U.S. DEPARTMENT OF ENERGY | Office of Science

DOE/SC-ARM-TR-201

AIP1OGREN: Aerosol Observing Station Intensive Properties Value-Added Product

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September 2017

ARM CLIMATE RESEARCH FACILITY

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Work supported by the U.S. Department of Energy,
Office of Science, Office of Biological and Environmental Research

Acronyms and Abbreviations

AOS	aerosol observing station
ARM	Atmospheric Radiation Measurement
IOP	intensive operational period
NOAA	National Oceanic and Atmospheric Administration
PSAP	particle soot absorption photometer
QC	quality control
SGP	Southern Great Plains
VAP	value-added product

Contents

Acronyms and Abbreviations iii
1.0 General Description 6
2.0 The Algorithm and Methodology 6
2.1 Input Data 6
2.2 Value-Added Output 7
2.3 Data Quality Assessment Included 8
2.4 Process Description with Flow Chart 8
2.5 Known Algorithm Caveats 10
3.0 Output Datastream Details 10
3.1 Data Plots 25
3.2 Tips for the Data User 25
4.0 VAP Status and Version History 26
4.1 Time Periods Processed 26
4.2 Version Information 26
4.3 Plans for Future Modifications 26
4.4 Expected Reprocessing Efforts 26
5.0 Data Access 26
5.1 Registering at the ARM Data Archive 27
5.2 Routine Data Request 27
5.3 Intensive Operational Period Interface 27
5.4 Data Quality Assessment 27
6.0 Related Products Data and Links 27
6.1 Data Tools for ARM netCDF 27
6.2 Infrastructure/Developer Links 28
6.3 Other Data Sites 28
7.0 Frequently Asked Questions 28
8.0 Contacts 28
9.0 VAP-Specific Terminology 29
10.0 Citable References 29

Figures

1 Intensive property calculations flow chart.... 9

Tables

1 Aip1ogren data sources. 7
2 Aip1ogren aerosol intensive properties. 8
3 Aip1ogren output datastream details. 10
4 netCDF files generated by the aip1ogren VAP. 12
5 Fields in the sssaip1ogrenFn.cl file. 12
6 Fields in the xxxaipavg1ogrenFn.cl file. 18
7 Quicklook plots generated by the aip1ogren VAP. 25

1.0 General Description

The aip1ogren value-added product (VAP) computes several aerosol intensive properties. It requires as input calibrated, corrected, aerosol extensive properties (scattering and absorption coefficients, primarily) from the Aerosol Observing Station (AOS). Aerosol extensive properties depend on both the nature of the aerosol and the amount of the aerosol. We compute several properties as relationships between the various extensive properties. These *intensive* properties are independent of aerosol amount and instead relate to intrinsic properties of the aerosol itself. Along with the original extensive properties we report aerosol single-scattering albedo, hemispheric backscatter fraction, asymmetry parameter, and Ångström exponent for scattering and absorption with one-minute averaging. An hourly averaged file is produced from the 1-minute files that includes all extensive and intensive properties as well as submicron scattering and submicron absorption fractions. Finally, in both the minutely and hourly files the aerosol radiative forcing efficiency is provided.

2.0 The Algorithm and Methodology

The aip1ogren VAP computes several aerosol intensive properties. These intensive properties are aerosol single-scattering albedo, hemispheric backscatter fraction, asymmetry parameter, Ångström exponent, submicron scattering and absorption fractions, and radiative forcing efficiency. These intensive properties are derived from ratios of measured extensive properties contained in the AOS data. The resulting intensive properties provide information about the nature of the aerosol rather than the aerosol abundance.

The AOS instrumentation measures data at 1 μm and 10 μm particle size cuts at alternating intervals. This controls the temporal nature of the aip1ogren output products, and in particular constrains the submicron scattering and absorption fractions to the hourly-averaged product. More information on this is provided below.

Explicit quality control (QC) flags are included in the aip1ogren VAP output. The aip1ogren VAP uses quality controlled AOS data as inputs. The aip1ogren VAP encapsulates several algorithms, as described in Delene and Ogren, 2002.

2.1 Input Data

The aip1ogren VAP uses measured absorption and scattering coefficients for red, green, and blue wavelengths, measured at two particle size cuts (1 μm and 10 μm). This data is obtained from the Aerosol Observation Station, operated by National Oceanic and Atmospheric Administration (NOAA) at several locations around the world.

Table 1. Aip1ogren data sources.

ARM Site	ARM Facility	Geographic Location	Aip1ogren Datastreams	Dates
sgp	C1	Lamont, Oklahoma, USA	sgpaip1ogrenC1.c1, sgpaipavg1ogrenC1.c1	1999/01/01 to 2017/03/31
nsa	X1	Barrow, Alaska, USA	nsaaip1ogrenX1.c1, nsaaipavg1ogrenX1.c1	1998/01/01 to 2017/03/31
pye	M1	Point Reyes, California, USA	pyeaip1ogrenM1.c1, pyeaipavg1ogrenM1.c1	2005/03/09 to 2005/09/15
nim	M1	Niamey, Niger, West Africa	nimaip1ogrenM1.c1, nimaipavg1ogrenM1.c1	2005/11/19 to 2006/12/30
fkb	M1	Black Forest, Germany	fkbaip1ogrenM1.c1, fkbaipavg1ogrenM1.c1	2007/03/19 to 2007/12/30
hfe	M1	China	hfeaip1ogrenM1.c1, hfeaipavg1ogrenM1.c1	2008/05/09 to 2008/12/26
pvc	M1	Cape Cod, Massachusetts, USA	pvcaip1ogrenM1.c1, pvcaipavg1ogrenM1.c1	2012/07/12 to 2013/06/23
mao	M1	Manacapuru, Amazonas, Brazil	maoaip1ogrenM1.c1, maoaipavg1ogrenM1.c1	2012/07/16 to 2015/11/30

The input data used by the aip1ogren VAP are the quality-controlled AOS data. The AOS instrumentation has been described by Sheridan, Delene, and Ogren, 2001.

The aip1ogren VAP uses the following AOS measurements

- Absorption coefficient σ_{ap} (545 nm)
- Total scattering coefficient, σ_{sp} (450 nm, RH < 40%)
- Total scattering coefficient, σ_{sp} (550 nm, RH < 40%)
- Total scattering coefficient, σ_{sp} (700 nm, RH < 40%)
- Hemispheric backscattering coefficient, σ_{bsp} (450 nm, RH < 40%)
- Hemispheric backscattering coefficient, σ_{bsp} (550 nm, RH < 40%)
- Hemispheric backscattering coefficient, σ_{bsp} (700 nm, RH < 40%)

2.2 Value-Added Output

The following aerosol intensive properties are generated by the aip1ogren VAP:

Table 2. Aip1ogren aerosol intensive properties.

Intensive Property	Symbol	Equation	Notes
Aerosol single scattering albedo	ω_o	$\sigma_{sp}/(\sigma_{sp}+\sigma_{ap})$	Computed for PSAP1W and PSAP3W depending upon data availability
Hemispheric backscatter fraction	*b*	σ_{bsp}/σ_{sp}	
Average upscatter fraction	b	$0.0817 + 1.8495b - 2.9682b^2$	
Asymmetry parameter	g	$1.011 - 1.036b - 2.005b^2$	
Angstrom exponent	å	$-\log[\sigma_{sp}(\lambda_1)/\sigma_{sp}(\lambda_2)]/\log[\lambda_1/\lambda_2]$	Computed for PSAP3W (absorption), Neph3W (backscatter and total scatter), when data are available
Submicron scattering fraction	R_{sp}	$\sigma_{sp}(1\ \mu m)/\sigma_{sp}(10\ \mu m)$	
Submicron absorption fraction	R_{ap}	$\sigma_{ap}(1\ \mu m)/\sigma_{ap}(10\ \mu m)$	
Aerosol forcing efficiency	$\Delta F/\delta$	$-DS_oT_{at}^2(1-A_c)\omega_o b[(1-R_s)^2 - (2R_s/b)[(1/\omega_o)-1]]$ (Sheridan, Ogren, 1999)	D = fractional day length (0.5), S_o = solar constant (1370 Wm^{-2}), T_{at} = atmospheric transmission (0.76), A_c = fractional cloud amount (0.6), R_s = surface reflectance (0.15) ω_o = single scattering albedo *b* = backscatter fraction

2.3 Data Quality Assessment Included

The inputs to the aip1ogren VAP have undergone extensive QC at NOAA prior to use in the aerosol intensive properties VAP. Specific QC tests are reported for each aerosol property, both extensive and intensive.

2.4 Process Description with Flow Chart

The intensive property calculations are straightforward:

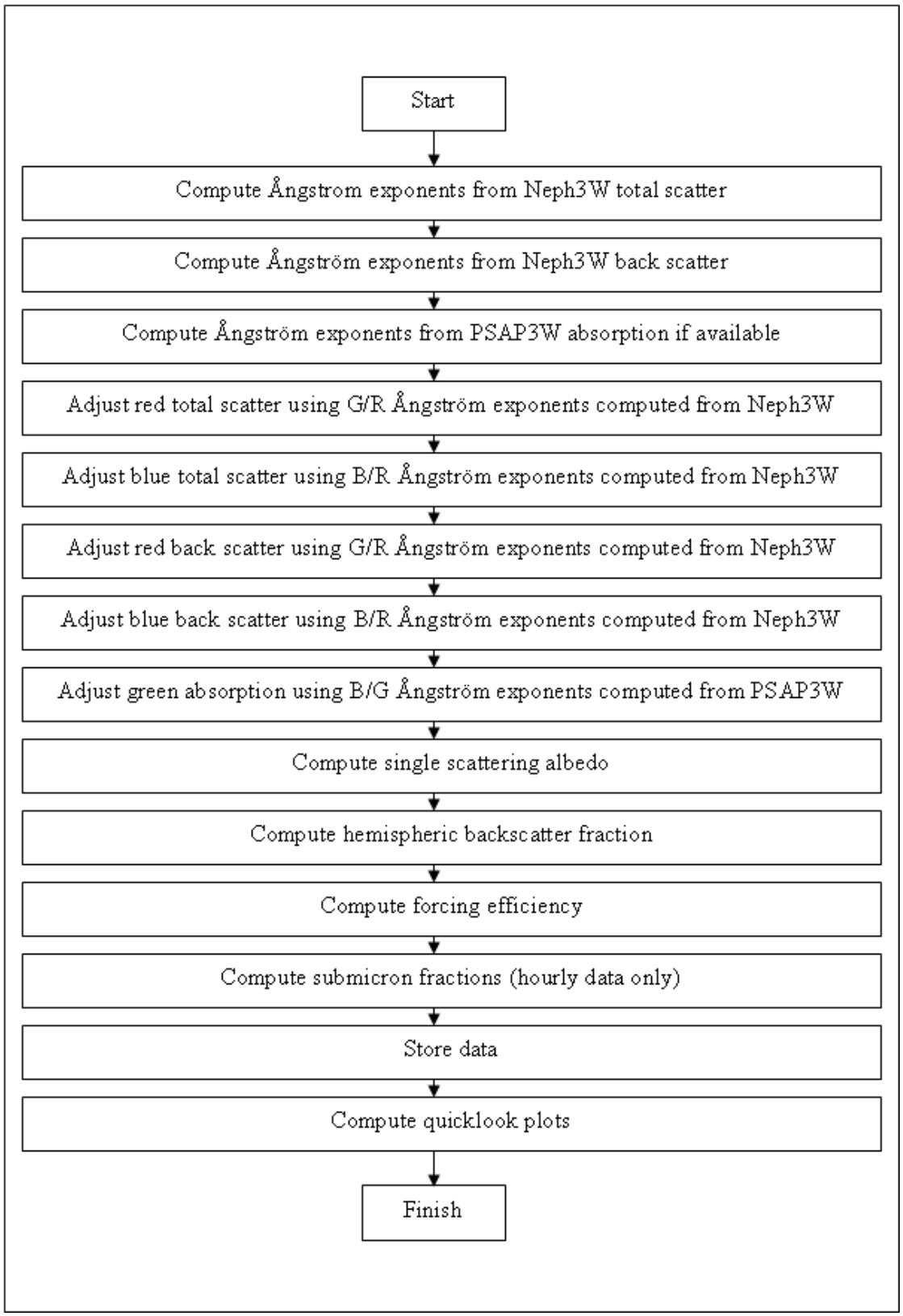

Figure 1. Intensive property calculations flow chart.

2.5 Known Algorithm Caveats

Many of the intensive properties are computed as ratios of the measured extensive properties. Under clean conditions with low aerosol burden, the signal-to-noise ratio for these extensive measurements can become quite low. Although these conditions are flagged, the user is advised to treat such data with caution. The single-scattering albedo measurements use absorption measurements from the particle soot absorption photometer (PSAP), which is a filter-based approach. As the filter becomes more heavily loaded with aerosols, the filter transmittance (and thus the measurement sensitivity) decreases. This may tend to bias the absorption measurements and the respective single scattering albedo computations. Again, these conditions are flagged as questionable. Moreover, the submicron fractions are necessarily computed from interleaved quantities so will be error prone under rapidly changing conditions. This is more difficult to detect with an automated algorithm so the user should be particularly attentive when using these size-dependent ratios. Finally, some of the produced quantities, namely average upscatter fraction, asymmetry parameter, and forcing efficiency, are in fact parameterizations, not strict derivations, and therefore some systematic errors are possible.

3.0 Output Datastream Details

The aip1ogren VAP generates two (2) datastreams:

- sssaip1ogrenFn.c1
- sssaipavg1ogrenFn.c1

Where:

sss and Fn together identify the location with sss as the Atmospheric Radiation Measurement (ARM) site and Fn the exact facility at that site. For example, sgp indicates Southern Great Plains, and C1 indicates the central facility in Lamont, Oklahoma.

sssaip1ogrenFn.c1 contains the one-minute aerosol intensive properties. A typical file contains data for an entire day.

sssaipavg1ogrenFn.c1 contains hourly averaged intensive properties. This is not simply an average of the sssaip1ogrenFn.c1 file. Rather, it contains some intensive properties that are not available at the 1-minute level, including products depending upon or relating to the size cut, which alternates throughout a typical 1-hour interval.

Table 3. Aip1ogren output datastream details.

ACRF Site	ACRF Facility	Size Cut Interval = 6 minutes	Size Cut Interval = 30 minutes
NSA	X1		2006/08/14 to current
SGP	C1	11/02/1998 to 05/14/2007	05/19/2007 to current
PYE	M1		2005/03/19 to 2005/09/15
NIM	M1		2005/11/19 to 2006/01/07
FKB	M1		2007/03/19 to 2007/12/31

ACRF Site	ACRF Facility	Size Cut Interval = 6 minutes	Size Cut Interval = 30 minutes
HFE	M1		2008/05/09 to 2008/12/17
PVC	M1		2012/07/16 to 2013/06/23
MAO	M1		2013/12/11 to 2015/11/30

aip1ogren sssaip1ogrenFn.c1

Filename described:

The aip1ogren VAP output files are named with the convention:

sssaip1ogrenFn.c1.YYYYMMDD.hhmmss.cdf

"sss" indicates the ARM site for this datastream.

"aip1ogren" indicates that the data were generated via the aip1ogren VAP. "aip" indicates "aerosol intensive properties", "1ogren" indicates that this is the first version of the Ogren formulation for this VAP.

"Fn" indicates the ARM facility identifier for this datastream. The formulas and/or parameterizations are a result of work performed by Dr. John Ogren of NOAA, et. al.

YYYYMMDDDD.hhmmss is the date and hhmmss is the time.

sssaipavg1ogrenFn.c1

Filename described:

The aip1ogren VAP output files are named with the convention:

"sss" indicates the ARM site for this datastream

"aipavg" indicates that this is the hourly averaged data. "1ogren" indicates that the data were generated via the aip1ogren VAP

"Fn" indicates the ARM facility identifier for this datastream.

YYYYMMDDDD.hhmmss is the date and hhmmss is the time

Sample Data Files

The table below contains links to actual netCDF files generated by the aip1ogren VAP as well as text version (“header: links”) of the netCDF file structure.

Table 4. netCDF files generated by the aip1ogren VAP.

Date				
	sgpaip1ogrenC1.c1		sgpaipavg1ogrenC1.c1	
2007/01/05	cdf	header	cdf	header
	nsaaip1ogrenX1.c1		nsaaipavg1ogrenX1.c1	
2005/10/06	cdf	header	cdf	header
	nimaip1ogrenM1.c1		nimaipavg1ogrenM1.c1	
2006/03/15	cdf	header	cdf	header
	fkbaip1ogrenM1.c1		fkbaipavg1ogrenM1.c1	
2007/07/04	cdf	header	cdf	header

The table below briefly describes each field in the sssaip1ogrenFn.c1 file. Refer to the netcdf header for additional information.

Table 5. Fields in the sssaip1ogrenFn.cl file.

Fieldname	**Description**	**Units**
base_time	Base time in Epoch	seconds since 1970-1-1 0:00:00 0:00
time_offset	Time offset from base_time	seconds since 2007-01-05 00:00:00 0:00
time	Time offset from midnight	seconds since 2007-01-05 00:00:00 0:00
qc_time	Quality check results on field: Time offset from midnight.	unitless
Ba_G_Dry_1um_PSAP1W_1	Absorption coefficient, green wavelength, low RH, 1 µm size cut	1/Mm
qc_Ba_G_Dry_1um_PSAP1W_1	Quality check results on field: Absorption coefficient, green wavelength, low RH, 1 µm size cut	unitless
Ba_G_Dry_10um_PSAP1W_1	Absorption coefficient, green wavelength, low RH, 10 µm size cut	1/Mm
qc_Ba_G_Dry_10um_PSAP1W_1	Quality check results on field: Absorption coefficient, green wavelength, low RH, 10 µm size cut	unitless
Ba_R_Dry_10um_PSAP3W_1	Absorption coefficient, red wavelength, 3 wavelength PSAP, low RH, 10 µm size cut	1/Mm
qc_Ba_R_Dry_10um_PSAP3W_1	Quality check results on field: Absorption coefficient, red wavelength, 3 wavelength PSAP, low RH, 10 µm size cut	unitless
Ba_G_Dry_10um_PSAP3W_1	Absorption coefficient, green wavelength, 3 wavelength PSAP, low RH, 10 µm size cut	1/Mm
qc_Ba_G_Dry_10um_PSAP3W_1	Quality check results on field: Absorption coefficient, green wavelength, 3 wavelength PSAP, low RH, 10 µm size cut	unitless
Ba_B_Dry_10um_PSAP3W_1	Absorption coefficient, blue wavelength, 3 wavelength PSAP, low RH, 10 µm size cut	1/Mm

Fieldname	Description	Units
qc_Ba_B_Dry_10um_PSAP3W_1	Quality check results on field: Absorption coefficient, blue wavelength, 3 wavelength PSAP, low RH, 10 μm size cut	unitless
Ba_R_Dry_1um_PSAP3W_1	Absorption coefficient, red wavelength, 3 wavelength PSAP, low RH, 1 μm size cut	1/Mm
qc_Ba_R_Dry_1um_PSAP3W_1	Quality check results on field: Absorption coefficient, red wavelength, 3 wavelength PSAP, low RH, 1 μm size cut	unitless
Ba_G_Dry_1um_PSAP3W_1	Absorption coefficient, green wavelength, 3 wavelength PSAP, low RH, 1 μm size cut	1/Mm
qc_Ba_G_Dry_1um_PSAP3W_1	Quality check results on field: Absorption coefficient, green wavelength, 3 wavelength PSAP, low RH, 1 μm size cut	unitless
Ba_B_Dry_1um_PSAP3W_1	Absorption coefficient, blue wavelength, 3 wavelength PSAP, low RH, 1 μm size cut	1/Mm
qc_Ba_B_Dry_1um_PSAP3W_1	Quality check results on field: Absorption coefficient, blue wavelength, 3 wavelength PSAP, low RH, 1 μm size cut	unitless
RH_NephVol_Dry	TSI Low RH Neph. relative humidity	%
qc_RH_NephVol_Dry	Quality check results on field: TSI Low RH Neph. relative humidity	unitless
Bs_R_Dry_10um_Neph3W_1	Total scattering coefficient, red wavelength, 10 μm size cut, low RH	1/Mm
qc_Bs_R_Dry_10um_Neph3W_1	Quality check results on field: Total scattering coefficient, red wavelength, 10 μm size cut, low RH	unitless
Bs_G_Dry_10um_Neph3W_1	Total scattering coefficient, green wavelength, low RH, 10 μm size cut	1/Mm
qc_Bs_G_Dry_10um_Neph3W_1	Quality check results on field: Total scattering coefficient, green wavelength, low RH, 10 μm size cut	unitless
Bs_B_Dry_10um_Neph3W_1	Total scattering coefficient, blue wavelength, low RH, 10 μm size cut	1/Mm
qc_Bs_B_Dry_10um_Neph3W_1	Quality check results on field: Total scattering coefficient, blue wavelength, low RH, 10 μm size cut	unitless
Bs_R_Dry_1um_Neph3W_1	Total scattering coefficient, red wavelength, low RH, 1 μm size cut	1/Mm
qc_Bs_R_Dry_1um_Neph3W_1	Quality check results on field: Total scattering coefficient, red wavelength, low RH, 1 μm size cut	unitless
Bs_G_Dry_1um_Neph3W_1	Total scattering coefficient, green wavelength, low RH, 1 μm size cut	1/Mm
qc_Bs_G_Dry_1um_Neph3W_1	Quality check results on field: Total scattering coefficient, green wavelength, low RH, 1 μm size cut	unitless
Bs_B_Dry_1um_Neph3W_1	Total scattering coefficient, blue wavelength, low RH, 1 μm size cut	1/Mm
qc_Bs_B_Dry_1um_Neph3W_1	Quality check results on field: Total scattering coefficient, blue wavelength, low RH, 1 μm size cut	unitless

Fieldname	Description	Units
Bbs_R_Dry_10um_Neph3W_1	Back-scattering coefficient, red wavelength, low RH, 10 µm size cut	1/Mm
qc_Bbs_R_Dry_10um_Neph3W_1	Quality check results on field: Back-scattering coefficient, red wavelength, low RH, 10 µm size cut	unitless
Bbs_G_Dry_10um_Neph3W_1	Back-scattering coefficient, green wavelength, low RH, 10 µm size cut	1/Mm
qc_Bbs_G_Dry_10um_Neph3W_1	Quality check results on field: Back-scattering coefficient, green wavelength, low RH, 10 µm size cut	unitless
Bbs_B_Dry_10um_Neph3W_1	Back-scattering coefficient, blue wavelength, low RH, 10 µm size cut	1/Mm
qc_Bbs_B_Dry_10um_Neph3W_1	Quality check results on field: Back-scattering coefficient, blue wavelength, low RH, 10 µm size cut	unitless
Bbs_R_Dry_1um_Neph3W_1	Back-scattering coefficient, red wavelength, low RH, 1 µm size cut	1/Mm
qc_Bbs_R_Dry_1um_Neph3W_1	Quality check results on field: Back-scattering coefficient, red wavelength, low RH, 1 µm size cut	unitless
Bbs_G_Dry_1um_Neph3W_1	Back-scattering coefficient, green wavelength, low RH, 1 µm size cut	1/Mm
qc_Bbs_G_Dry_1um_Neph3W_1	Quality check results on field: Back-scattering coefficient, green wavelength, low RH, 1 µm size cut	unitless
Bbs_B_Dry_1um_Neph3W_1	Back-scattering coefficient, blue wavelength, low RH, 1 µm size cut	1/Mm
qc_Bbs_B_Dry_1um_Neph3W_1	Quality check results on field: Back-scattering coefficient, blue wavelength, low RH, 1 µm size cut	unitless
ssa_R_Dry_10um	Single scattering albedo, red wavelength, low RH, 10 µm size cut	unitless
qc_ssa_R_Dry_10um	Quality check results on field: Single scattering albedo, red wavelength, low RH, 10 µm size cut	unitless
ssa_G_Dry_10um	Single scattering albedo, green wavelength, low RH, 10 µm size cut	unitless
qc_ssa_G_Dry_10um	Quality check results on field: Single scattering albedo, green wavelength, low RH, 10 µm size cut	unitless
ssa_B_Dry_10um	Single scattering albedo, blue wavelength, low RH, 10 µm size cut	unitless
qc_ssa_B_Dry_10um	Quality check results on field: Single scattering albedo, blue wavelength, low RH, 10 µm size cut	unitless
ssa_R_Dry_1um	Single scattering albedo, red wavelength, low RH, 1 µm size cut	unitless
qc_ssa_R_Dry_1um	Quality check results on field: Single scattering albedo, red wavelength, low RH, 1 µm size cut	unitless
ssa_G_Dry_1um	Single scattering albedo, green wavelength, low RH, 1 µm size cut	unitless
qc_ssa_G_Dry_1um	Quality check results on field: Single scattering albedo, green wavelength, low RH, 1 µm size cut	unitless
ssa_B_Dry_1um	Single scattering albedo, blue wavelength, low RH, 1 µm size cut	unitless

Fieldname	Description	Units
qc_ssa_B_Dry_1um	Quality check results on field: Single scattering albedo, blue wavelength, low RH, 1 μm size cut	unitless
bsf_R_Dry_10um	Hemispheric backscatter fraction, red wavelength, 10 μm size cut	unitless
qc_bsf_R_Dry_10um	Quality check results on field: Hemispheric backscatter fraction, red wavelength, 10 μm size cut	unitless
bsf_G_Dry_10um	Hemispheric backscatter fraction, green wavelength, 10 μm size cut	unitless
qc_bsf_G_Dry_10um	Quality check results on field: Hemispheric backscatter fraction, green wavelength, 10 μm size cut	unitless
bsf_B_Dry_10um	Hemispheric backscatter fraction, blue wavelength, 10 μm size cut	unitless
qc_bsf_B_Dry_10um	Quality check results on field: Hemispheric backscatter fraction, blue wavelength, 10 μm size cut	unitless
bsf_R_Dry_1um	Hemispheric backscatter_fraction, red wavelength, 1 μm size cut	unitless
qc_bsf_R_Dry_1um	Quality check results on field: Hemispheric backscatter_fraction, red wavelength, 1 μm size cut	unitless
bsf_G_Dry_1um	Hemispheric backscatter fraction, green wavelength, 1 μm size cut	unitless
qc_bsf_G_Dry_1um	Quality check results on field: Hemispheric backscatter fraction, green wavelength, 1 μm size cut	unitless
bsf_B_Dry_1um	Hemispheric backscatter fraction, blue wavelength, 1 μm size cut	unitless
qc_bsf_B_Dry_1um	Quality check results on field: Hemispheric backscatter fraction, blue wavelength, 1 μm size cut	unitless
usf_R_Dry_10um	Average upscatter fraction, red wavelength, 10 μm size cut	unitless
qc_usf_R_Dry_10um	Quality check results on field: Average upscatter fraction, red wavelength, 10 μm size cut	unitless
usf_G_Dry_10um	Average upscatter fraction, green wavelength, 10 μm size cut	unitless
qc_usf_G_Dry_10um	Quality check results on field: Average upscatter fraction, green wavelength, 10 μm size cut	unitless
usf_B_Dry_10um	Average upscatter fraction, blue wavelength, 10 μm size cut	unitless
qc_usf_B_Dry_10um	Quality check results on field: Average upscatter fraction, blue wavelength, 10 μm size cut	unitless
usf_R_Dry_1um	Average upscatter fraction, red wavelength, 1 μm size cut	unitless
qc_usf_R_Dry_1um	Quality check results on field: Average upscatter fraction, red wavelength, 1 μm size cut	unitless
usf_G_Dry_1um	Average upscatter fraction, green wavelength, 1 μm size cut	unitless
qc_usf_G_Dry_1um	Quality check results on field: Average upscatter fraction, green wavelength, 1 μm size cut	unitless

Fieldname	Description	Units
usf_B_Dry_1um	Average upscatter fraction, blue wavelength, 1 μm size cut	unitless
qc_usf_B_Dry_1um	Quality check results on field: Average upscatter fraction, blue wavelength, 1 μm size cut	unitless
Bs_angstrom_exponent_BG_Dry_10um	Angstrom exponent computed from blue/green ratio, 10 μm size cut, Neph3W total scatter data	unitless
qc_Bs_angstrom_exponent_BG_Dry_10um	Quality check results on field: Angstrom exponent computed from blue/green ratio, 10 μm size cut, Neph3W total scatter data	unitless
Bs_angstrom_exponent_BR_Dry_10um	Angstrom exponent computed from blue/red ratio, 10 μm size cut, Neph3W total scatter data	unitless
qc_Bs_angstrom_exponent_BR_Dry_10um	Quality check results on field: Angstrom exponent computed from blue/red ratio, 10 μm size cut, Neph3W total scatter data	unitless
Bs_angstrom_exponent_GR_Dry_10um	Angstrom exponent computed from green/red ratio, 10 μm size cut, Neph3W total scatter data	unitless
qc_Bs_angstrom_exponent_GR_Dry_10um	Quality check results on field: Angstrom exponent computed from green/red ratio, 10 μm size cut, Neph3W total scatter data	unitless
Bs_angstrom_exponent_BG_Dry_1um	Angstrom exponent computed from blue/green ratio, 1 μm size cut, Neph3W total scatter data	unitless
qc_Bs_angstrom_exponent_BG_Dry_1um	Quality check results on field: Angstrom exponent computed from blue/green ratio, 1 μm size cut, Neph3W total scatter data	unitless
Bs_angstrom_exponent_BR_Dry_1um	Angstrom exponent computed from blue/red ratio, 1 μm size cut, Neph3W total scatter data	unitless
qc_Bs_angstrom_exponent_BR_Dry_1um	Quality check results on field: Angstrom exponent computed from blue/red ratio, 1 μm size cut, Neph3W total scatter data	unitless
Bs_angstrom_exponent_GR_Dry_1um	Angstrom exponent computed from green/red ratio, 1 μm size cut, Neph3W total scatter data	unitless
qc_Bs_angstrom_exponent_GR_Dry_1um	Quality check results on field: Angstrom exponent computed from green/red ratio, 1 μm size cut, Neph3W total scatter data	unitless
Bbs_angstrom_exponent_BG_Dry_10um	Angstrom exponent computed from blue/green ratio, 10 μm size cut, Neph3W backscatter data	unitless
qc_Bbs_angstrom_exponent_BG_Dry_10um	Quality check results on field: Angstrom exponent computed from blue/green ratio, 10 μm size cut, Neph3W backscatter data	unitless
Bbs_angstrom_exponent_BR_Dry_10um	Angstrom exponent computed from blue/red ratio, 10 μm size cut, Neph3W backscatter data	unitless
qc_Bbs_angstrom_exponent_BR_Dry_10um	Quality check results on field: Angstrom exponent computed from blue/red ratio, 10 μm size cut, Neph3W backscatter data	unitless
Bbs_angstrom_exponent_GR_Dry_10um	Angstrom exponent computed from green/red ratio, 10 μm size cut, Neph3W backscatter data	unitless
qc_Bbs_angstrom_exponent_GR_Dry_10um	Quality check results on field: Angstrom exponent computed from green/red ratio, 10 μm size cut, Neph3W backscatter data	unitless

Fieldname	Description	Units
Bbs_angstrom_exponent_BG_Dry_1um	Angstrom exponent computed from blue/green ratio, 1 μm size cut, Neph3W backscatter data	unitless
qc_Bbs_angstrom_exponent_BG_Dry_1um	Quality check results on field: Angstrom exponent computed from blue/green ratio, 1 μm size cut, Neph3W backscatter data	unitless
Bbs_angstrom_exponent_BR_Dry_1um	Angstrom exponent computed from blue/red ratio, 1 μm size cut, Neph3W backscatter data	unitless
qc_Bbs_angstrom_exponent_BR_Dry_1um	Quality check results on field: Angstrom exponent computed from blue/red ratio, 1 μm size cut, Neph3W backscatter data	unitless
Bbs_angstrom_exponent_GR_Dry_1um	Angstrom exponent computed from green/red ratio, 1 μm size cut, Neph3W backscatter data	unitless
qc_Bbs_angstrom_exponent_GR_Dry_1um	Quality check results on field: Angstrom exponent computed from green/red ratio, 1 μm size cut, Neph3W backscatter data	unitless
Ba_angstrom_exponent_BG_Dry_10um	Angstrom exponent computed from blue/green ratio, 10 μm size cut, PSAP3W data	unitless
qc_Ba_angstrom_exponent_BG_Dry_10um	Quality check results on field: Angstrom exponent computed from blue/green ratio, 10 μm size cut, PSAP3W data	unitless
Ba_angstrom_exponent_BR_Dry_10um	Angstrom exponent computed from blue/red ratio, 10 μm size cut, PSAP3W data	unitless
qc_Ba_angstrom_exponent_BR_Dry_10um	Quality check results on field: Angstrom exponent computed from blue/red ratio, 10 μm size cut, PSAP3W data	unitless
Ba_angstrom_exponent_GR_Dry_10um	Angstrom exponent computed from green/red ratio, 10 μm size cut, PSAP3W data	unitless
qc_Ba_angstrom_exponent_GR_Dry_10um	Quality check results on field: Angstrom exponent computed from green/red ratio, 10 μm size cut, PSAP3W data	unitless
Ba_angstrom_exponent_BG_Dry_1um	Angstrom exponent computed from blue/green ratio, 1 μm size cut, PSAP3W data	unitless
qc_Ba_angstrom_exponent_BG_Dry_1um	Quality check results on field: Angstrom exponent computed from blue/green ratio, 1 μm size cut, PSAP3W data	unitless
Ba_angstrom_exponent_BR_Dry_1um	Angstrom exponent computed from blue/red ratio, 1 μm size cut, PSAP3W data	unitless
qc_Ba_angstrom_exponent_BR_Dry_1um	Quality check results on field: Angstrom exponent computed from blue/red ratio, 1 μm size cut, PSAP3W data	unitless
Ba_angstrom_exponent_GR_Dry_1um	Angstrom exponent computed from green/red ratio, 1 μm size cut, PSAP3W data	unitless
qc_Ba_angstrom_exponent_GR_Dry_1um	Quality check results on field: Angstrom exponent computed from green/red ratio, 1 μm size cut, PSAP3W data	unitless
asymmetry_parameter_R_Dry_10um	Asymmetry factor, red wavelength, 10 μm size cut	unitless
qc_asymmetry_parameter_R_Dry_10um	Quality check results on field: Asymmetry factor, red wavelength, 10 μm size cut	unitless

Fieldname	Description	Units
asymmetry_parameter_G_Dry_10um	Asymmetry factor, green wavelength, 10 μm size cut	unitless
qc_asymmetry_parameter_G_Dry_10um	Quality check results on field: Asymmetry factor, green wavelength, 10 μm size cut	unitless
asymmetry_parameter_B_Dry_10um	Asymmetry factor, blue wavelength, 10 μm size cut	unitless
qc_asymmetry_parameter_B_Dry_10um	Quality check results on field: Asymmetry factor, blue wavelength, 10 μm size cut	unitless
asymmetry_parameter_R_Dry_1um	Asymmetry factor, red wavelength, 1 μm size cut	unitless
qc_asymmetry_parameter_R_Dry_1um	Quality check results on field: Asymmetry factor, red wavelength, 1 μm size cut	unitless
asymmetry_parameter_G_Dry_1um	Asymmetry factor, green wavelength, 1 μm size cut	unitless
qc_asymmetry_parameter_G_Dry_1um	Quality check results on field: Asymmetry factor, green wavelength, 1 μm size cut	unitless
asymmetry_parameter_B_Dry_1um	Asymmetry factor, blue wavelength, 1 μm size cut	unitless
qc_asymmetry_parameter_B_Dry_1um	Quality check results on field: Asymmetry factor, blue wavelength, 1 μm size cut	unitless
aerosol_forcing_efficiency_10um	Aerosol forcing per unit optical depth, 10 μm size cut	unitless
qc_aerosol_forcing_efficiency_10um	Quality check results on field: Aerosol forcing per unit optical depth, 10 μm size cut	unitless
aerosol_forcing_efficiency_1um	Aerosol forcing per unit optical depth, 1 μm size cut	unitless
qc_aerosol_forcing_efficiency_1um	Quality check results on field: Aerosol forcing per unit optical depth, 1 μm size cut	unitless
lat	north latitude	degrees
lon	east longitude	degrees
alt	altitude	meters above Mean Sea Level

The table below briefly describes the xxxaipavg1ogrenFn.c1 fieldnames. Refer to the actual netCDF header for additional information.

Table 6. Fields in the xxxaipavg1ogrenFn.cl file.

Fieldname	Description	Units
base_time	Base time in Epoch	seconds since 1970-1-1 0:00:00 0:00
time_offset	Time offset from base_time	seconds since 2007-01-05 00:00:00 0:00
time	Time offset from midnight	seconds since 2007-01-05 00:00:00 0:00
qc_time	Quality check results on field: Time offset from midnight.	unitless
Ba_G_Dry_1um_PSAP1W_1	Absorption coefficient, 565 nm, 1 μm size cut	1/Mm

Fieldname	Description	Units
qc_Ba_G_Dry_1um_PSAP1W_1	Quality check results on field: Absorption coefficient, 565 nm, 1 μm size cut	unitless
Ba_G_Dry_10um_PSAP1W_1	Absorption coefficient, 565 nm, 10 μm size cut	1/Mm
qc_Ba_G_Dry_10um_PSAP1W_1	Quality check results on field: Absorption coefficient, 565 nm, 10 μm size cut	unitless
Ba_R_Dry_10um_PSAP3W_1	Absorption coefficient, red wavelength, 3 wavelength PSAP, low RH, 10 μm size cut	1/Mm
qc_Ba_R_Dry_10um_PSAP3W_1	Quality check results on field: Absorption coefficient, red wavelength, 3 wavelength PSAP, low RH, 10 μm size cut	unitless
Ba_G_Dry_10um_PSAP3W_1	Absorption coefficient, green wavelength, 3 wavelength PSAP, low RH, 10 μm size cut	1/Mm
qc_Ba_G_Dry_10um_PSAP3W_1	Quality check results on field: Absorption coefficient, green wavelength, 3 wavelength PSAP, low RH, 10 μm size cut	unitless
Ba_B_Dry_10um_PSAP3W_1	Absorption coefficient, blue wavelength, 3 wavelength PSAP, low RH, 10 μm size cut	1/Mm
qc_Ba_B_Dry_10um_PSAP3W_1	Quality check results on field: Absorption coefficient, blue wavelength, 3 wavelength PSAP, low RH, 10 μm size cut	unitless
Ba_R_Dry_1um_PSAP3W_1	Absorption coefficient, red wavelength, 3 wavelength PSAP, low RH, 1 μm size cut	1/Mm
qc_Ba_R_Dry_1um_PSAP3W_1	Quality check results on field: Absorption coefficient, red wavelength, 3 wavelength PSAP, low RH, 1 μm size cut	unitless
Ba_G_Dry_1um_PSAP3W_1	Absorption coefficient, green wavelength, 3 wavelength PSAP, low RH, 1 μm size cut	1/Mm
qc_Ba_G_Dry_1um_PSAP3W_1	Quality check results on field: Absorption coefficient, green wavelength, 3 wavelength PSAP, low RH, 1 μm size cut	unitless
Ba_B_Dry_1um_PSAP3W_1	Absorption coefficient, blue wavelength, 3 wavelength PSAP, low RH, 1 μm size cut	1/Mm
qc_Ba_B_Dry_1um_PSAP3W_1	Quality check results on field: Absorption coefficient, blue wavelength, 3 wavelength PSAP, low RH, 1 μm size cut	unitless
RH_NephVol_Dry	TSI Low RH Neph. relative humidity	%
qc_RH_NephVol_Dry	Quality check results on field: TSI Low RH Neph. relative humidity	unitless
Bs_R_Dry_10um_Neph3W_1	Total scattering coefficient, red wavelength, 10 μm size cut, low RH	1/Mm
qc_Bs_R_Dry_10um_Neph3W_1	Quality check results on field: Total scattering coefficient, red wavelength, 10 μm size cut, low RH	unitless
Bs_G_Dry_10um_Neph3W_1	Total scattering coefficient, green wavelength, low RH, 10 μm size cut	1/Mm
qc_Bs_G_Dry_10um_Neph3W_1	Quality check results on field: Total scattering coefficient, green wavelength, low RH, 10 μm size cut	unitless
Bs_B_Dry_10um_Neph3W_1	Total scattering coefficient, blue wavelength, low RH, 10 μm size cut	1/Mm

Fieldname	Description	Units
qc_Bs_B_Dry_10um_Neph3W_1	Quality check results on field: Total scattering coefficient, blue wavelength, low RH, 10 μm size cut	unitless
Bs_R_Dry_1um_Neph3W_1	Total scattering coefficient, red wavelength, low RH, 1 μm size cut	1/Mm
qc_Bs_R_Dry_1um_Neph3W_1	Quality check results on field: Total scattering coefficient, red wavelength, low RH, 1 μm size cut	unitless
Bs_G_Dry_1um_Neph3W_1	Total scattering coefficient, green wavelength, low RH, 1 μm size cut	1/Mm
qc_Bs_G_Dry_1um_Neph3W_1	Quality check results on field: Total scattering coefficient, green wavelength, low RH, 1 μm size cut	unitless
Bs_B_Dry_1um_Neph3W_1	Total scattering coefficient, blue wavelength, low RH, 1 μm size cut	1/Mm
qc_Bs_B_Dry_1um_Neph3W_1	Quality check results on field: Total scattering coefficient, blue wavelength, low RH, 1 μm size cut	unitless
Bbs_R_Dry_10um_Neph3W_1	Back-scattering coefficient, red wavelength, low RH, 10 μm size cut	1/Mm
qc_Bbs_R_Dry_10um_Neph3W_1	Quality check results on field: Back-scattering coefficient, red wavelength, low RH, 10 μm size cut	unitless
Bbs_G_Dry_10um_Neph3W_1	Back-scattering coefficient, green wavelength, low RH, 10 μm size cut	1/Mm
qc_Bbs_G_Dry_10um_Neph3W_1	Quality check results on field: Back-scattering coefficient, green wavelength, low RH, 10 μm size cut	unitless
Bbs_B_Dry_10um_Neph3W_1	Back-scattering coefficient, blue wavelength, low RH, 10 μm size cut	1/Mm
qc_Bbs_B_Dry_10um_Neph3W_1	Quality check results on field: Back-scattering coefficient, blue wavelength, low RH, 10 μm size cut	unitless
Bbs_R_Dry_1um_Neph3W_1	Back-scattering coefficient, red wavelength, low RH, 1 μm size cut	1/Mm
qc_Bbs_R_Dry_1um_Neph3W_1	Quality check results on field: Back-scattering coefficient, red wavelength, low RH, 1 μm size cut	unitless
Bbs_G_Dry_1um_Neph3W_1	Back-scattering coefficient, green wavelength, low RH, 1 μm size cut	1/Mm
qc_Bbs_G_Dry_1um_Neph3W_1	Quality check results on field: Back-scattering coefficient, green wavelength, low RH, 1 μm size cut	unitless
Bbs_B_Dry_1um_Neph3W_1	Back-scattering coefficient, blue wavelength, low RH, 1 μm size cut	1/Mm
qc_Bbs_B_Dry_1um_Neph3W_1	Quality check results on field: Back-scattering coefficient, blue wavelength, low RH, 1 μm size cut	unitless
ssa_R_Dry_10um	Single scattering albedo, red wavelength, low RH, 10μm size cut	unitless
qc_ssa_R_Dry_10um	Quality check results on field: Single scattering albedo, red wavelength, low RH, 10 μm size cut	unitless
ssa_G_Dry_10um	Single scattering albedo, green wavelength, low RH, 10 μm size cut	unitless
qc_ssa_G_Dry_10um	Quality check results on field: Single scattering albedo, green wavelength, low RH, 10 μm size cut	unitless
ssa_B_Dry_10um	Single scattering albedo, blue wavelength, low RH, 10 μm size cut	unitless

Fieldname	Description	Units
qc_ssa_B_Dry_10um	Quality check results on field: Single scattering albedo, blue wavelength, low RH, 10 μm size cut	unitless
ssa_R_Dry_1um	Single scattering albedo, red wavelength, low RH, 1 μm size cut	unitless
qc_ssa_R_Dry_1um	Quality check results on field: Single scattering albedo, red wavelength, low RH, 1 μm size cut	unitless
ssa_G_Dry_1um	Single scattering albedo, green wavelength, low RH, 1 μm size cut	unitless
qc_ssa_G_Dry_1um	Quality check results on field: Single scattering albedo, green wavelength, low RH, 1 μm size cut	unitless
ssa_B_Dry_1um	Single scattering albedo, blue wavelength, low RH, 1 μm size cut	unitless
qc_ssa_B_Dry_1um	Quality check results on field: Single scattering albedo, blue wavelength, low RH, 1 μm size cut	unitless
bsf_R_Dry_10um	Hemispheric backscatter fraction, red wavelength, 10 μm size cut	unitless
qc_bsf_R_Dry_10um	Quality check results on field: Hemispheric backscatter fraction, red wavelength, 10 μm size cut	unitless
bsf_G_Dry_10um	Hemispheric backscatter fraction, green wavelength, 10 μm size cut	unitless
qc_bsf_G_Dry_10um	Quality check results on field: Hemispheric backscatter fraction, green wavelength, 10 μm size cut	unitless
bsf_B_Dry_10um	Hemispheric backscatter fraction, blue wavelength, 10 μm size cut	unitless
qc_bsf_B_Dry_10um	Quality check results on field: Hemispheric backscatter fraction, blue wavelength, 10 μm size cut	unitless
bsf_R_Dry_1um	Hemispheric backscatter_fraction, red wavelength, 1 μm size cut	unitless
qc_bsf_R_Dry_1um	Quality check results on field: Hemispheric backscatter_fraction, red wavelength, 1 μm size cut	unitless
bsf_G_Dry_1um	Hemispheric backscatter fraction, green wavelength, 1 μm size cut	unitless
qc_bsf_G_Dry_1um	Quality check results on field: Hemispheric backscatter fraction, green wavelength, 1 μm size cut	unitless
bsf_B_Dry_1um	Hemispheric backscatter fraction, blue wavelength, 1 μm size cut	unitless
qc_bsf_B_Dry_1um	Quality check results on field: Hemispheric backscatter fraction, blue wavelength, 1 μm size cut	unitless
usf_R_Dry_10um	Average upscatter fraction, red wavelength, 10 μm size cut	unitless
qc_usf_R_Dry_10um	Quality check results on field: Average upscatter fraction, red wavelength, 10 μm size cut	unitless
usf_G_Dry_10um	Average upscatter fraction, green wavelength, 10 μm size cut	unitless
qc_usf_G_Dry_10um	Quality check results on field: Average upscatter fraction, green wavelength, 10 μm size cut	unitless
usf_B_Dry_10um	Average upscatter fraction, blue wavelength, 10 μm size cut	unitless

Fieldname	Description	Units
qc_usf_B_Dry_10um	Quality check results on field: Average upscatter fraction, blue wavelength, 10 μm size cut	unitless
usf_R_Dry_1um	Average upscatter fraction, red wavelength, 1 μm size cut	unitless
qc_usf_R_Dry_1um	Quality check results on field: Average upscatter fraction, red wavelength, 1 μm size cut	unitless
usf_G_Dry_1um	Average upscatter fraction, green wavelength, 1 μm size cut	unitless
qc_usf_G_Dry_1um	Quality check results on field: Average upscatter fraction, green wavelength, 1 μm size cut	unitless
usf_B_Dry_1um	Average upscatter fraction, blue wavelength, 1 μm size cut	unitless
qc_usf_B_Dry_1um	Quality check results on field: Average upscatter fraction, blue wavelength, 1 μm size cut	unitless
Bs_angstrom_exponent_BG_Dry_10um	Angstrom exponent computed from blue/green ratio, 10 μm size cut, Neph3W total scatter data	unitless
qc_Bs_angstrom_exponent_BG_Dry_10um	Quality check results on field: Angstrom exponent computed from blue/green ratio, 10 μm size cut, Neph3W total scatter data	unitless
Bs_angstrom_exponent_BR_Dry_10um	Angstrom exponent computed from blue/red ratio, 10 μm size cut, Neph3W total scatter data	unitless
qc_Bs_angstrom_exponent_BR_Dry_10um	Quality check results on field: Angstrom exponent computed from blue/red ratio, 10 μm size cut, Neph3W total scatter data	unitless
Bs_angstrom_exponent_GR_Dry_10um	Angstrom exponent computed from green/red ratio, 10 μm size cut, Neph3W total scatter data	unitless
qc_Bs_angstrom_exponent_GR_Dry_10um	Quality check results on field: Angstrom exponent computed from green/red ratio, 10 μm size cut, Neph3W total scatter data	unitless
Bs_angstrom_exponent_BG_Dry_1um	Angstrom exponent computed from blue/green ratio, 1 μm size cut, Neph3W total scatter data	unitless
qc_Bs_angstrom_exponent_BG_Dry_1um	Quality check results on field: Angstrom exponent computed from blue/green ratio, 1 μm size cut, Neph3W total scatter data	unitless
Bs_angstrom_exponent_BR_Dry_1um	Angstrom exponent computed from blue/red ratio, 1 μm size cut, Neph3W total scatter data	unitless
qc_Bs_angstrom_exponent_BR_Dry_1um	Quality check results on field: Angstrom exponent computed from blue/red ratio, 1 μm size cut, Neph3W total scatter data	unitless
Bs_angstrom_exponent_GR_Dry_1um	Angstrom exponent computed from green/red ratio, 1 μm size cut, Neph3W total scatter data	unitless
qc_Bs_angstrom_exponent_GR_Dry_1um	Quality check results on field: Angstrom exponent computed from green/red ratio, 1 μm size cut, Neph3W total scatter data	unitless
Bbs_angstrom_exponent_BG_Dry_10um	Angstrom exponent computed from blue/green ratio, 10 μm size cut, Neph3W backscatter data	unitless
qc_Bbs_angstrom_exponent_BG_Dry_10um	Quality check results on field: Angstrom exponent computed from blue/green ratio, 10 μm size cut, Neph3W backscatter data	unitless

Fieldname	Description	Units
Bbs_angstrom_exponent_BR_Dry_10um	Angstrom exponent computed from blue/red ratio, 10 μm size cut, Neph3W backscatter data	unitless
qc_Bbs_angstrom_exponent_BR_Dry_10um	Quality check results on field: Angstrom exponent computed from blue/red ratio, 10 μm size cut, Neph3W backscatter data	unitless
Bbs_angstrom_exponent_GR_Dry_10um	Angstrom exponent computed from green/red ratio, 10 μm size cut, Neph3W backscatter data	unitless
qc_Bbs_angstrom_exponent_GR_Dry_10um	Quality check results on field: Angstrom exponent computed from green/red ratio, 10 μm size cut, Neph3W backscatter data	unitless
Bbs_angstrom_exponent_BG_Dry_1um	Angstrom exponent computed from blue/green ratio, 1 μm size cut, Neph3W backscatter data	unitless
qc_Bbs_angstrom_exponent_BG_Dry_1um	Quality check results on field: Angstrom exponent computed from blue/green ratio, 1 μm size cut, Neph3W backscatter data	unitless
Bbs_angstrom_exponent_BR_Dry_1um	Angstrom exponent computed from blue/red ratio, 1 μm size cut, Neph3W backscatter data	unitless
qc_Bbs_angstrom_exponent_BR_Dry_1um	Quality check results on field: Angstrom exponent computed from blue/red ratio, 1 μm size cut, Neph3W backscatter data	unitless
Bbs_angstrom_exponent_GR_Dry_1um	Angstrom exponent computed from green/red ratio, 1 μm size cut, Neph3W backscatter data	unitless
qc_Bbs_angstrom_exponent_GR_Dry_1um	Quality check results on field: Angstrom exponent computed from green/red ratio, 1 μm size cut, Neph3W backscatter data	unitless
Ba_angstrom_exponent_BG_Dry_10um	Angstrom exponent computed from blue/green ratio, 10 μm size cut, PSAP3W data	unitless
qc_Ba_angstrom_exponent_BG_Dry_10um	Quality check results on field: Angstrom exponent computed from blue/green ratio, 10 μm size cut, PSAP3W data	unitless
Ba_angstrom_exponent_BR_Dry_10um	Angstrom exponent computed from blue/red ratio, 10 μm size cut, PSAP3W data	unitless
qc_Ba_angstrom_exponent_BR_Dry_10um	Quality check results on field: Angstrom exponent computed from blue/red ratio, 10 μm size cut, PSAP3W data	unitless
Ba_angstrom_exponent_GR_Dry_10um	Angstrom exponent computed from green/red ratio, 10 μm size cut, PSAP3W data	unitless
qc_Ba_angstrom_exponent_GR_Dry_10um	Quality check results on field: Angstrom exponent computed from green/red ratio, 10 μm size cut, PSAP3W data	unitless
Ba_angstrom_exponent_BG_Dry_1um	Angstrom exponent computed from blue/green ratio, 1 μm size cut, PSAP3W data	unitless
qc_Ba_angstrom_exponent_BG_Dry_1um	Quality check results on field: Angstrom exponent computed from blue/green ratio, 1 μm size cut, PSAP3W data	unitless
Ba_angstrom_exponent_BR_Dry_1um	Angstrom exponent computed from blue/red ratio, 1 μm size cut, PSAP3W data	unitless

Fieldname	Description	Units
qc_Ba_angstrom_exponent_BR_Dry_1um	Quality check results on field: Angstrom exponent computed from blue/red ratio, 1 μm size cut, PSAP3W data	unitless
Ba_angstrom_exponent_GR_Dry_1um	Angstrom exponent computed from green/red ratio, 1 μm size cut, PSAP3W data	unitless
qc_Ba_angstrom_exponent_GR_Dry_1um	Quality check results on field: Angstrom exponent computed from green/red ratio, 1 μm size cut, PSAP3W data	unitless
asymmetry_parameter_R_Dry_10um	Asymmetry factor, red wavelength, 10 μm size cut	unitless
qc_asymmetry_parameter_R_Dry_10um	Quality check results on field: Asymmetry factor, red wavelength, 10 μm size cut	unitless
asymmetry_parameter_G_Dry_10um	Asymmetry factor, green wavelength, 10 μm size cut	unitless
qc_asymmetry_parameter_G_Dry_10um	Quality check results on field: Asymmetry factor, green wavelength, 10 μm size cut	unitless
asymmetry_parameter_B_Dry_10um	Asymmetry factor, blue wavelength, 10 μm size cut	unitless
qc_asymmetry_parameter_B_Dry_10um	Quality check results on field: Asymmetry factor, blue wavelength, 10 μm size cut	unitless
asymmetry_parameter_R_Dry_1um	Asymmetry factor, red wavelength, 1 μm size cut	unitless
qc_asymmetry_parameter_R_Dry_1um	Quality check results on field: Asymmetry factor, red wavelength, 1 μm size cut	unitless
asymmetry_parameter_G_Dry_1um	Asymmetry factor, green wavelength, 1 μm size cut	unitless
qc_asymmetry_parameter_G_Dry_1um	Quality check results on field: Asymmetry factor, green wavelength, 1 μm size cut	unitless
asymmetry_parameter_B_Dry_1um	Asymmetry factor, blue wavelength, 1 μm size cut	unitless
qc_asymmetry_parameter_B_Dry_1um	Quality check results on field: Asymmetry factor, blue wavelength, 1 μm size cut	unitless
aerosol_forcing_efficiency_10um	Aerosol forcing per unit optical depth, 10 μm size cut	unitless
qc_aerosol_forcing_efficiency_10um	Quality check results on field: Aerosol forcing per unit optical depth, 10 μm size cut	unitless
aerosol_forcing_efficiency_1um	Aerosol forcing per unit optical depth, 1 μm size cut	unitless
qc_aerosol_forcing_efficiency_1um	Quality check results on field: Aerosol forcing per unit optical depth, 1 μm size cut	unitless
submicron_fraction_absorption_R	Submicron absorption fraction, red wavelength, low RH	unitless
qc_submicron_fraction_absorption_R	Quality check results on field: Submicron absorption fraction, red wavelength, low RH	unitless
submicron_fraction_absorption_G	Submicron absorption fraction, green wavelength, low RH	unitless
qc_submicron_fraction_absorption_G	Quality check results on field: Submicron absorption fraction, green wavelength, low RH	unitless
submicron_fraction_absorption_B	Submicron absorption fraction, blue wavelength, low RH	unitless

Fieldname	Description	Units
qc_submicron_fraction_absorption_B	Quality check results on field: Submicron absorption fraction, blue wavelength, low RH	unitless
submicron_fraction_scattering_R	Submicron scattering fraction, red wavelength, low RH	unitless
qc_submicron_fraction_scattering_R	Quality check results on field: Submicron scattering fraction, red wavelength, low RH	unitless
submicron_fraction_scattering_G	Submicron scattering fraction, green wavelength, low RH	unitless
qc_submicron_fraction_scattering_G	Quality check results on field: Submicron scattering fraction, green wavelength, low RH	unitless
submicron_fraction_scattering_B	Submicron scattering fraction, blue wavelength, low RH	unitless
qc_submicron_fraction_scattering_B	Quality check results on field: Submicron scattering fraction, blue wavelength, low RH	unitless
lat	north latitude	degrees
lon	east longitude	degrees
alt	altitude	meters above Mean Sea Level

3.1 Data Plots

The aip1ogren VAP generates several quicklook plots. The table below contains links to each type of plot generated by the VAP for 2003/07/01.

Table 7. Quicklook plots generated by the aip1ogren VAP.

Description	Quicklook Plot
Hemispheric backscatter	HemispBackscat.png
Asymmetry parameter	Asymmetry.png
Average upscatter fraction	AvgUpscat.png
Angstrom exponent	Angstrom.png
Single-scattering albedo, 1 μm	Albedo1um.png
Single-scattering albedo, 10 μm	Albedo10um.png
Submicron absorption ratio	RatioAbsorp.png
Submicron scattering ratio	RatioScatter.png
Forcing efficiency	ForcingEfficiency.png

3.2 Tips for the Data User

Many of the intensive properties are computed as ratios of the measured extensive properties. Under clean conditions with low aerosol burden, the signal-to-noise ratio for these extensive measurements can become quite low. Although these conditions are flagged, it can be difficult to distinguish transient atmospheric events (spikes) from spurious noise so the user is advised to treat such data with caution. The single-scattering albedo measurements use absorption measurements from the PSAP, which is a filter-based approach. As the filter becomes more heavily loaded with aerosols, the filter transmittance (and

thus the measurement sensitivity) decreases. This may tend to bias the absorption measurements and the respective single-scattering albedo computations. Again, these conditions are flagged as questionable. Moreover, the submicron fractions are necessarily computed from interleaved quantities and so may be error prone under rapidly changing conditions. This is unavoidable, but is reduced to a certain extent by averaging over the hour. Finally, some of the produced quantities, namely average upscatter fraction, asymmetry parameter, and forcing efficiency, are in fact parameterizations, not strict derivations, and therefore some systematic errors are possible.

4.0 VAP Status and Version History

Initial production release, version XX.

4.1 Time Periods Processed

The aip1ogren VAP can be used to generate aerosol intensive properties for all available noaaaos data. Thus, it will be used to generate data for SGP C1, NSA X1, NIM M1, and FKB M1. As soon as the HFE M1 data are made available, those data will also be processed.

4.2 Version Information

Initial production release.

4.3 Plans for Future Modifications

N/A

4.4 Expected Reprocessing Efforts

When the aip1ogren VAP goes into production, all sites and facilities for which there exist sssnoaaaosFn.b0 and sssnoaaaosavgFn.b0 data (currently all SGP, NSA, PYE, NIM and FKB) will be reprocessed at the ARM Data Archive.

5.0 Data Access

The data policy of the U.S. Global Change Research Program requires a commitment to "the establishment, maintenance, validation, description, accessibility, and distribution of high-quality, long-term data sets." Further, it calls for "full and open sharing" of data sets for all global change researchers. ARM fully supports the spirit and intent of this policy by providing "free and open" access via the ARM Data Archive. The Data Quality Office buttresses this effort in documenting and communicating data quality issues.

5.1 Registering at the ARM Data Archive

The ARM Data Archive supports the ARM Facility by storing and distributing the large quantities of data produced. There is no charge for access to the ARM Data Archive. However, in the interests of communicating data quality concerns to users of ARM data and in order to fulfill obligations as a National User Facility, ARM requires users to register prior to having access via the ARM Data Archive. If you are not a registered ARM Archive User, please first proceed to the automatic online registration form before continuing with the instructions below on ordering data.

5.2 Routine Data Request

To request data produced routinely:

1. Log in to the ARM Data Archive.
2. Select Data Browser Interface.
3. Select Power Interface.
4. Select specific site (always choose “production” sites).
5. Select Start Date and End Date noting the time periods processed for this VAP as documented above.
6. From the menu, select the desired datastream names: for example, sgpaip1ogrenC1.c1 and sgpaipavg1ogrenC1.c1. Hold down the Ctrl key to select more than one datastream name.
7. Select “List files to order.”
8. Select any or all files desired from the menu and select Order.

5.3 Intensive Operational Period Interface

No intensive operational period (IOP) data exist for the aip1ogren VAP.

5.4 Data Quality Assessment

At present, the Data Quality Office does not independently conduct data quality assessment of VAPs.

6.0 Related Products Data and Links

6.1 Data Tools for ARM netCDF

The Unidata netCDF Home Page is the authoritative source for netcdf. There are a broad variety of tools (freely available and commercial) accessible through their web site.

However, some netcdf tools expect netcdf files having a particular convention. The ARM-Tested Tools website contains descriptions and links for tools that have been specifically tested to work well with ARM netcdf files.

6.2 Infrastructure/Developer Links

- NOTIFICATION file
- Release History

6.3 Other Data Sites

Not applicable at this time.

7.0 Frequently Asked Questions

Q: What is an aerosol intensive property?

A: Intensive properties are independent of aerosol amount, depending only on the nature of the specific aerosol.

Q: What is an aerosol extensive property?

A: Extensive properties pertain mainly to the amount of aerosol present in the atmosphere.

Q: How often does the aip1ogren VAP run?

A: The aip1ogren VAP will run periodically, usually after receipt of new sgpcmdlaos data from the ARM Data Archive. NOAA/CMDL currently delivers quality-checked AOS data to the XDC in quarterly batches, shortly after the end of a particular calendar quarter. Thus, within a few days of processing the AOS data, the aip1ogren data will be generated and delivered to the ARM Data Archive.

8.0 Contacts

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9.0 VAP-Specific Terminology

Aerosol Intensive Property	An aerosol property that is independent of the amount of aerosol present, e.g., single-scattering albedo.
Aerosol Extensive Property	An aerosol property that depends on aerosol concentration as well as intrinsic properties, e.g., aerosol optical depth.

10.0 Citable References

Delene, DJ, and JA Ogren. 2002. "Variability of Aerosol Optical Properties at Four North American Surface Monitoring Sites." *Journal of the Atmospheric Sciences* 59: 1135-1150, doi:10.1175/1520-0469(2002)059<1135:VOAOPA>2.0.CO;2.

Sheridan, PJ, and JA Ogren. 1999. "Observations of the vertical and regional variability of aerosol optical properties over central and eastern North America." *Journal of Geophysical Research – Atmospheres* 104(D14): 16 793-16 805, doi:10.1029/1999JD900241.

Sheridan, PJ, DJ Delene, and JA Ogren. 2001. "Four years of continuous surface aerosol measurements from the Department of Energy's Atmospheric Radiation Measurement Program Southern Great Plains Cloud and Radiation Testbed site." *Journal of Geophysical Research – Atmospheres* 106(D18): 20735-20747, doi:10.1029/2001JD000785.


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