions:
AerOpt_Absorption_InSitu_red_RHd_Bulk_AMB

Table 12: Aerosol Optical Property Measurement CoreNames

MeasurementCategory	CoreName	Definition
AerOpt	Absorption	Light absorption coefficient of Aerosol Particle
AerOpt	AbsorptionBrC	Aerosol particle measurement of light absorbance by particulate organic carbon
AerOpt	AbsorptionBrCLiquid	Liquid based measurement of light absorbance by particulate organic carbon
AerOpt	Scattering	Light scattering coefficient of Aerosol Particle
AerOpt	BackScattering	Light backscattering coefficient of Aerosol Particle
AerOpt	Extinction	Light extinction coefficient of Aerosol Particle

MeasurementCategory	CoreName	Definition
AerOpt	KExinction	Light extinction cross section of Aerosol Particle
AerOpt	LidarRatio	Ratio of Aerosol Extinction Coefficient to Backscattering Coefficient of Aerosol Particles
AerOpt	AerosolType	Classification of Aerosol Particles Determined from Optical Properties
AerOpt	AngstromExponentAbs	Angstrom Exponent for Absorption Coefficients of aerosol particles
AerOpt	AngstromExponentScat	Aerosol Particle Angstrom Exponent for Scattering Coefficients
AerOpt	AngstromExponentBackScat	Aerosol Particle Angstrom Exponent for Backscattering Coefficients
AerOpt	AngstromExponentExt	Aerosol Particle Angstrom Exponent for Extinction Coefficients
AerOpt	AngstromExponentAOD	Aerosol Particle Angstrom Exponent for Aerosol Optical Depth
AerOpt	DepolarizationRatio	Aerosol Particle Depolarization Ratio
AerOpt	TotalDepolarizationRatio	Aerosol Particle and Molecular Depolarization Ratio
AerOpt	SSA	Single Scattering Albedo of aerosol particles
AerOpt	AsymmetryParameterScat	Aerosol Particle Scattering Asymmetry Parameter
AerOpt	fRHScat	Aerosol Particle Scattering Hygroscopicity Factor
AerOpt	fRHBC	Particulate Black Carbon Specific Scattering Hygroscopicity Factor
AerOpt	Gamma	Aerosol Particle Scattering Hygroscopicity Gamma Factor
AerOpt	PhaseFunctionExt	Aerosol Particle Extinction Phase Function
AerOpt	PhaseFunctionScat	Aerosol Particle Scattering Phase Function
AerOpt	PolarPhaseFunctionScat	Aerosol Particle Scattering Polarized Phase Function
AerOpt	m	Real Component of Particulate

MeasurementCategory	CoreName	Definition
		Refractive Index
AerOpt	k	Imaginary Component of Particulate Refractive Index
AerOpt	n	Particulate Complex Refractive Index
AerOpt	AOD	Column-Integrated aerosol particle extinction coefficient
AerOpt	AAOD	Column-Integrated Absorption Aerosol Optical Depth

2.3 Cloud Standard Names

Similar to aerosol particle variables, the MeasurementCategory for measurements of cloud properties are "CldOpt" for optical properties, "CldComp" for chemical composition, "CldMicro" for microphysical properties, and "CldMacro" for macrophysical properties. CoreNames for the variables in each of these categories are given in Table 15. The DescriptiveAttributes for CldMicro and CldComp are SizingTechnique, SizeRange, and Reporting. For CldOpt, the DescriptiveAttribute is WL for wavelength of light. There are no DescriptiveAttributes associated with CldMacro (i.e., DescriptiveAttributes = None).

SizingTechnique is an important property because a single cloud particle can have a different size based on the particle's composition and shape, depending on which technique is used. Each technique has inherent assumptions, limitations, and operable ranges that are vital for proper interpretation and comparison of the data. The cloud particle size can be determined by one of two different techniques: Imaging or Optical. If there is no specific size determination (e.g., bulk measurements), the SizingTechnique is "None". In this case, the SizeRange must be "Bulk". See Table 11 for a description of these techniques.

Table 11: Summary of Cloud Particle Sizing Techniques

SizingTechnique	Description
Imaging	Measurement of a particle's size using an image.
Optical	Size derived from the intensity of light scattered by a particle, related to particle size using a prescribed refractive index of 1.33 (for water).
None	No specific size determination – Bulk measurement

Another DescriptiveAttribute associated with CldMicro and CldComp variables is SizeRange. SizeRange delineates the range of measured particle sizes, which can be categorized as either droplets ("Drop"), precipitation ("Precip"), or "Bulk". When "Bulk" is used, the accompanying SizingTechnique must be "None". Table 12 specifies the SizeRange for each of these ranges.

Table 12: Specification of Cloud Particle Size Ranges

SizeRange	**Description**
Drop	Droplets: Particle size range: 2-50 um diameter
Precip	Precipitation: Particle size range: greater than 50 um diameter
Bulk	Measurement not size resolved
XtoY	Size Range from X to Y, e.g., DroptoPrecip

Cloud optical properties are functions of wavelengths of light. Therefore, a measurement of cloud optical properties is made at a specific wavelength. Table 13 lists the WL DescriptiveAttributes specifying the wavelength ranges within which instruments commonly operate.

Table 13: List Wavelength Ranges for Cloud Optical Property Measurements

WL Attributes	**Description**
UV	Ultraviolet: 10- 400 nm
Blue	440 - 490 nm
Green	490 - 570 nm
Red	620 - 700 nm
IR	Infrared: 700 - 10^6 nm
XtoY	Ratio of a measurement at X wavelength to the same measurement at Y wavelength. E.g., BluetoRed

Table 14: Reporting Attribute Values for Cloud Measurements

Reporting	**Description**
MassSTP	Mass concentration reported at standard temperature and pressure
MassAMB	Mass concentration reported at ambient temperature and pressure
MassFrac	Mass Fraction - Ratio of a constituent mass to the total aerosol cloud mass concentration
NumFrac	Number Fraction - Ratio of a constituent number to the total particle number concentration

Reporting	Description
NumConc	Number concentration of particle constituent
STP	Cloud properties reported at standard temperature and pressure
AMB	Cloud properties reported at ambient temperature and pressure
None	For dimensionless variables

Cloud Variables for Microphysical Properties:
CldMicro_CoreName_AcquisitionMethod_SizingTechnique_SizeRange_Reporting
AcquisitionMethod = InSitu, VertCol, SlantCol, Profile
SizingTechnique = Imaging, Optical, None
SizeRange = Drop, Precip, Bulk, XtoY
Reporting = STP, AMB, None

Example of an in-situ measurement of cloud particle number size distribution derived from an optical sizing technique measuring droplets being reported at ambient conditions:
CldMicro_NumSizeDist_InSitu_Optical_Drop_AMB

Cloud Variables for Chemical Composition:
CldComp_CoreName_AcquisitionMethod_SizingTechnique_SizeRange_Reporting
AcquisitionMethod = InSitu, VertCol, SlantCol, Profile
SizingTechnique = Imaging, Optical, None
SizeRange = Drop, Precip, Bulk, XtoY
Reporting = MassSTP, MassAMB, MassFrac, NumFrac, NumConc

Example of an in-situ measurement of the mass concentration of sodium derived from a chemical technique where the particle measurement is not size resolved reported at ambient conditions:
CldComp_Sodium_InSitu_None_Bulk_MassAMB

Cloud Variables for Optical Properties:
CldOpt_CoreName_AcquisitionMethod_WL
AcquisitionMethod = InSitu, VertCol, SlantCol, Profile
WL = UV, Blue, Green, Red, IR, or XtoY

Example of an in-situ measurement of cloud particle extinction coefficient measured in the blue wavelength: CldOpt_Extinction_InSitu_Blue

Cloud Variables for Macrophysical Properties:
CldMacro_CoreName_AcquisitionMethod_None
AcquisitionMethod = InSitu, VertCol, SlantCol, Profile

Example of an in-situ measurement of cloud top height: CldMacro_CTH_InSitu_None

Table 15: List of CoreNames for Cloud Property Measurements

MeasurementCategory	CoreName	Definition
CldMicro	CrossSectionalAreaSizeDist	Cloud Particle Cross Section Area Concentration Size Distribution
CldMicro	MassSizeDist	Cloud Particle Mass Concentration Size Distribution
CldMicro	NumSizeDist	Cloud Particle Number Concentration Size Distribution
CldMicro	NumConc	Cloud Particle Number Concentration
CldMicro	SurfAreaConc	Cloud Particle Surface Area Concentration
CldMicro	VolConc	Cloud Particle Volume Concentration
CldMicro	SurfAreaSizeDist	Cloud Particle Surface Area Concentration Size Distribution
CldMicro	VolSizeDist	Cloud Particle Volume Concentration Size Distribution
CldMicro	MeanSize	Cloud Particle Mean Size (Radius or Diameter)
CldMicro	MedianSize	Cloud Particle Median Size (Radius or Diameter)
CldMicro	MeanVolumeSize	Cloud Particle Mean Size (Radius or Diameter) weighted by Volume
CldMicro	MedianVolumeSize	Cloud Particle Median Size (Radius or Diameter) weighted by Volume
CldMicro	EffSize	Cloud Particle Effective Radius or Diameter
CldMicro	EffVar	Cloud Particle Effective Variance
CldMicro	LWC	Cloud Particle Liquid Water Content
CldMicro	IWC	Cloud Particle Ice Water Content
CldMicro	TWC	Cloud Particle Total Water content
CldMacro	LWP	Liquid Water Path – Column Integrated Liquid Water Content
CldMacro	CTH	Cloud Top Height
CldMacro	CBH	Cloud Bottom Height
CldOpt	Extinction	Cloud Particle Extinction Coefficient

MeasurementCategory	CoreName	Definition
CldOpt	OD	Cloud Optical Depth
CldComp	INP	Ice Nucleating Particles
CldComp	Sodium	Sodium in Cloud Water
CldComp	Chloride	Chloride in Cloud Water
CldComp	Calcium	Calcium in Cloud Water
CldComp	Ammonium	Ammonium in Cloud Water
CldComp	Potassium	Potassium in Cloud Water
CldComp	Magnesium	Magnesium in Cloud Water
CldComp	Sulfate	Sulfate in Cloud Water
CldComp	Nitrate	Nitrate in Cloud Water
CldComp	Oxalate	Oxalate in Cloud Water
CldComp	Lithium	Lithium in Cloud Water
CldComp	Beryllium	Beryllium in Cloud Water
CldComp	Boron	Boron in Cloud Water
CldComp	Aluminum	Aluminum in Cloud Water
CldComp	Silicon	Silicon Cloud Water
CldComp	Phosphorus	Phosphorus Cloud Water
CldComp	Sulfur	Sulfur Cloud Water
CldComp	Titanium	Titanium Cloud Water
CldComp	Vanadium	Vanadium Cloud Water
CldComp	Chromium	Chromium Cloud Water
CldComp	Manganese	Manganese in Cloud Water
CldComp	Iron	Iron in Cloud Water
CldComp	Cobalt	Cobalt in Cloud Water
CldComp	Nickel	Nickel in Cloud Water
CldComp	Copper	Copper in Cloud Water
CldComp	Zinc	Zinc in Cloud Water
CldComp	Arsenic	Arsenic in Cloud Water

MeasurementCategory	CoreName	Definition
CldComp	Selenium	Selenium in Cloud Water
CldComp	Rubidium	Rubidium in Cloud Water
CldComp	Strontium	Strontium in Cloud Water
CldComp	Yttrium	Yttrium in Cloud Water
CldComp	Zirconium	Zirconium in Cloud Water
CldComp	Niobium	Niobium in Cloud Water
CldComp	Molybdenum	Molybdenum in Cloud Water
CldComp	Ruthenium	Ruthenium in Cloud Water
CldComp	Palladium	Palladium in Cloud Water
CldComp	Silver	Silver in Cloud Water
CldComp	Cadmium	Cadmium Cloud Water
CldComp	Tin	Tin in Cloud Water
CldComp	Tellurium	Tellurium in Cloud Water
CldComp	Caesium	Caesium in Cloud Water
CldComp	Barium	Barium in Cloud Water
CldComp	Hafnium	Hafnium in Cloud Water
CldComp	Tantalum	Tantalum in Cloud Water
CldComp	Osmium	Osmium in Cloud Water
CldComp	Platinum	Platinum in Cloud Water
CldComp	Gold	Gold in Cloud Water
CldComp	Mercury	Mercury in Cloud Water
CldComp	Thallium	Thallium in Cloud Water
CldComp	Lead	Lead in Cloud Water
CldComp	DMA	DMA in Cloud Water
CldComp	Glycolate	Glycolate Cloud Water
CldComp	Acetate	Acetate in Cloud Water
CldComp	MSA	MSA in Cloud Water
CldComp	Nitrite	Nitrite in Cloud Water

MeasurementCategory	CoreName	Definition
CldComp	Bromide	Bromide in Cloud Water
CldComp	Glutarate	Glutarate in Cloud Water
CldComp	Adipate	Adipate in Cloud Water
CldComp	Succinate	Succinate in Cloud Water
CldComp	Maleate	Maleate in Cloud Water
CldComp	OrganicCarbon	Organic Carbon in Cloud Water
CldComp	Formate	Formate in Cloud Water
CldComp	Pyruvate	Pyruvate in Cloud Water
CldComp	Glyoxylate	Glyoxylate in Cloud Water
CldComp	Phthalate	Phthalate in Cloud Water
CldComp	Chlorine	Chlorine in Cloud Water
CldComp	Germanium	Germanium in Cloud Water
CldComp	Bromine	Bromine in Cloud Water
CldComp	Antimony	Antimony in Cloud Water
CldComp	Iodine	Iodine in Cloud Water
CldComp	Cerium	Cerium in Cloud Water
CldComp	Tungsten	Tungsten in Cloud Water
CldComp	Rhenium	Rhenium in Cloud Water
CldComp	Iridium	Iridium in Cloud Water
CldComp	Thorium	Thorium in Cloud Water
CldComp	Uranium	Uranium in Cloud Water
CldComp	WSOC	Water Soluble Organic Carbon in Cloud Water

2.4 Meteorology Standard Names

The MeasurementCategory for meteorology parameters is “Met”. CoreNames for meteorology variables are listed in Table 16. There are no DescriptiveAttributes associated with meteorology variables (i.e., DescriptiveAttributes = None).

Meteorology Parameters:
Met_CoreName_AcquisitionMethod_None
AcquisitionMethod = InSitu, VertCol, SlantCol, Profile

Example of an in-situ measurement of static temperature:
Met_StaticAirTemperature_InSitu_None

Table 16: List of CoreNames for Meteorological Measurements

CoreName	**Definition**
StaticPressure	Ambient atmospheric static pressure
StaticAirTemperature	Ambient static air temperature
PotentialTemperature	Potential temperature
DewPoint	Temperature to which air must be cooled to become saturated with respect to liquid water (or frost)
PartialPressureH2O	Partial pressure of water vapor in air
H2OMRV	Volumetric water vapor mixing ratio
H2OMR	Mass mixing ratio of water vapor to dry air mass
H2OdD	Deviations in the D/H Stable Hydrogen Isotope Ratio relative to H_2O vapor
H2Od18O	Deviations in the $^{18}O/^{16}O$ Stable Oxygen Isotope Ratio relative to H_2O vapor
H2OTotalDMR	Mass mixing ratio of total water (vapor + liquid + ice) over dry air
VWP	Vapor Water Path – column integrated water vapor content
SpecificHumidity	Ratio of the mass of water vapor to the total mass of air (ambient air)
VaporDensity	Absolute Humidity: Ratio of the mass of water vapor present to the volume occupied by ambient air
RelativeHumidityIce	Relative Humidity over Ice
RelativeHumidityWater	Relative Humidity over Water
SatVaporPressureH2OIce	Saturation Vapor Pressure over Ice – Equilibrium saturation water vapor pressure with respect to water ice
SatVaporPressureH2OWater	Saturation Vapor Pressure over liquid Water – Equilibrium saturation water vapor pressure with respect to liquid water
SurfaceTemperature	Temperature of large-area of subjects, e.g., Sea or other large water surface, cloud, or terrain

CoreName	Definition
SurfacePressure	The atmospheric pressure at a given location on the earth's surface
UWindSpeed	E-W Horizontal Wind Speed
VWindSpeed	N-S Horizontal Wind Speed
WWindSpeed	Vertical Wind Speed
UstdWindSpeed	Standard deviation of E-W Horizontal Wind Speed
VstdWindSpeed	Standard deviation of N-S Horizontal Wind Speed
WstdWindSpeed	Standard deviation of Vertical Wind Speed
UWindVariance	Variance of the E-W Horizontal Wind Speed
VWindVariance	Variance of the N-S Horizontal Wind Speed
WWindVariance	Variance of the vertical Wind Speed
WindSpeed	Scalar Wind Speed
WindDirection	Wind Direction, positive North
SolarAzimuthAngle	Solar Azimuth Angle
SolarZenithAngle	Solar Zenith Angle
Ustar	Friction Velocity
Wstar	Convective Velocity Scale
PV	Potential Vorticity
TKE	Turbulent Kinetic Energy
TEDR	Turbulent Dissipation Rate
REYN	Reynolds Number
LatentHeatFlux	Latent Heat Flux
SensibleHeatFlux	Sensible Heat Flux
Obukhov	Obukhov length
BoundaryLayerHeight	Height of planetary boundary layer defined by constant potential temperature
BufferLayerHeight	Height of Buffer Layer typically marked by a distinct temperature inversion
MixedLayerHeight	Height of the planetary boundary layer defined by an aerosol particle gradient

CoreName	Definition
TropopausePressure	The pressure at the Tropopause
TropopauseHeight	The height of the Tropopause
TropopauseTemperature	The temperature at the Tropopause
GeopotentialHeight	A vertical coordinate that adjusts for changes in gravity at different locations on the surface of the Earth relative to mean sea level
RainAccumulation	The cumulative amount of rain over a defined period of time
RainDuration	The period of time in which continuous rainfall is observed
RainRate	The intensity of rain over a specified interval of time
HailAccumulation	The cumulative amount of hail over a defined period of time
HailDuration	The period of time in which continuous hail is observed
HailRate	The intensity of hail over a specified interval of time

2.5 Platform Navigation and Attitude Standard Names

This group of standard names is for variables describing measurement platform (e.g., aircraft, ship, and motor vehicles) location and attitude (if applicable) as a function of sampling time. The value of MeasurementCategory for this group is "Platform". CoreNames for navigation variables are listed in Table 17. There is no need for further description (i.e., DescriptiveAttributes always has the value of "None"), and the AcquisitionMethod is always "InSitu".

Platform Navigation:
Platform_CoreName_AcquisitionMethod_None
AcquisitionMethod = InSitu

Example of an in-situ measurement for aircraft Yaw angle: Platform_YawAngle_InSitu_None

Table 17: List of CoreNames for Measurement Platform Navigation and Attitude

CoreName	Description
Latitude	The angle between the equatorial plane and the straight line that passes through a point of interest and through (or close to) the center of the Earth
Longitude	The angle east or west of a reference meridian to another meridian that passes through a point of interest
AltitudePressure	Elevation above a standard datum air-pressure plane
AltitudeAGL	Height above ground level

CoreName	Description
AltitudeMSL	Height above mean sea surface level
AltitudeEllipsoid	Height above Ellipsoid**
AltitudeGeoid	Height about Geoid
HeadingTrue	Direction of nose orientation, positive cardinal north
HeadingMagnetic	Direction of nose orientation, positive magnetic north
TrackAngle	Vehicle track over ground reference, positive cardinal north
DriftAngle	Angle difference between HeadingTrue and TrackAngle
PitchAngle	Angle between horizontal axis and the longitudinal axis of the vehicle, positive nose up
RollAngle	Angle between horizontal axis and the lateral axis of the vehicle, positive right wing down
YawAngle	Angle about a vertical axis between vehicle longitudinal axis and the direction of motion of the vehicle, positive right
AngleofAttack	Angle between the chord line of the aircraft and the relative wind
AircraftTrueAirSpeed	Speed of air flow with respect to the aircraft
GroundSpeed	Horizontal speed of vehicle with respect to the earth's surface
AircraftIndicatedAirSpeed	Derived vehicle speed from pitot-static system components (Static and Impact pressure)

** Reference ellipsoid must be defined in variable long name and/or in file header

2.6 Photolysis Rate Standard Names

The MeasurementCategory for photolysis rate variables is either GasJvalue for gas phase photolysis or AquJvalue for aqueous phase photolysis processes. The CoreNames for the photolysis rates (Table 18) consist of "j" plus the CoreName of the gas phase reactants previously given in Table 4. There are no aqueous phase photolysis rate coefficient measurements from current suborbital field studies. The AcquisitionMethod is "InSitu". Three DescriptiveAttributes are associated with the photolysis variables: "MeasurementDirection", "SpectralCoverage", and "Products". MeasurementDirection describes if the photolysis rates are

derived from downwelling, upwelling, or total (Downwelling and Upwelling) actinic flux measurements. SpectralCoverage indicates whether the spectral range of the measurement spans the entire range of photolysis or only a partial range (e.g., UV/Visible range only), and Products is used to list the products from photolysis reactions, separated by a hyphen ("-"). If no specific products are identified in the photolysis reaction, "Products" has the value of "NoProductsSpecified".

Photolysis Rates:
MeasurementCategory_CoreName_AcquisitionMethod_MeasurementDirection_SpectralCoverage_Products
MeasurementCategory = GasJvalue or AquJvalue
AcquisitionMethod = InSitu
MeasurementDirection = Downwelling, Upwelling, or Total
SpectralCoverage = Partial, Full
Products = Products from photolysis reactions, e.g., NO2-O3P

Example of photolysis rate coefficient for reaction NO2 + hv → NO + O(3P) derived from total actinic flux measurement:
GasJvalue_jNO2_InSitu_Total_Full_NO2-O3P

Example of photolysis rate coefficient for reaction CHBr3 + hv → products derived from downwelling actinic flux measurement:
GasJvalue_jCHBr3_InSitu_Downwelling_Full_NoProductsSpecified

Example of photolysis rate coefficient for reaction HNO4 + hv → HO2 + NO2 derived from total actinic flux measurement:
GasJvalue_jHNO4_InSitu_Total_Partial_HO2-NO2

Table 18: List of CoreNames for Gas Phase Photolytic Rate Coefficients

CoreName	**Definition**
jO3	Rate Coefficient for Photolysis of Ozone
jNO2	Rate Coefficient for Photolysis of Nitrogen Dioxide
jH2O2	Rate Coefficient for Photolysis of Hydrogen Peroxide
jNO3	Rate Coefficient for Photolysis of Nitrate Radical
jN2O5	Rate Coefficient for Photolysis of Nitrogen Pentoxide
jHNO2	Rate Coefficient for Photolysis of Nitrous Acid
jHNO3	Rate Coefficient for Photolysis of Nitric Acid
jHNO4	Rate Coefficient for Photolysis of Peroxynitric acid
jCH2O	Rate Coefficient for Photolysis of Formaldehyde

CoreName	Definition
jCH3CHO	Rate Coefficient for Photolysis of Acetaldehyde
jPropanal	Rate Coefficient for Photolysis of Propanal
jCH3OOH	Rate Coefficient for Photolysis of Methyl Hydroperoxide
jMeONO2	Rate Coefficient for Photolysis of Methyl Nitrate
jEthONO2	Rate Coefficient for Photolysis of Ethyl Nitrate
jPAN	Rate Coefficient for Photolysis of Peroxyacetyl Nitrate
jMAC	Rate Coefficient for Photolysis of Methacrolein
jMVK	Rate Coefficient for Photolysis of Methyl Vinyl Ketone
jMEK	Rate Coefficient for Photolysis of Methyl Ethyl Ketone
jAcetone	Rate Coefficient for Photolysis of Acetone
jEthAcetate	Rate Coefficient for Photolysis of Ethyl Acetate
jMeAcetate	Rate Coefficient for Photolysis of Methyl Acetate
jCHOCHO	Rate Coefficient for Photolysis of Glyoxal
jCH3COCHO	Rate Coefficient for Photolysis of Methyl Glyoxal
j23Butanedione	Rate Coefficient for Photolysis of 2,3-Butanedione
jCl2	Rate Coefficient for Photolysis of Chlorine
jClO	Rate Coefficient for Photolysis of Chlorine Oxide
jClNO2	Rate Coefficient for Photolysis of Nitryl Chloride
jClONO	Rate Coefficient for Photolysis of ClONO
jClONO2	Rate Coefficient for Photolysis of Chlorine Nitrate
jBr2	Rate Coefficient for Photolysis of Bromine to Br+Br
jBrO	Rate Coefficient for Photolysis of Bromine Oxide
jHOBr	Rate Coefficient for Photolysis of Hypobromous Acid
jBrNO	Rate Coefficient for Photolysis of BrNO
jBrONO	Rate Coefficient for Photolysis of BrONO
jBrONO2	Rate Coefficient for Photolysis of BrONO2
jBrNO2	Rate Coefficient for Photolysis of BrNO2
jBrCl	Rate Coefficient for Photolysis of Bromine Chloride

CoreName	Definition
jCHBr3	Rate Coefficient for Photolysis of Bromoform
jButanal	Rate Coefficient for Photolysis of Butanal
jBr2O	Rate Coefficient for Photolysis of Dibromine Monoxide
jHydroxyacetone	Rate Coefficient for Photolysis of Hydroxyacetone

2.7 Radiation Standard Names

The "Rad" MeasurementCategory is a group of standard names that describe radiation measurement variables. The AcquisitionMethod for this category is always "InSitu", and possible CoreNames are given in Table 19. There is only one DescriptiveAttribute, "WLMode", which refers to the spectral measurement mode. WLmode may be three options: "BB" for broadband measurements, "SP" for spectral measurements, and "SC" for measurement-specific spectral channels. While measurement spectral range is important, fully describing it requires specific wavelength information, which is beyond the scope of the broad ranges and controlled vocabulary of standard names. Specific spectral range information should be given in the variable description, e.g., in the long variable name in the ICARTT format.

Radiation Measurements:
Rad_CoreName_InSitu_WLMode
WLMode = BB (broadband), SP (spectral), or SC (specific channels)

Example of an in-situ measurement of Downwelling Diffuse Broadband Solar Irradiance between 0.2 and 3.6 micron: Rad_IrradianceDownwellingDiffuse_InSitu_BB

Table 19: List of CoreNames for Radiation Measurements

CoreName	Definition
Insolation	Amount of solar radiation reaching the Earth's surface
Radiance	Radiant flux emitted, reflected, transmitted or received by a surface, per unit solid angle per unit projected area
RadianceDownwellingZenith	Radiant flux emitted, reflected, transmitted or received by a surface, per unit solid angle per unit projected area, for the radiance measured via a narrow field of view pointed directly at zenith, usually under clouds.
RadianceDownwellingSky	Radiant flux emitted, reflected, transmitted or received by a surface, per unit solid angle per unit projected area, for the radiance measured via a narrow field of view pointed at defined points in the sky, sampling diffuse skylight.
IrradianceDownwellingDirect	Radiant flux received by a surface per unit area, i.e.,

	downwelling direct component of irradiance
IrradianceDownwellingDiffuse	Radiant flux received by a surface per unit area, i.e., downwelling diffuse component of irradiance
IrradianceDownwelling	Radiant flux received by a surface per unit area (downwelling). For solar radiation this is also referred to as global (diffuse and direct) solar irradiance
IrradianceUpwelling	Radiant flux received by a surface per unit area (upwelling)
ActinicFlux	Spherically integrated solar radiation flux in the earth's atmosphere
ActinicFluxDownwelling	Spherically integrated solar radiation flux in the earth's atmosphere, i.e., downwelling component of actinic flux (uncorrected for aircraft attitude)
ActinicFluxUpwelling	Spherically integrated solar radiation flux in the earth's atmosphere, i.e., upwelling component of actinic flux (uncorrected for aircraft attitude)
BrightnessTemperature	The temperature of a black body which radiates the same power per unit solid angle per unit area

3 Maintenance and Future

This document is intended to be a living document that contains detailed instructions on how to construct an atmospheric composition variable standard name and the controlled vocabulary lists for each component of the atmospheric composition variable standard names. To stay relevant to the measurements and user community, CoreNames will be updated and/or modified as part of each major field campaign to represent newly developed measurements or instruments. The vocabulary for descriptive attributes may also be updated, but far less often as the current lists capture all possibilities that are known to exist in the atmospheric composition field study data holdings. The process for creating new CoreNames happens on a case-by-case basis, between the document manager, principal investigator (PI), and other subject matter experts to ensure that the CoreNames follow the general format set forth already in the document (i.e., chemical nomenclature vs literature terminology) and are in line with what is commonly used in the literature and atmospheric composition community. The process for adding new DescriptiveAttributes will be the same process as adding new CoreNames, heavily relying on field experts to decide the best term to use. This document is maintained by Morgan Silverman and the Earth Venture-SubOrbital Support Team (EV-SOS) at the NASA Langley Atmospheric Science Data Center.

4 References

Informative References

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