

Merged datasets for the Wintertime Investigation of Transport, Emissions and Reactivity (WINTER) 2015 campaign.

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Dataset overview

The merged dataset is an aggregation of the measurements made onboard the NSF/NCAR C-130 aircraft during the WINTER 2015 campaign. The purpose of the merged dataset is to make it convenient for the WINTER Science Team to perform joint analysis and intercomparison of the data collected by different instruments. In addition to the measurements, this dataset includes the output of the GEOS-Chem model sampled along the WINTER flight tracks. It also includes some derived parameters, namely, the dry and wet surface areas and volumes of aerosol particles. The WINTER merged datasets are available at the 1 second, 60 second, and the SAGA-AERO measurement timesteps for each of the thirteen research flights (RF01-RF13).

It is important to note that although the merging process includes averaging of all measurements to a common time period, it does not include synchronizing of the measurements to any reference measurement. We assume that the final data posted on the WINTER data archive has been synchronized, as needed. Secondly, the notes in the header sections of the individual instrument ICARTT files have not been replicated in the merged data file headers. We recommend referring to the instrument ICARTT file headers for information on measurement uncertainties, instrument LODs, data processing notes, etc.

Data processing

The main step in the generating the merged dataset is the mapping of the measurement time periods of each instrument to the time periods selected for the merged data. This mapping follows the procedure below:

$$\overline{M(i_0, i_1)} = \frac{\sum \alpha * M(j_0, j_1) * (j_1 - j_0)}{\sum \alpha * (j_1 - j_0)}$$

where,

$\overline{M(i_0, i_1)}$ is the value in the merged dataset for the time period (i_0, i_1) for the parameter M

$M(j_0, j_1)$ is the measurement in the time period (j_0, j_1)

$$\alpha = \begin{cases} 0 & j_1 \leq i_0 \text{ and } j_0 \geq i_1 \text{ or } M(j_0, j_1) \text{ is Missing, <LLOD, or >ULOD} \\ 1 & j_0 \geq i_0 \text{ and } j_1 \leq i_1 \\ \frac{i_1 - j_0}{j_1 - j_0} & j_0 \geq i_0 > j_1 \text{ and } j_1 > i_1 \\ \frac{j_1 - i_0}{j_1 - j_0} & j_0 < i_0 \text{ and } i_0 < j_1 \leq i_1 \end{cases}$$

Zero and infinite values of $\overline{M(i_0, i_1)}$ are treated as missing values in the merged files. It is important to note that the merging procedure treats the missing, below the lower limit of detection (LLOD), and above the upper limit of detection (ULOD) measurements as invalid data, and assigns them a zero weight.

Derivation of surface areas from number concentrations

We infer the aerosol surface areas based on the number concentrations measured on-board the C-130 aircraft. The total dry aerosol surface area is calculated as follows:

$$SA^{dry} = SA_{subm}^{dry} + SA_{superm}^{dry}$$

where,

SA^{dry} is the particle surface area of particles with particle diameter, $d_p < 3 \mu m$

SA_{subm}^{dry} is the particle surface area of particles with $d_p < 1 \mu m$. It is calculated from the UHSAS measurements when available. If UHSAS measurements are not available, the PCASP surface area is used after multiplying by a scale factor of 1.216. The scale factor is the median of the ratio of the surface areas from simultaneous measurements by the UHSAS and the PCASP during the WINTER campaign. The scale factor represents the reduced resolution of the PCASP in the submicron size range.

SA_{superm}^{dry} is the particle surface area of particles with $1 \mu m < d_p < 3 \mu m$. It is calculated from the PCSAP measurements.

$$SA_{subm/superm}^{dry} = \sum \pi \left(\frac{d_{i-1/2} + d_{i+1/2}}{2} \right)^2 n_i$$

where,

$d_{i-1/2}$ and $d_{i+1/2}$ are the edges of the size bin i of the UHSAS or PCASP instrument
 n_i is the number density in the size bin i in particles per cm^3

Similarly,

$$Vol^{dry} = Vol_{subm}^{dry} + Vol_{superm}^{dry}$$

$$Vol_{subm/superm}^{dry} = \sum \frac{\pi}{6} \left(\frac{d_{i-1/2} + d_{i+1/2}}{2} \right)^3 n_i$$

and the multiplication factor to substitute PCASP measurements for missing UHSAS measurements is 1.34.

The wet surface areas and volumes are calculated as follows:

$$SA^{wet} = SA_{subm}^{dry} * GF_{subm} + SA_{superm}^{dry} * GF_{superm}$$

$$Vol^{wet} = Vol_{subm}^{dry} * GF_{subm}^{3/2} + SA_{superm}^{dry} * GF_{superm}^{3/2}$$

where,

GF_{subm} and GF_{superm} are the relative humidity (RH) dependent growth factors for submicron and supermicron particles, respectively. They are calculated from the E-AIM model for NH_4NO_3 (submicron) and $NaCl$ (supermicron) assuming no solid formation (metastable). The relative humidity dependence is given in the table below.

RH (%)	<50	50-55	55-60	60-65	65-70	70-75	75-80	80-85	85-90	90-95	>95
GF_{subm}	1	1.36	1.43	1.52	1.62	1.75	1.93	2.19	2.61	3.42	5.52
GF_{superm}	1	2.56	2.70	2.86	3.05	3.29	3.59	4.01	4.65	5.80	8.74

Data format

The merged data files are in the ICARTT format (one file per flight). The merged data is based on the following instrument data files:

Instrument / platform	Date (Revision number)
C-130 instruments (RAF netCDF file)	Nov 17, 2015
ARNOLD	Jan 15, 2016 (R0)
UW-CIMS1	Jan 22, 2016 (R0)
PICARRO CO2,CH4	Sept 16, 2015 (R0)
AeroLaser CO	Sept 16, 2015 (R0)
Chemiluminescence NO, NOy, O3	Jan 22, 2016 (R3)
SO2	April 5, 2016 (R0)
ISAF HCHO	Jan 22, 2016 (R0)
AMS (AMS-60s for 60s and SAGA merges)	Jan 15, 2016 (R0)
PILS Anions	Oct 19, 2015 (R2)
TDLIF	Dec 18, 2015 (R0)
TOGA	Sept 17, 2015 (R0)
SAGA-AERO	Jan 11, 2016 (R3/R4)
NH3	Jan 12, 2016 (R0)
HARP	Dec 18, 2015 (R0)
GEOS-Chem	Nov 17, 2015 (R1)

The following parameters are included in the merged files:

Parameter name	Unit	Description
Start.UTC	s	Start of averaging period
End.UTC (for 60s and SAGA)	s	End of averaging period
RAF_LATC	degree_N	GPS-Corrected Inertial Latitude
RAF_LONC	degree_E	GPS-Corrected Inertial Longitude
RAF_PALT	m	NACA Pressure Altitude
RAF_HGM232	feet	Altitude above ground (radar altimeter)
RAF_PSXC	hPa	Corrected Static Pressure, Reference

Parameter name	Unit	Description
RAF_ATX	deg_C	Ambient Temperature, Reference
RAF_THETA	K	Potential Temperature
RAF_WSC	m/s	GPS-Corrected Horizontal Wind Speed
RAF_WDC	degree_T	GPS-Corrected Horizontal Wind Direction
RAF_UIC	m/s	GPS-Corrected Wind Vector, East Component
RAF_VIC	m/s	GPS-Corrected Wind Vector, North Component
RAF_WIC	m/s	GPS-Corrected Wind Vector, Vertical Gust Component
RAF_DPXC	deg_C	Dew/Frost Point Temperature, Reference
RAF_RHUM	%	Relative Humidity
RAF_EW_VXL	hPa	Ambient Water Vapor Pressure (VCSEL)
RAF_PLWCC	gram/m3	Corrected PMS-King Liquid Water Content
RAF_PLWCD_LPC	gram/m3	CDP Water/Ice Content
RAF_PLWCF_LPT	gram/m3	FSSP-100 Water/Ice Content
RAF_NCONC	#/cm3	Particle_number_concentration_lt_3um_from_PCASP
RAF_CONCP1UM	#/cm3	PCASP_number_concentration_lt_1um
RAF_CONCP1_3UM	#/cm3	PCASP_number_concentration_gt_1um_lt_3um
RAF_CONCF3_10UM	#/cm3	FSSP_number_concentration_gt_3um_lt_10um
RAF_DRYAREA	um2/cm3	Particle_dry_surface_area_lt_3um
RAF_WETAREA	um2/cm3	Particle_wet_surface_area_lt_3um
RAF_SAREAP1UM	um2/cm3	PCASP_surface_area_lt_1um
RAF_SAREAP1_3UM	um2/cm3	PCASP_surface_area_gt_1um_lt_3um
RAF_SAREAF3_10UM	um2/cm3	FSSP_surface_area_gt_3um_lt_10um
RAF_SAREAU	um2/cm3	UHSAS_surface_area_lt_1um
RAF_DRYVOL	um3/cm3	Particle_dry_volume_lt_3um
RAF_WETVOL	um3/cm3	Particle_wet_volume_lt_3um
ARNOLD_NO_ppbv	ppbv	NO mixing ratio (ARNOLD)
ARNOLD_NO2_ppbv	ppbv	NO2 mixing ratio (ARNOLD)
ARNOLD_NOy_ppbv	ppbv	NOy mixing ratio (ARNOLD)
ARNOLD_O3_ppbv	ppbv	O3 mixing ratio (ARNOLD)
ARNOLD_N2O5_pptv	pptv	N2O5 mixing ratio (ARNOLD)
ARNOLD_Flag_NONO2NOyO3	Unitless	Flag for larger measurement uncertainty (ARNOLD)
CIMS1_UW_N2O5	pptv	N2O5 mixing ratio (CIMS1)
CIMS1_UW_CINO2	pptv	CINO2 mixing ratio (CIMS1)
CIMS1_UW_HNO3	pptv	HNO3 mixing ratio (CIMS1)
CIMS1_UW_CH2O2	pptv	CH2O2 mixing ratio (CIMS1)
CIMS1_UW_C2H4O2	pptv	C2H4O2 mixing ratio (CIMS1)
CIMS1_UW_HNO2	pptv	HNO2 mixing ratio (CIMS1)
CIMS1_UW_CIH	pptv	CIH mixing ratio (CIMS1)
CIMS1_UW_CINO3	pptv	CINO3 mixing ratio (CIMS1)
CIMS1_UW_Cl2	pptv	Cl2 mixing ratio (CIMS1)
CIMS1_UW_CHNO	pptv	CHNO mixing ratio (CIMS1)
CIMS1_UW_HO4S	pptv	HO4S mixing ratio (CIMS1)
CIMS1_UW_H2O4S	pptv	H2O4S mixing ratio (CIMS1)
CIMS1_UW_O3S	pptv	O3S mixing ratio (CIMS1)
CIMS1_UW_BrH	pptv	BrH mixing ratio (CIMS1)
CIMS1_UW_BrHO	pptv	BrHO mixing ratio (CIMS1)
CIMS1_UW_ClHO	pptv	ClHO mixing ratio (CIMS1)
ACD_CO2	ppmv	Carbon dioxide mixing ratio
ACD_Methane	ppbv	Methane mixing ratio
ACD_H2O	ppmv	Water mixing ratio

Parameter name	Unit	Description
ACD_CO	ppbv	Carbon monoxide mixing ratio
ACD_NO_pptv	pptv	Nitric Oxide Mixing Ratio
ACD_NOy_pptv	pptv	Total Reactive Nitrogen Mixing Ratio
ACD_O3_ppbv	ppbv	Ozone Mixing Ratio
CSD_SO2	ppbv	SO2 mixing ratio
ISAF_HCHO	pptv	Formaldehyde mixing ratio
CIMS2_HCOOH_pptv	pptv	HCOOH mixing ratio (CIMS2)
CIMS2_HNCO_pptv	pptv	HNCO mixing ratio (CIMS2)
CIMS2_HONO_pptv	pptv	HONO mixing ratio (CIMS2)
CIMS2_HNCO_Stdev	pptv	HNCO stdev (CIMS2)
CIMS2_HCOOH_Stdev	pptv	HCOOH stdev (CIMS2)
CIMS2_HONO_Stdev	pptv	HONO stdev (CIMS2)
AMS_OA_lt_1um	ug_sm-3	mass_concentration_of_organic_aerosol_in_air_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_OA_lt_1um_AMS_prec	ug_sm-3	1s_precision_error_of_the_mass_concentration_of_organic_aerosol_in_air_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_OA_lt_1um_AMS_DL	ug_sm-3	detection_limit_for_the_mass_concentration_of_organic_aerosol_in_air_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_Sulfate_lt_1um_AMS	ug_sm-3	mass_concentration_of_sulfate_aerosol_in_air_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_Sulfate_lt_1um_AMS_prec	ug_sm-3	1s_precision_error_of_mass_concentration_of_sulfate_aerosol_in_air_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_Sulfate_lt_1um_AMS_DL	ug_sm-3	detection_limit_for_the_mass_concentration_of_sulfate_aerosol_in_air_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_Ammonium_lt_1um_AMS	ug_sm-3	mass_concentration_of_ammonium_aerosol_in_air_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_Ammonium_lt_1um_AMS_prec	ug_sm-3	1s_precision_error_of_mass_concentration_of_ammonium_aerosol_in_air_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_Ammonium_lt_1um_AMS_DL	ug_sm-3	detection_limit_for_the_mass_concentration_of_ammonium_aerosol_in_air_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_Nitrate_NO2_lt_1um_AMS	ug_sm-3	mass_concentration_of_nitrate_plus_nitrite_aerosol_in_air_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_Nitrate_NO2_lt_1um_AMS_prec	ug_sm-3	1s_precision_error_of_mass_concentration_of_nitrate_plus_nitrite_aerosol_in_air_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_Nitrate_NO2_lt_1um_AMS_DL	ug_sm-3	detection_limit_for_the_mass_concentration_of_nitrate_plus_nitrite_aerosol_in_air_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_Nitrate_Inorg_lt_1um_AMS	ug_sm-3	mass_concentration_of_nitrate_plus_nitrite_aerosol_scaled_to_online_PILS-IC_in_air_for_particle_diameter_less_than_1um_measured_by_HRAMS

Parameter name	Unit	Description
AMS_Chloride_lt_1um_AMS	ug_sm-3	mass_concentration_of_chloride_aerosol_in_air_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_Chloride_lt_1um_AMS_prec	ug_sm-3	1s_precision_error_of_mass_concentration_of_chloride_aerosol_in_air_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_Chloride_lt_1um_AMS_DL	ug_sm-3	detection_limit_for_the_mass_concentration_of_chloride_aerosol_in_air_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_StdtoVol_AMS	m3_sm-3	Conversion_factor_from_std_to_ambient_volume_and_pressure
AMS_O_C_lt_1um_AMS	unitless	O/C_ratio_of_the_organic_mass_fraction_of_the_aerosol_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_H_C_lt_1um_AMS	unitless	H/C_ratio_of_the_organic_mass_fraction_of_the_aerosol_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_OM_OC_lt_1um_AMS	unitless	OA_to_OC_ratio_of_the_organic_mass_fraction_of_the_aerosol_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_f43_lt_1um_AMS	unitless	Contribution_of_m/z_43_to_total_organic_mass_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_f44_lt_1um_AMS	unitless	Contribution_of_m/z_44_to_total_organic_mass_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_f57_lt_1um_AMS	unitless	Contribution_of_m/z_57_to_total_organic_mass_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_f60_lt_1um_AMS	unitless	Contribution_of_m/z_60_to_total_organic_mass_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_f82_lt_1um_AMS	unitless	Contribution_of_m/z_82_to_total_organic_mass_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_f91_lt_1um_AMS	unitless	Contribution_of_m/z_91_to_total_organic_mass_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_fc2H3O_lt_1um_AMS	unitless	Contribution_of_C2H3O+to_total_organic_mass_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_fcO2_lt_1um_AMS	unitless	Contribution_of_CO2+to_total_organic_mass_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_fc4H9_lt_1um_AMS	unitless	Contribution_of_C4H9+to_total_organic_mass_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_fc2H4O2_lt_1um_AMS	unitless	Contribution_of_C2H4O2+to_total_organic_mass_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_fc5H6O_lt_1um_AMS	unitless	Contribution_of_C5H6O+to_total_organic_mass_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_fc7H7_lt_1um_AMS	unitless	Contribution_of_C7H7+to_total_organic_mass_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_Density_lt_1um_AMS	g_cm-3	Estimated_aerosol_density_assuming_internally_mixed_aerosol_for_particle_diameter_less_than_1um_measured_by_HRAMS
AMS_OA_Density_lt_1um_AMS	g_cm-3	Estimated_organic_aerosol_density_using_Kuwata_et_al_EST_2012_for_particle_diameter_less_than_1um_measured_by_HRAMS

Parameter name	Unit	Description
PILS_SO4	ugm-3	SO4 concentration (PILS-IC)
PILS_NO3	ugm-3	NO3 concentration (PILS-IC)
PILS_Cl	ugm-3	Cl concentration (PILS-IC)
PILS_Na	ugm-3	Na concentration (PILS-IC)
PILS_NH4	ugm-3	NH4 concentration (PILS-IC)
TDLIF_NO2	pptv	volume_mixing_ratio_of_nitrogen_dioxide_in_air (TDLIF)
TDLIF_PNs_N2O5	pptv	volume_mixing_ratio_of_sum_of_peroxy_nitrates_and_N2O5(x1)_in_air (TDLIF)
TDLIF_ANs	pptv	volume_mixing_ratio_of_sum_of_alkyl_nitrates_in_air (TDLIF)
TDLIF_HNO3	pptv	volume_mixing_ratio_of_sum_of_gas_and_particulate_HNO3_in_air (TDLIF)
TDLIF_NOy_minus_NO	pptv	volume_mixing_ratio_from_HNO3_temperature_dissociation_channel_in_air (TDLIF)
TOGA_C3H8	pptv	Propane mixing ratio (TOGA)
TOGA_CH2O	pptv	Formaldehyde mixing ratio (TOGA)
TOGA_HCN	pptv	Hydrogen cyanide mixing ratio (TOGA)
TOGA_i_Butane	pptv	i-butane mixing ratio (TOGA)
TOGA_n_Butane	pptv	n-butane mixing ratio (TOGA)
TOGA_Acetaldehyde	pptv	Acetaldehyde mixing ratio (TOGA)
TOGA_i_Butene_1_Butene	pptv	i_Butene_1_Butene mixing ratio (TOGA)
TOGA_Methyl_Bromide	pptv	Methyl bromide mixing ratio (TOGA)
TOGA_i_Pentane	pptv	i-pentane mixing ratio (TOGA)
TOGA_n_Pentane	pptv	n-pentane mixing ratio (TOGA)
TOGA_Methanol	pptv	methanol mixing ratio (TOGA)
TOGA_Ethanol	pptv	ethanol mixing ratio (TOGA)
TOGA_Acrolein	pptv	acrolein mixing ratio (TOGA)
TOGA_Isoprene	pptv	isoprene mixing ratio (TOGA)
TOGA_DMS	pptv	DMS mixing ratio (TOGA)
TOGA_CFC11	pptv	CFC11 mixing ratio (TOGA)
TOGA_CFC113	pptv	CFC113 mixing ratio (TOGA)
TOGA_Propanal	pptv	Propanal mixing ratio (TOGA)
TOGA_Acetone	pptv	Acetone mixing ratio (TOGA)
TOGA_2_Methylpentane	pptv	2-Methylpentane mixing ratio (TOGA)
TOGA_3_Methylpentane	pptv	3-Methylpentane mixing ratio (TOGA)
TOGA_n_Hexane	pptv	n-hexane mixing ratio (TOGA)
TOGA_Dichloromethane	pptv	Dichloromethane mixing ratio (TOGA)
TOGA_CH3CN	pptv	Acetonitrile mixing ratio (TOGA)
TOGA_MACR	pptv	Methacrolein mixing ratio (TOGA)
TOGA_MVK	pptv	Methyl vinyl ketone mixing ratio (TOGA)
TOGA_3_MethylFuran	pptv	3_MethylFuran mixing ratio (TOGA)
TOGA_Butanal	pptv	Butanal mixing ratio (TOGA)
TOGA_MEK	pptv	Methyl ethyl ketone mixing ratio (TOGA)
TOGA_Chloroform	pptv	Chloroform mixing ratio (TOGA)
TOGA_Carbon_Tetrachloride	pptv	Carbon tetrachloride mixing ratio (TOGA)
TOGA_EthylNitrate	pptv	Ethyl nitrate mixing ratio (TOGA)
TOGA_I_PropylNitrate	pptv	i-propyl nitrate mixing ratio (TOGA)
TOGA_MBO	pptv	MBO mixing ratio (TOGA)
TOGA_Benzene	pptv	benzene mixing ratio (TOGA)
TOGA_n_Heptane	pptv	n-heptane mixing ratio (TOGA)

Parameter name	Unit	Description
TOGA_Bromodichloromethane	pptv	Bromodichloromethane mixing ratio (TOGA)
TOGA_Dibromomethane	pptv	Dibromomethane mixing ratio (TOGA)
TOGA_tert_ButylNitrate	pptv	tert_ButylNitrate mixing ratio (TOGA)
TOGA_2_ButylNitrate_n_ButylNitrate	pptv	2_ButylNitrate_n_ButylNitrate mixing ratio (TOGA)
TOGA_2_PentylNitrate_3_PentylNitrate	pptv	2_PentylNitrate_3_PentylNitrate mixing ratio (TOGA)
TOGA_Toluene	pptv	Toluene mixing ratio (TOGA)
TOGA_Ethylbenzene_m_p_Xylene	pptv	Ethylbenzene_m_p_Xylene mixing ratio (TOGA)
TOGA_o_Xylene	pptv	o_Xylene mixing ratio (TOGA)
TOGA_Tetrachloroethylene	pptv	Tetrachloroethylene mixing ratio (TOGA)
TOGA_Dibromochloromethane	pptv	Dibromochloromethane mixing ratio (TOGA)
TOGA_Chlorobenzene	pptv	Chlorobenzene mixing ratio (TOGA)
TOGA_Bromoform	pptv	Bromoform mixing ratio (TOGA)
TOGA_Alpha_Pinene	pptv	Alpha_Pinene mixing ratio (TOGA)
TOGA_Camphene	pptv	Camphene mixing ratio (TOGA)
TOGA_Beta_Pinene	pptv	Beta_Pinene mixing ratio (TOGA)
TOGA_d_Limonene_3_Carene	pptv	d_Limonene_3_Carene mixing ratio (TOGA)
TOGA_1_2_4_Trimethylbenzene	pptv	1_2_4_Trimethylbenzene mixing ratio (TOGA)
TOGA_1_2_3_Trimethylbenzene	pptv	1_2_3_Trimethylbenzene mixing ratio (TOGA)
UNH_Cl_ug/m3	ug/m3	Chloride_in_microgram_per_cubic_meter (SAGA AERO)
UNH_Br_ug/m3	ug/m3	Bromide_in_microgram_per_cubic_meter (SAGA AERO)
UNH_NO3_ug/m3	ug/m3	Nitrate_in_microgram_per_cubic_meter (SAGA AERO)
UNH_SO4_ug/m3	ug/m3	Sulfate_in_microgram_per_cubic_meter (SAGA AERO)
UNH_C2O4_ug/m3	ug/m3	Oxalate_in_microgram_per_cubic_meter (SAGA AERO)
UNH_Na_ug/m3	ug/m3	Sodium_in_microgram_per_cubic_meter (SAGA AERO)
UNH_NH4_ug/m3	ug/m3	Ammonium_in_microgram_per_cubic_meter (SAGA AERO)
UNH_K_ug/m3	ug/m3	Potassium_in_microgram_per_cubic_meter (SAGA AERO)
UNH_Mg_ug/m3	ug/m3	Magnesium_in_microgram_per_cubic_meter (SAGA AERO)
UNH_Ca_ug/m3	ug/m3	Calcium_in_microgram_per_cubic_meter (SAGA AERO)
LG_AmbT_C	Celsius	Instrument temperature (Los Gatos NH3 detector)
LG_NH3_ppt	ppt	NH3 mixing ratio (Los Gatos NH3 detector)
LG_NH3_ppt_5pt	ppt	NH3 mixing ratio 5 pt moving average (Los Gatos NH3 detector)
LG_NH3_ppt_10pt	ppt	NH3 mixing ratio 10 pt moving average (Los Gatos NH3 detector)
HARP_O3->O2+O(1D)	/s	Photolysis frequency (HARP)
HARP_NO2->NO+O(3P)	/s	Photolysis frequency (HARP)
HARP_H2O2->2OH	/s	Photolysis frequency (HARP)
HARP_N2O5->NO3+NO2	/s	Photolysis frequency (HARP)
HARP_HNO2->OH+NO	/s	Photolysis frequency (HARP)
HARP_HNO3->OH+NO2	/s	Photolysis frequency (HARP)
HARP_HNO4->HO2+NO2	/s	Photolysis frequency (HARP)
HARP_CH2O->H+HCO	/s	Photolysis frequency (HARP)
HARP_CH2O->H2+CO	/s	Photolysis frequency (HARP)
HARP_CH3CHO->CH3+HCO	/s	Photolysis frequency (HARP)
HARP_C2H5CHO->C2H5+HCO	/s	Photolysis frequency (HARP)

Parameter name	Unit	Description
HARP_CH3OOH->CH3O+OH	/s	Photolysis frequency (HARP)
HARP_CH3ONO2->CH3O+NO2	/s	Photolysis frequency (HARP)
HARP_CH3CH2ONO2->CH3CH2O+NO2	/s	Photolysis frequency (HARP)
HARP_CH3CO(OONO2)[PAN]->CH3CO(OO)+NO2	/s	Photolysis frequency (HARP)
HARP_CH3CO(OONO2)[PAN]->CH3CO(O)+NO3	/s	Photolysis frequency (HARP)
HARP_CH2=C(CH3)CHO->Products	/s	Photolysis frequency (HARP)
HARP_CH3COCH=CH2->Products	/s	Photolysis frequency (HARP)
HARP_CH3COCH3->CH3CO+CH3	/s	Photolysis frequency (HARP)
HARP_CH3COCH2CH3->CH3CO+CH2CH3	/s	Photolysis frequency (HARP)
HARP_CHOCHO->HCO+HCO	/s	Photolysis frequency (HARP)
HARP_CHOCHO->H2+2CO	/s	Photolysis frequency (HARP)
HARP_CHOCHO->CH2O+CO	/s	Photolysis frequency (HARP)
HARP_CH3COCHO->CH3CO+HCO	/s	Photolysis frequency (HARP)
HARP_Cl2->Cl+Cl	/s	Photolysis frequency (HARP)
HARP_ClO->Cl+O(3P)	/s	Photolysis frequency (HARP)
HARP_ClNO2->Cl+NO2	/s	Photolysis frequency (HARP)
HARP_ClONO->Cl+NO2	/s	Photolysis frequency (HARP)
HARP_ClONO2->Cl+NO3	/s	Photolysis frequency (HARP)
HARP_ClONO2->ClO+NO2	/s	Photolysis frequency (HARP)
HARP_Br2->Br+Br	/s	Photolysis frequency (HARP)
HARP_BrO->Br+O	/s	Photolysis frequency (HARP)
HARP_HOBr->OH+Br	/s	Photolysis frequency (HARP)
HARP_BrNO->Br+NO	/s	Photolysis frequency (HARP)
HARP_BrONO->Br+NO2	/s	Photolysis frequency (HARP)
HARP_BrONO->BrO+NO	/s	Photolysis frequency (HARP)
HARP_BrNO2->Br+NO2	/s	Photolysis frequency (HARP)
HARP_BrNO2->BrO+NO2	/s	Photolysis frequency (HARP)
HARP_BrNO2->Br+NO3	/s	Photolysis frequency (HARP)
HARP_BrCl->Br+Cl	/s	Photolysis frequency (HARP)
HARP_CHBr3->Products	/s	Photolysis frequency (HARP)
HARP_CH3CH2CH2CHO->C3H7+HCO	/s	Photolysis frequency (HARP)
HARP_CH3CH2CH2CHO->C2H4+CH2CHOH	/s	Photolysis frequency (HARP)
HARP_Br2O->Products	/s	Photolysis frequency (HARP)
GEOSChem_TEMPERATURE	degreesC	GEOS-5_Temperature
GEOSChem_WV	mole/mole	GEOS_Chem_Water_vapor_mixing_ratio
GEOSChem_U	m/s	GEOS-5_East_Component_of_Wind
GEOSChem_V	m/s	GEOS-5_North_Component_of_Wind
GEOSChem_PBLH	m	GEOS-5_Planetary_Boundary_Layer_Height

Parameter name	Unit	Description
GEOSChem_SA	cm2/cm3	GEOS-Chem_Aerosol_wet_surface_area
GEOSChem_NO	mole/mole	Nitrous_Oxide_(MolWt_30)
GEOSChem_O3	mole/mole	Ozone_(MolWt_48)
GEOSChem_PAN	mole/mole	Peroxy_acetyl_nitrate_(MolWt_121)
GEOSChem_CO	mole/mole	Carbon_monoxide_(MolWt_28)
GEOSChem_ALK4	moleC/mole	Org_carbon_as_C4_alkanes_(4C)
GEOSChem_ISOP	moleC/mole	Org_carbon_as_Isoprene_(5C)
GEOSChem_HNO3	mole/mole	Nitric_acid_(MolWt_63)
GEOSChem_H2O2	mole/mole	Hydrogen_peroxide_(MolWt_34)
GEOSChem_ACET	moleC/mole	Org_carbon_as_Acetone_(3C)
GEOSChem_MEK	moleC/mole	Org_carbon_as_Methyl_ethyl_ketone_(4C)
GEOSChem_ALD2	moleC/mole	Org_carbon_as_Acetaldehyde_(2C)
GEOSChem_RCHO	mole/mole	Lumped_C3_or_higher_aldehyde_(MolWt_58)
GEOSChem_MVK	mole/mole	Methyl_vinyl_ketone_(MolWt_70)
GEOSChem_MACR	mole/mole	Methacrolein_(MolWt_70)
GEOSChem_PMN	mole/mole	Peroxymethacroyl_nitrate_(MolWt_147)
GEOSChem_PPN	mole/mole	Lumped_peroxypropionol_nitrate_(MolWt_135)
GEOSChem_R4N2	mole/mole	Lumped_alkyl_nitrate_(MolWt_119)
GEOSChem_PRPE	moleC/mole	Org_carbon_as_C3_alkenes_(3C)
GEOSChem_C3H8	moleC/mole	Org_carbon_as_Propane_(3C)
GEOSChem_CH2O	mole/mole	Formaldehyde_(Molwt_30)
GEOSChem_C2H6	moleC/mole	Org_carbon_as_Ethane_(2C)
GEOSChem_N2O5	mole/mole	Dinitrogen_pentoxide_(MolWt_105)
GEOSChem_HNO4	mole/mole	Pernitric_acid_(MolWt_79)
GEOSChem_MP	mole/mole	Methyl_hydroperoxide_(MolWt_48)
GEOSChem_DMS	mole/mole	Dimethyl_sulfide_(MolWt_62)
GEOSChem_SO2	mole/mole	Sulfur_dioxide_(MolWt_64)
GEOSChem_SO4	mole/mole	Sulfate_aerosol_(MolWt_96)
GEOSChem_SO4ssa	mole/mole	Sulfate_on_seasalt_(MolWt_64)
GEOSChem_MSA	mole/mole	Methyl_sulfonic_acid_(MolWt_96)
GEOSChem_NH3	mole/mole	Ammonia_(MolWt_17)
GEOSChem_NH4	mole/mole	Ammonium_aerosol_(MolWt_18)
GEOSChem_NIT	mole/mole	Inorganic_nitrate_aerosol_(MolWt_62)
GEOSChem_NITssa	mole/mole	Inorganic_nitrate_on_seasalt_(MolWt_62)
GEOSChem_BCPI	mole/mole	Hydrophilic_black_carbon_aerosol_(MolWt_12)
GEOSChem_OCPI	mole/mole	Anthropogenic_hydrophilic_primary_organic_aerosol_(MolWt_16)
GEOSChem_BCPO	mole/mole	Hydrophobic_black_carbon_aerosol_(MolWt_12)
GEOSChem_OCPO	mole/mole	Anthropogenic_hydrophobic_primary_organic_carbon_aerosol_(MolWt_16)
GEOSChem_DST1	mole/mole	Dust_aerosol_0.7_micron_(MolWt_29)
GEOSChem_DST2	mole/mole	Dust_aerosol_1.4_micron_(MolWt_29)
GEOSChem_DST3	mole/mole	Dust_aerosol_2.4_micron_(MolWt_29)
GEOSChem_DST4	mole/mole	Dust_aerosol_4.5_micron_(MolWt_29)
GEOSChem_SALA	mole/mole	Seasalt_aerosol_0.01-0.5_micron_(MolWt_31.4)
GEOSChem_SALC	mole/mole	Seasalt_aerosol_0.5-8_micron_(MolWt_31.4)
GEOSChem_Br2	mole/mole	Molecular_bromine_(MolWt_160)
GEOSChem_Br	mole/mole	Atomic_bromine_(MolWt_80)
GEOSChem_BrO	mole/mole	Bromine_oxide_(MolWt_96)
GEOSChem_HOBr	mole/mole	Hypobromous_acid_(MolWt_97)

Parameter name	Unit	Description
GEOSChem_HBr	mole/mole	Hypobromic_acid_(MolWt_81)
GEOSChem_BrNO2	mole/mole	Nitryl_bromide_(MolWt_126)
GEOSChem_BrNO3	mole/mole	Bromine_nitrate_(MolWt_142)
GEOSChem_CHBr3	mole/mole	Bromoform_(MolWt_253)
GEOSChem_CH2Br2	mole/mole	Dibromomethane_(MolWt_174)
GEOSChem_CH3Br	mole/mole	Methyl_bromide_(MolWt_95)
GEOSChem_MPN	mole/mole	Methylperoxynitrate_(MolWt_93)
GEOSChem_ISOPN	mole/mole	Isoprene_nitrate_(MolWt_147)
GEOSChem_MOBA	mole/mole	5C_acid_from_isoprene_(MolWt_114)
GEOSChem_PROPNN	mole/mole	Propanonenitrate_(MolWt_119)
GEOSChem_HAC	mole/mole	Hydroxyacetone_(MolWt_74)
GEOSChem_GLYC	mole/mole	Glycoaldehyde_(MolWt_60)
GEOSChem_MMN	mole/mole	Nitrate_from_MACR_or_MVK_(MolWt_149)
GEOSChem_RIP	mole/mole	RO2_from_isoprene_(MolWt_118)
GEOSChem_IEPOX	mole/mole	Isoprene_epoxide_(MolWt_118)
GEOSChem_MAP	mole/mole	Peroxyacetic_acid_(MolWt_76)
GEOSChem_NO2	mole/mole	Nitrogen_dioxide_(MolWt_46)
GEOSChem_NO3	mole/mole	Nitrate_radical_(MolWt_62)
GEOSChem_HNO2	mole/mole	Nitrous_acid_(MolWt_47)
GEOSChem_MTPA	mole/mole	a-pinene_b-pinene_sabinene_carene_(MolWt_136.23)
GEOSChem_LIMO	mole/mole	Limonene_(MolWt_136.23)
GEOSChem_MTPO	mole/mole	Terpinene_terpinolene_myrcene_ocimene_other_monoterpenes_(MolWt_136.23)
GEOSChem_TSOG	mole/mole	Semivolatile_gas_products_monoterpenes_sesquiterpenes_oxid_(MolWt_150)
GEOSChem_TSOA	mole/mole	Semivolatile_aerosol_products_monoterpenes_sesquiterpenes_oxid_(MolWt_150)
GEOSChem_ISOG	mole/mole	Semivolatile_gas_products_isoprene_oxid_(MolWt_150)
GEOSChem_ISOA	mole/mole	Semivolatile_aerosol_products_isoprene_oxid_(MolWt_150)
GEOSChem_BENZ	moleC/mole	Org_carbon_as_Benzene_(6C)
GEOSChem_TOLU	moleC/mole	Org_carbon_as_Toluene_(7C)
GEOSChem_XYLE	moleC/mole	Org_carbon_as_Xylene_(8C)
GEOSChem_ASOG	mole/mole	Semivolatile_gas_products_aromatics_IVOC_oxid_(MolWt_150)
GEOSChem_ASOAN	mole/mole	Nonvolatile_aerosol_products_aromatics_IVOC_oxid_(MolWt_150)
GEOSChem_ASOA	mole/mole	Semivolatile_aerosol_products_aromatics_IVOC_oxid_(MolWt_150)
GEOSChem_CINO2	mole/mole	Nitryl_chloride_(MolWt_81.5)
GEOSChem_OH	mole/mole	Hydroxyl_radical_(MolWt_17)
GEOSChem_HO2	mole/mole	Hydroperoxyl_radical_(MolWt_33)
GEOSChem_JO1D	s-1	O3->O1D_photolysis_rate
GEOSChem_G_N2O5	unitless	Gamma_N2O5_hydrolysis
GEOSChem_Y_CINO2	unitless	Yield_of_CINO2