

DOE/SC-ARM-TR-201

AIP10GREN: Aerosol Observing Station Intensive Properties Value-Added Product

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September 2017



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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

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1.0 General Description

The aiplogren 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 <u>Aerosol Observing Station (AOS)</u>. 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 aiplogren 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 μ m and 10 μ m particle size cuts at alternating intervals. This controls the temporal nature of the aiplogren 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 aiplogren VAP uses measured absorption and scattering coefficients for red, green, and blue wavelengths, measured at two particle size cuts (1 μ m and 10 μ m). This data is obtained from the Aerosol Observation Station, operated by National Oceanic and Atmospheric Administration (NOAA) at several locations around the world.

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

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, $\sigma_{bsp}~(550$ 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 aiplogren VAP:

Intensive Property	Symbol	Equation	Notes
Aerosol single scattering	ωο	$\sigma_{sp}/(\sigma_{sp}+\sigma_{ap})$	Computed for PSAP1W and PSAP3W
albedo			depending upon data availability
Hemispheric backscatter	b	σ_{bsp}/σ_{sp}	
fraction			
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	$\Delta F/\delta$	$-DS_{o}T_{at}^{2}(1-A_{c})\omega_{o}b[(1-R_{s})^{2}-$	D = fractional day length (0.5),
		$(2R_s/b)[(1/\omega_o)-1]])$	$S_o = solar constant (1370 Wm^{-2}),$
			T_{at} = atmospheric transmission (0.76),
		(Sheridan, Ogren, 1999)	A_c = fractional cloud amount (0.6),
			$R_s = surface reflectance (0.15)$
			$\omega_{o} =$ single scattering albedo
			<i>b</i> = backscatter fraction

Table 2.Aiplogren aerosol intensive properties.

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 aiplogren VAP generates two (2) datastreams:

- sssaiplogrenFn.cl
- 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.

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

 Table 3.
 Aiplogren output datastream details.

	ACRF		
ACRF Site	Facility	Size Cut Interval = 6 minutes	Size Cut Interval = 30 minutes
HFE	Ml		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.

"aiplogren" indicates that the data were generated via the aiplogren VAP. "aip" indicates "aerosol intensive properties", "logren" 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 aiplogren 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. "10gren" indicates that the data were generated via the aip10gren 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.

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Date				
	sgpaip1ogrenC1.c1		sgpaipavglo	ogrenC1.c1
2007/01/05	<u>cdf</u>	<u>header</u>	<u>cdf</u>	<u>header</u>
	nsaaip1ogrenX1.c1		nsaaipavg1ogrenX1.c1	
2005/10/06	<u>cdf</u>	<u>header</u>	<u>cdf</u>	<u>header</u>
	nimaip1ogrenM1.c1		nimaipavg1	ogrenM1.c1
2006/03/15	<u>cdf</u>	<u>header</u>	<u>cdf</u>	header
	fkbaip1ogrenM1.c1		fkbaipavg1c	grenM1.c1
2007/07/04	<u>cdf</u>	<u>header</u>	<u>cdf</u>	header

Table 4.netCDF files generated by the aip1ogren VAP.

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

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

Table 5.Fields in the sssaip1ogrenFn.cl file.

Fieldname	Description	Units
_qc_Ba_B_Dry_10um_PSAP3W	Quality check results on field: Absorption	unitless
_1	coefficient, blue wavelength, 3 wavelength PSAP,	
	low RH, 10 µm size cut	
Ba_R_Dry_1um_PSAP3W_1	Absorption coefficient, red wavelength, 3	1/Mm
	wavelength PSAP, low RH, 1 µm size cut	
qc_Ba_R_Dry_1um_PSAP3W_	Quality check results on field: Absorption	unitless
1	coefficient, red wavelength, 3 wavelength PSAP,	
	low RH, 1 μm size cut	
Ba_G_Dry_1um_PSAP3W_1	Absorption coefficient, green wavelength, 3	1/Mm
	wavelength PSAP, low RH, 1 µm size cut	
qc_Ba_G_Dry_1um_PSAP3W_	Quality check results on field: Absorption	unitless
1	coefficient, green wavelength, 3 wavelength PSAP,	
	low RH, 1 μm size cut	
Ba_B_Dry_1um_PSAP3W_1	Absorption coefficient, blue wavelength, 3	1/Mm
	wavelength PSAP, low RH, 1 µm size cut	
qc_Ba_B_Dry_1um_PSAP3W_	Quality check results on field: Absorption	unitless
1	coefficient, blue wavelength, 3 wavelength PSAP,	
	low RH, 1 μm size cut	
RH_NephVol_Dry	TSI Low RH Neph. relative humidity	%
qc_RH_NephVol_Dry	Quality check results on field: TSI Low RH Neph.	unitless
	relative humidity	
Bs_R_Dry_10um_Neph3W_1	Total scattering coefficient, red wavelength, 10 µm	1/Mm
	size cut, low RH	
qc_Bs_R_Dry_10um_Neph3W_	Quality check results on field: Total scattering	unitless
1	coefficient, red wavelength, 10 µm size cut, low RH	
Bs_G_Dry_10um_Neph3W_1	Total scattering coefficient, green wavelength, low	1/Mm
	RH, 10 µm size cut	
qc_Bs_G_Dry_10um_Neph3W	Quality check results on field: Total scattering	unitless
_1	coefficient, green wavelength, low RH, 10 µm size	
	cut	
Bs_B_Dry_10um_Neph3W_1	Total scattering coefficient, blue wavelength, low	1/Mm
	RH, 10 µm size cut	
qc_Bs_B_Dry_10um_Neph3W_	Quality check results on field: Total scattering	unitless
1	coefficient, blue wavelength, low RH, 10 µm size	
	cut	
Bs_R_Dry_1um_Neph3W_1	Total scattering coefficient, red wavelength, low	1/Mm
	RH, 1 µm size cut	
qc_Bs_R_Dry_1um_Neph3W_1	Quality check results on field: Total scattering	unitless
	coefficient, red wavelength, low RH, 1 µm size cut	
Bs_G_Dry_1um_Neph3W_1	Total scattering coefficient, green wavelength, low	1/Mm
	RH, 1 µm size cut	
qc_Bs_G_Dry_1um_Neph3W_	Quality check results on field: Total scattering	unitless
1	coefficient, green wavelength, low RH, 1 µm size	
	cut	
Bs_B_Dry_1um_Neph3W_1	Total scattering coefficient, blue wavelength, low	1/Mm
	RH, 1 μm size cut	
qc_Bs_B_Dry_1um_Neph3W_1	Quality check results on field: Total scattering	unitless
	coefficient, blue wavelength, low RH, 1 µm size cut	

Fieldname	Description	Units
Bbs_R_Dry_10um_Neph3W_1	Back-scattering coefficient, red wavelength, low	1/Mm
	RH, 10 μm size cut	
qc_Bbs_R_Dry_10um_Neph3W	Quality check results on field: Back-scattering	unitless
_1	coefficient, red wavelength, low RH, 10 µm size cut	
Bbs_G_Dry_10um_Neph3W_1	Back-scattering coefficient, green wavelength, low	1/Mm
	RH, 10 μm size cut	
qc_Bbs_G_Dry_10um_Neph3	Quality check results on field: Back-scattering	unitless
W_1	coefficient, green wavelength, low RH, 10 µm size	
Dha D Day 10 and Neal 200 1	Cut	1/\.
Bbs_B_Dry_10um_Neph3w_1	Back-scattering coefficient, blue wavelength, low	1/Mm
an Dha D Dry 10um Manh2W	RH, 10 μm size cu	unitlaga
dc_Bos_B_Dry_10um_Neph3 w	Quality check results on field. Back-scattering	unitiess
_ ¹	controllent, blue wavelength, low KH, 10 µm size	
Bbs B Dry 1um Neph3W 1	Back-scattering coefficient red wavelength low	1/Mm
	RH 1 um size cut	1/1/1/111
ac Bbs R Dry 1um Neph3W	Quality check results on field. Back-scattering	unitless
1	coefficient, red wavelength, low RH, 1 um size cut	
Bbs G Dry 1um Neph3W 1	Back-scattering coefficient, green wavelength, low	1/Mm
	RH, 1 µm size cut	
qc Bbs G Dry 1um Neph3W	Quality check results on field: Back-scattering	unitless
	coefficient, green wavelength, low RH, 1 µm size	
	cut	
Bbs_B_Dry_1um_Neph3W_1	Back-scattering coefficient, blue wavelength, low	1/Mm
	RH, 1 µm size cut	
qc_Bbs_B_Dry_1um_Neph3W_	Quality check results on field: Back-scattering	unitless
1	coefficient, blue wavelength, low RH, 1 µm size cut	
ssa_R_Dry_10um	Single scattering albedo, red wavelength, low RH,	unitless
	10 μm size cut	
qc_ssa_R_Dry_10um	Quality check results on field: Single scattering	unitless
C. D. 10	albedo, red wavelength, low RH, 10 µm size cut	:4
ssa_G_Dry_10um	Single scattering albedo, green wavelength, low	unitless
aa aaa C Dm; 10um	KH, 10 µIII size cut	unitlaga
dc_ssa_G_Dry_rounn	albedo, green wavelength low RH 10 µm size cut	unitiess
ssa B Dry 10um	Single scattering albedo blue wavelength low RH	unitless
ssu_D_Dry_rouni	10 um size cut	unitiess
ac ssa B Dry 10um	Quality check results on field. Single scattering	unitless
q•	albedo, blue wavelength, low RH, 10 um size cut	
ssa R Dry 1um	Single scattering albedo, red wavelength, low RH, 1	unitless
	µm size cut	
qc_ssa_R_Dry_1um	Quality check results on field: Single scattering	unitless
	albedo, red wavelength, low RH, 1 µm size cut	
ssa_G_Dry_1um	Single scattering albedo, green wavelength, low	unitless
	RH, 1 µm size cut	
qc_ssa_G_Dry_1um	Quality check results on field: Single scattering	unitless
	albedo, green wavelength, low RH, 1 µm size cut	
ssa_B_Dry_1um	Single scattering albedo, blue wavelength, low RH,	unitless
	1 μm size cut	

Fieldname	Description	Units
_qc_ssa_B_Dry_1um	Quality check results on field: Single scattering	unitless
	albedo, blue wavelength, low RH, 1 µm size cut	
bsf_R_Dry_10um	Hemispheric backscatter fraction, red wavelength,	unitless
	10 μm size cut	
qc_bsf_R_Dry_10um	Quality check results on field: Hemispheric	unitless
	backscatter fraction, red wavelength, 10 µm size cut	
bsf_G_Dry_10um	Hemispheric backscatter fraction, green	unitless
	wavelength, 10 µm size cut	
qc_bsf_G_Dry_10um	Quality check results on field: Hemispheric	unitless
	backscatter fraction, green wavelength, 10 µm size	
	cut	
bsf_B_Dry_10um	Hemispheric backscatter fraction, blue wavelength,	unitless
	10 μm size cut	
qc_bsf_B_Dry_10um	Quality check results on field: Hemispheric	unitless
	backscatter fraction, blue wavelength, 10 µm size	
	cut	
bsf_R_Dry_1um	Hemispheric backscatter_fraction, red wavelength,	unitless
	1 µm size cut	
qc_bsf_R_Dry_1um	Quality check results on field: Hemispheric	unitless
	backscatter_fraction, red wavelength, 1 µm size cut	
bsf_G_Dry_1um	Hemispheric backscatter fraction, green	unitless
	wavelength, 1 µm size cut	
qc_bsf_G_Dry_1um	Quality check results on field: Hemispheric	unitless
	backscatter fraction, green wavelength, 1 μ m size	
	cut	
bst_B_Dry_1um	Hemispheric backscatter fraction, blue wavelength,	unifless
qc_bsf_B_Dry_1um	Quality check results on field: Hemispheric	unitless
und D. Davis 10.000	backscatter fraction, blue wavelength, 1 µm size cut	
usi_K_Dry_10um	Average upscatter fraction, red wavelength, 10 µm	unitiess
as usf P Dry 10um	Size cui Quality about regults on field: Average uncentter	unitlaga
qc_usi_K_Diy_rouin	fraction red wavelength 10 um size cut	unitiess
usf G Dry 10um	Average unscatter fraction green wavelength 10	unitless
usi_O_Dry_rouni	um size cut	unitiess
ac usf G Dry 10um	Quality check results on field: Average unscatter	unitless
qe_usi_s_bry_rouni	fraction green wavelength 10 um size cut	unitiess
usf B Dry 10um	Average upscatter fraction blue wavelength 10 um	unitless
	size cut	
ac usf B Dry 10um	Ouality check results on field: Average upscatter	unitless
	fraction, blue wavelength, 10 µm size cut	
usf R Dry 1um	Average upscatter fraction, red wavelength, 1 um	unitless
	size cut	
qc usf R Dry 1um	Quality check results on field: Average upscatter	unitless
	fraction, red wavelength, 1 µm size cut	
usf_G_Dry_1um	Average upscatter fraction, green wavelength, 1 µm	unitless
_	size cut	
qc_usf_G_Dry_1um	Quality check results on field: Average upscatter	unitless
	fraction, green wavelength, 1 µm size cut	

Fieldname	Description	Units
usf_B_Dry_1um	Average upscatter fraction, blue wavelength, 1 µm	unitless
	size cut	
qc_usf_B_Dry_1um	Quality check results on field: Average upscatter	unitless
	fraction, blue wavelength, 1 µm size cut	
Bs_angstrom_exponent_BG_Dr	Angstrom exponent computed from blue/green	unitless
y_10um	ratio, 10 µm size cut, Neph3W total scatter data	
qc_Bs_angstrom_exponent_BG	Quality check results on field: Angstrom exponent	unitless
_Dry_10um	computed from blue/green ratio, 10 µm size cut,	
	Neph3W total scatter data	
Bs_angstrom_exponent_BR_Dr	Angstrom exponent computed from blue/red ratio,	unitless
y_10um	10 µm size cut, Neph3W total scatter data	1.1
qc_Bs_angstrom_exponent_BR	Quality check results on field: Angstrom exponent	unitless
_Dry_10um	computed from blue/red ratio, 10 µm size cut,	
	Neph3W total scatter data	
Bs_angstrom_exponent_GR_Dr	Angstrom exponent computed from green/red ratio,	unitiess
y_10ulli	10 µm size cut, Nepiis w total scatter data	mitlaga
qc_bs_angstrom_exponent_OK	Quanty check results on held. Angstrom exponent	unitiess
	Nenh2W total scatter data	
Bs angstrom exponent BG Dr	Angstrom exponent computed from hlue/green	unitless
v lum	ratio 1 um size cut Neph3W total scatter data	unitiess
ac Bs angstrom exponent BG	Quality check results on field: Angstrom exponent	unitless
Dry 1um	computed from blue/green ratio 1 um size cut	unitiess
	Neph3W total scatter data	
Bs angstrom exponent BR Dr	Angstrom exponent computed from blue/red ratio, 1	unitless
y lum	µm size cut, Neph3W total scatter data	
qc Bs angstrom exponent BR	Quality check results on field: Angstrom exponent	unitless
_Dry_1um	computed from blue/red ratio, 1 µm size cut,	
	Neph3W total scatter data	
Bs_angstrom_exponent_GR_Dr	Angstrom exponent computed from green/red ratio,	unitless
y_1um	1 μm size cut, Neph3W total scatter data	
qc_Bs_angstrom_exponent_GR	Quality check results on field: Angstrom exponent	unitless
_Dry_1um	computed from green/red ratio, 1 µm size cut,	
	Neph3W total scatter data	
Bbs_angstrom_exponent_BG_D	Angstrom exponent computed from blue/green	unitless
ry_10um	ratio, 10 µm size cut, Neph3W backscatter data	
qc_Bbs_angstrom_exponent_B	Quality check results on field: Angstrom exponent	unitless
G_Dry_10um	computed from blue/green ratio, 10 µm size cut,	
	Neph3W backscatter data	· .1
Bbs_angstrom_exponent_BR_D	Angstrom exponent computed from blue/red ratio,	unitless
ry_loum	10 µm size cut, Neph3 w backscatter data	
qc_Bbs_angstrom_exponent_B	Quality check results on field: Angstrom exponent	unitiess
K_DIY_10ulli	Neph3W backscatter data	
Bhs angstrom exponent GD D	Angstrom exponent computed from green/red ratio	unitless
rv 10um	10 um size cut Neph3W backscatter data	uniticoo
ac Bbs angstrom exponent G	Quality check results on field. Anostrom exponent	unitless
R Drv 10um	computed from green/red ratio. 10 um size cut	
	Neph3W backscatter data	

Fieldname	Description	Units
Bbs_angstrom_exponent_BG_D	Angstrom exponent computed from blue/green	unitless
ry_1um	ratio, 1 µm size cut, Neph3W backscatter data	
qc_Bbs_angstrom_exponent_B	Quality check results on field: Angstrom exponent	unitless
G_Dry_1um	computed from blue/green ratio, 1 µm size cut,	
	Neph3W backscatter data	
Bbs_angstrom_exponent_BR_D	Angstrom exponent computed from blue/red ratio,	unitless
ry_lum	1 μm size cut, Neph3W backscatter data	
qc_Bbs_angstrom_exponent_B	Quality check results on field: Angstrom exponent	unitless
R_Dry_1um	computed from blue/red ratio, 1 µm size cut,	
	Neph3W backscatter data	
Bbs_angstrom_exponent_GR_D	Angstrom exponent computed from green/red ratio,	unitless
ry_lum	1 μm size cut, Neph3W backscatter data	
qc_Bbs_angstrom_exponent_G	Quality check results on field: Angstrom exponent	unitless
R_Dry_1um	computed from green/red ratio, 1 µm size cut,	
	Neph3W backscatter data	
Ba_angstrom_exponent_BG_Dr	Angstrom exponent computed from blue/green	unitless
y_10um	ratio, 10 µm size cut, PSAP3W data	
qc_Ba_angstrom_exponent_BG	Quality check results on field: Angstrom exponent	unitless
_Dry_10um	computed from blue/green ratio, 10 µm size cut,	
	PSAP3W data	
Ba_angstrom_exponent_BR_Dr	Angstrom exponent computed from blue/red ratio,	unitless
y_10um	10 µm size cut, PSAP3W data	
qc_Ba_angstrom_exponent_BR	Quality check results on field: Angstrom exponent	unitless
_Dry_10um	computed from blue/red ratio, 10 µm size cut,	
	PSAP3W data	
Ba_angstrom_exponent_GR_Dr	Angstrom exponent computed from green/red ratio,	unitless
y_10um	10 μm size cut, PSAP3W data	
qc_Ba_angstrom_exponent_GR	Quality check results on field: Angstrom exponent	unitless
_Dry_10um	computed from green/red ratio, 10 µm size cut,	
	PSAP3W data	
Ba_angstrom_exponent_BG_Dr	Angstrom exponent computed from blue/green	unitless
y_1um	ratio, 1 µm size cut, PSAP3W data	
qc_Ba_angstrom_exponent_BG	Quality check results on field: Angstrom exponent	unitless
_Dry_1um	computed from blue/green ratio, 1 µm size cut,	
	PSAP3W data	
Ba_angstrom_exponent_BR_Dr	Angstrom exponent computed from blue/red ratio,	unitless
y_1um	1 μm size cut, PSAP3W data	
qc_Ba_angstrom_exponent_BR	Quality check results on field: Angstrom exponent	unitless
_Dry_1um	computed from blue/red ratio, 1 µm size cut,	
	PSAP3W data	
Ba_angstrom_exponent_GR_Dr	Angstrom exponent computed from green/red ratio,	unitless
y_1um	1 μm size cut, PSAP3W data	
qc_Ba_angstrom_exponent_GR	Quality check results on field: Angstrom exponent	unitless
_Dry_1um	computed from green/red ratio, 1 µm size cut,	
	PSAP3W data	
asymmetry_parameter_R_Dry_	Asymmetry factor, red wavelength, 10 µm size cut	unitless
10um		
qc_asymmetry_parameter_R_Dr	Quality check results on field: Asymmetry factor,	unitless
y_10um	red wavelength, 10 µm size cut	

Fieldname	Description	Units
asymmetry_parameter_G_Dry_	Asymmetry factor, green wavelength, 10 µm size	unitiess
10um	cut	
qc_asymmetry_parameter_G_D	Quality check results on field: Asymmetry factor,	unitless
ry_10um	green wavelength, 10 µm size cut	
asymmetry_parameter_B_Dry_	Asymmetry factor, blue wavelength, 10 µm size cut	unitless
10um		
qc_asymmetry_parameter_B_Dr	Quality check results on field: Asymmetry factor,	unitless
y_10um	blue wavelength, 10 µm size cut	
asymmetry_parameter_R_Dry_	Asymmetry factor, red wavelength, 1 µm size cut	unitless
lum		
qc_asymmetry_parameter_R_Dr	Quality check results on field: Asymmetry factor,	unitless
y_1um	red wavelength, 1 µm size cut	
asymmetry_parameter_G_Dry_	Asymmetry factor, green wavelength, 1 µm size cut	unitless
lum		
qc_asymmetry_parameter_G_D	Quality check results on field: Asymmetry factor,	unitless
ry_1um	green wavelength, 1 µm size cut	
asymmetry_parameter_B_Dry_	Asymmetry factor, blue wavelength, 1 µm size cut	unitless
lum		
qc_asymmetry_parameter_B_Dr	Quality check results on field: Asymmetry factor,	unitless
y_1um	blue wavelength, 1 µm size cut	
aerosol_forcing_efficiency_10u	Aerosol forcing per unit optical depth, 10 µm size	unitless
m	cut	
qc_aerosol_forcing_efficiency_	Quality check results on field: Aerosol forcing per	unitless
10um	unit optical depth, 10 µm size cut	
aerosol_forcing_efficiency_1um	Aerosol forcing per unit optical depth, 1 µm size cut	unitless
qc_aerosol_forcing_efficiency_	Quality check results on field: Aerosol forcing per	unitless
lum	unit optical depth, 1 µm size cut	
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.

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

Table 6.Fields in the xxxaipavg1ogrenFn.cl file.

Fieldname	Description	Units
qc_Ba_G_Dry_1um_PSAP1W_1	Quality check results on field: Absorption	unitiess
	coefficient, 565 nm, 1 µm size cut	
Ba_G_Dry_10um_PSAP1W_1	Absorption coefficient, 565 nm, 10 µm size cut	1/Mm
qc_Ba_G_Dry_10um_PSAP1W_	Quality check results on field: Absorption	unitless
1	coefficient, 565 nm, 10 µm size cut	
Ba_R_Dry_10um_PSAP3W_1	Absorption coefficient, red wavelength, 3	1/Mm
_	wavelength PSAP, low RH, 10 µm size cut	
qc_Ba_R_Dry_10um_PSAP3W_	Quality check results on field: Absorption	unitless
1	coefficient, red wavelength, 3 wavelength PSAP, low	
	RH, 10 µm size cut	
Ba_G_Dry_10um_PSAP3W_1	Absorption coefficient, green wavelength, 3	1/Mm
	wavelength PSAP, low RH, 10 µm size cut	
qc_Ba_G_Dry_10um_PSAP3W_	Quality check results on field: Absorption	unitless
1	coefficient, green wavelength, 3 wavelength PSAP,	
	low RH, 10 µm size cut	
Ba_B_Dry_10um_PSAP3W_1	Absorption coefficient, blue wavelength, 3	1/Mm
	wavelength PSAP, low RH, 10 µm size cut	
qc_Ba_B_Dry_10um_PSAP3W_	Quality check results on field: Absorption	unitless
1	coefficient, blue wavelength, 3 wavelength PSAP,	
	low RH, 10 µm size cut	
Ba_R_Dry_1um_PSAP3W_1	Absorption coefficient, red wavelength, 3	1/Mm
	wavelength PSAP, low RH, 1 µm size cut	
qc_Ba_R_Dry_1um_PSAP3W_1	Quality check results on field: Absorption	unitless
	coefficient, red wavelength, 3 wavelength PSAP, low	
	RH, 1 µm size cut	
Ba_G_Dry_1um_PSAP3W_1	Absorption coefficient, green wavelength, 3	1/Mm
	wavelength PSAP, low RH, 1 µm size cut	
qc_Ba_G_Dry_1um_PSAP3W_1	Quality check results on field: Absorption	unitless
	coefficient, green wavelength, 3 wavelength PSAP,	
	low RH, 1 μm size cut	
Ba_B_Dry_1um_PSAP3W_1	Absorption coefficient, blue wavelength, 3	1/Mm
	wavelength PSAP, low RH, 1 µm size cut	
qc_Ba_B_Dry_1um_PSAP3W_1	Quality check results on field: Absorption	unitless
	coefficient, blue wavelength, 3 wavelength PSAP,	
	low RH, 1 μm size cut	A./
RH_NephVol_Dry	TSI Low RH Neph. relative humidity	%
qc_RH_NephVol_Dry	Quality check results on field: TSI Low RH Neph.	unitless
	relative humidity	- 1= +
Bs_R_Dry_10um_Neph3W_1	Total scattering coefficient, red wavelength, $10 \ \mu m$	1/Mm
	size cut, low KH	*.1
qc_Bs_R_Dry_10um_Neph3w_1	Quality check results on field: I otal scattering	unitless
D. C. D. 10	coefficient, red wavelength, 10 µm size cut, 10w KH	-1 /5, g
Bs_G_Dry_10um_Nepn3w_1	I otal scattering coefficient, green wavelength, low	1/Mm
Dr. C. Dry. 10. m. Manh2W	KH, 10 μm size cut	:41
dc_Bs_G_Dry_10um_Neph3W_	Quality check results on field: Total scattering	unitiess
	coefficient, green wavelength, low RH, 10 µm size	
		1/14
Bs_B_Dry_10um_Neph3w_1	I otal scattering coefficient, blue wavelength, low	1/Mm
	RH, 10 μm size cut	

Fieldname	Description	Units
qc_Bs_B_Dry_10um_Neph3W_1	Quality check results on field: Total scattering	unitiess
	coefficient, blue wavelength, low RH, 10 µm size cut	
Bs R Dry 1um Neph3W 1	Total scattering coefficient, red wavelength, low RH,	1/Mm
	1 μm size cut	
qc Bs R Dry 1um Neph3W 1	Quality check results on field: Total scattering	unitless
	coefficient, red wavelength, low RH, 1 µm size cut	
Bs G Dry 1um Neph3W 1	Total scattering coefficient, green wavelength, low	1/Mm
	RH, 1 µm size cut	
qc Bs G Dry 1um Neph3W 1	Quality check results on field: Total scattering	unitless
	coefficient, green wavelength, low RH, 1 µm size cut	
Bs B Dry 1um Neph3W 1	Total scattering coefficient, blue wavelength, low	1/Mm
	RH, 1 μm size cut	
qc Bs B Dry 1um Neph3W 1	Quality check results on field: Total scattering	unitless
	coefficient, blue wavelength, low RH, 1 µm size cut	
Bbs R Dry 10um Neph3W 1	Back-scattering coefficient, red wavelength, low RH,	1/Mm
	10 um size cut	
ac Bbs R Dry 10um Neph3W	Ouality check results on field: Back-scattering	unitless
$\frac{1}{1}$	coefficient, red wavelength, low RH, 10 um size cut	
Bbs G Dry 10um Neph3W 1	Back-scattering coefficient, green wavelength, low	1/Mm
	RH. 10 um size cut	
ac Bbs G Dry 10um Neph3W	Ouality check results on field: Back-scattering	unitless
1	coefficient, green wavelength, low RH, 10 µm size	
	cut	
Bbs B Dry 10um Neph3W 1	Back-scattering coefficient blue wavelength low	1/Mm
	RH. 10 um size cut	1,1,1,1,1,1
ac Bbs B Dry 10um Neph3W	Quality check results on field. Back-scattering	unitless
1	coefficient, blue wavelength, low RH, 10 µm size cut	
Bbs R Dry 1um Neph3W 1	Back-scattering coefficient, red wavelength, low RH.	1/Mm
	1 um size cut	
ac Bbs R Dry 1um Neph3W 1	Ouality check results on field: Back-scattering	unitless
	coefficient, red wavelength, low RH, 1 um size cut	
Bbs G Dry 1um Neph3W 1	Back-scattering coefficient green wavelength low	1/Mm
	RH 1 um size cut	1,
ac Bbs G Dry 1um Neph3W	Quality check results on field: Back-scattering	unitless
1	coefficient, green wavelength, low RH, 1 µm size cut	unitioso
Bbs B Dry 1um Neph3W 1	Back-scattering coefficient blue wavelength low	1/Mm
	RH. 1 um size cut	1,1,1,1,1,1,1
ac Bbs B Dry 1um Neph3W 1	Quality check results on field. Back-scattering	unitless
	coefficient, blue wavelength, low RH, 1 um size cut	
ssa R Dry 10um	Single scattering albedo red wavelength low RH	unitless
ssu_rc_bry_rouni	10um size cut	unitioso
ac ssa R Dry 10um	Quality check results on field: Single scattering	unitless
	albedo red wavelength low RH 10 um size cut	unitiess
ssa G Dry 10um	Single scattering albedo, green wavelength low RH	unitless
	10 um size cut	41111000
ac ssa G Dry 10um	Quality check results on field: Single scattering	unitless
	albedo green wavelength low RH 10 um size out	unnuess
ssa B Dry 10um	Single scattering albedo blue wavelength low RH	unitless
	10 um size cut	unnuess
		1

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

Fieldname	Description	Units
qc_usf_B_Dry_10um	Quality check results on field: Average upscatter	unitless
	fraction, blue wavelength, 10 µm size cut	
usf_R_Dry_1um	Average upscatter fraction, red wavelength, 1 µm	unitless
	size cut	
qc_usf_R_Dry_1um	Quality check results on field: Average upscatter	unitless
	fraction, red wavelength, 1 µm size cut	
usf_G_Dry_1um	Average upscatter fraction, green wavelength, 1 µm	unitless
	size cut	
qc_usf_G_Dry_1um	Quality check results on field: Average upscatter	unitless
	fraction, green wavelength, 1 µm size cut	
usf_B_Dry_1um	Average upscatter fraction, blue wavelength, 1 µm	unitless
	size cut	
qc_usf_B_Dry_1um	Quality check results on field: Average upscatter	unitless
	fraction, blue wavelength, 1 µm size cut	
Bs_angstrom_exponent_BG_Dry	Angstrom exponent computed from blue/green ratio,	unitless
_10um	10 µm size cut, Neph3W total scatter data	
qc_Bs_angstrom_exponent_BG_	Quality check results on field: Angstrom exponent	unitless
Dry_10um	computed from blue/green ratio, 10 µm size cut,	
	Neph3W total scatter data	
Bs_angstrom_exponent_BR_Dry	Angstrom exponent computed from blue/red ratio,	unitless
_10um	10 µm size cut, Neph3W total scatter data	
qc_Bs_angstrom_exponent_BR_	Quality check results on field: Angstrom exponent	unitless
Dry_10um	computed from blue/red ratio, 10 µm size cut,	
	Neph3W total scatter data	
Bs_angstrom_exponent_GR_Dry	Angstrom exponent computed from green/red ratio,	unitless
_10um	10 μm size cut, Neph3W total scatter data	
qc_Bs_angstrom_exponent_GR_	Quality check results on field: Angstrom exponent	unitless
Dry_10um	computed from green/red ratio, 10 µm size cut,	
	Neph3W total scatter data	
Bs_angstrom_exponent_BG_Dry	Angstrom exponent computed from blue/green ratio,	unitless
lum	1 μm size cut, Neph3W total scatter data	
qc_Bs_angstrom_exponent_BG_	Quality check results on field: Angstrom exponent	unitless
Dry_1um	Computed from blue/green ratio, 1 µm size cut,	
	Neph3 W total scatter data	
Bs_angstrom_exponent_BR_Dry	Angstrom exponent computed from blue/red ratio,	unitless
_lum	1 μm size cut, Neph3 w total scatter data	
qc_Bs_angstrom_exponent_BR_	Quality check results on field. Angstrom exponent	unitiess
Dry_1um	Nonh2W total soutton data	
De angetrem europent CB Dry	A negative mount commuted from groon/red ratio	unitlaga
bs_angstrom_exponent_GK_DIy	Angstrom exponent computed from green/red fatto,	unitiess
_1uiii	1 µm size cut, Nepiis w total scatter data	unitlaga
Dry 1um	computed from green/red ratio 1 um size out	unitiess
	Nenh3W total scatter data	
Bhs angstrom exponent BC Dr	Angstrom exponent computed from blue/green ratio	unitless
v 10um	10 um size cut. Nenh3W backscatter data	umuess
ac Bbs angetrom exponent PC	Ouglity check results on field. Angetrom exponent	unitless
Dry 10um	computed from blue/green ratio 10 um size cut	uniticoo
	Nenh3W hackscatter data	
	Neph3W backscatter data	

Fieldname	Description	Units
Bbs_angstrom_exponent_BR_Dr	Angstrom exponent computed from blue/red ratio,	unitless
y_10um	10 μm size cut, Neph3W backscatter data	
qc_Bbs_angstrom_exponent_BR	Quality check results on field: Angstrom exponent	unitless
_Dry_10um	computed from blue/red ratio, 10 µm size cut,	
	Neph3W backscatter data	
Bbs_angstrom_exponent_GR_Dr	Angstrom exponent computed from green/red ratio,	unitless
y_10um	10 µm size cut, Neph3W backscatter data	
qc_Bbs_angstrom_exponent_GR	Quality check results on field: Angstrom exponent	unitless
_Dry_10um	computed from green/red ratio, 10 µm size cut,	
	Neph3W backscatter data	
Bbs_angstrom_exponent_BG_Dr	Angstrom exponent computed from blue/green ratio,	unitless
y_1um	1 µm size cut, Neph3W backscatter data	
qc_Bbs_angstrom_exponent_BG	Quality check results on field: Angstrom exponent	unitless
_Dry_1um	computed from blue/green ratio, 1 µm size cut,	
	Neph3W backscatter data	
Bbs_angstrom_exponent_BR_Dr	Angstrom exponent computed from blue/red ratio,	unitless
y_1um	1 μm size cut, Neph3W backscatter data	
qc_Bbs_angstrom_exponent_BR	Quality check results on field: Angstrom exponent	unitless
_Dry_1um	computed from blue/red ratio, 1 µm size cut,	
	Neph3W backscatter data	
Bbs_angstrom_exponent_GR_Dr	Angstrom exponent computed from green/red ratio,	unitless
y_1um	1 μm size cut, Neph3W backscatter data	
qc_Bbs_angstrom_exponent_GR	Quality check results on field: Angstrom exponent	unitless
_Dry_1um	computed from green/red ratio, 1 µm size cut,	
	Neph3W backscatter data	
Ba_angstrom_exponent_BG_Dry	Angstrom exponent computed from blue/green ratio,	unitless
_10um	10 µm size cut, PSAP3W data	
qc_Ba_angstrom_exponent_BG_	Quality check results on field: Angstrom exponent	unitless
Dry_10um	computed from blue/green ratio, 10 µm size cut,	
	PSAP3W data	
Ba_angstrom_exponent_BR_Dry	Angstrom exponent computed from blue/red ratio,	unitless
_10um	10 μm size cut, PSAP3W data	
qc_Ba_angstrom_exponent_BR_	Quality check results on field: Angstrom exponent	unitless
Dry_10um	computed from blue/red ratio, 10 µm size cut,	
	PSAP3W data	
Ba_angstrom_exponent_GR_Dry	Angstrom exponent computed from green/red ratio,	unitless
_10um	10 μm size cut, PSAP3W data	
qc_Ba_angstrom_exponent_GR_	Quality check results on field: Angstrom exponent	unitless
Dry_10um	computed from green/red ratio, 10 µm size cut,	
	PSAP3W data	
Ba_angstrom_exponent_BG_Dry	Angstrom exponent computed from blue/green ratio,	unitless
_lum	1 μm size cut, PSAP3W data	
qc_Ba_angstrom_exponent_BG_	Quality check results on field: Angstrom exponent	unitless
Dry_lum	computed from blue/green ratio, 1 µm size cut,	
	PSAP3W data	
Ba_angstrom_exponent_BR_Dry	Angstrom exponent computed from blue/red ratio,	unitless
_lum	1 μm size cut, PSAP3W data	

Fieldname	Description	Units
qc_Ba_angstrom_exponent_BR_	Quality check results on field: Angstrom exponent	unitiess
Dry_1um	computed from blue/red ratio, 1 µm size cut,	
	PSAP3W data	
Ba_angstrom_exponent_GR_Dry	Angstrom exponent computed from green/red ratio,	unitless
_lum	1 μm size cut, PSAP3W data	
qc_Ba_angstrom_exponent_GR_	Quality check results on field: Angstrom exponent	unitless
Dry_1um	computed from green/red ratio, 1 µm size cut,	
	PSAP3W data	
asymmetry_parameter_R_Dry_1	Asymmetry factor, red wavelength, 10 µm size cut	unitless
0um		
qc_asymmetry_parameter_R_Dry	Quality check results on field: Asymmetry factor, red	unitless
_10um	wavelength, 10 µm size cut	
asymmetry_parameter_G_Dry_1	Asymmetry factor, green wavelength, 10 µm size cut	unitless
0um		
qc_asymmetry_parameter_G_Dr	Quality check results on field: Asymmetry factor,	unitless
y_10um	green wavelength, 10 µm size cut	
asymmetry_parameter_B_Dry_1	Asymmetry factor, blue wavelength, $10 \ \mu m$ size cut	unitless
Oum		
qc_asymmetry_parameter_B_Dry	Quality check results on field: Asymmetry factor,	unitless
_10um	blue wavelength, 10 µm size cut	- 1
asymmetry_parameter_R_Dry_1	Asymmetry factor, red wavelength, 1 µm size cut	unitless
um	Quality shash results on field. Assurements fortan and	
dc_asymmetry_parameter_K_Dry	Quality check results on field. Asymmetry factor, red	unitiess
asymmetry parameter G Dry 1	A symmetry factor green wavelength 1 um size cut	unitless
um	Asymmetry factor, green wavelength, i pin size eut	unitiess
qc asymmetry parameter G Dr	Quality check results on field: Asymmetry factor,	unitless
y_1um	green wavelength, 1 µm size cut	
asymmetry_parameter_B_Dry_1	Asymmetry factor, blue wavelength, 1 µm size cut	unitless
um		
qc_asymmetry_parameter_B_Dry	Quality check results on field: Asymmetry factor,	unitless
_1um	blue wavelength, 1 µm size cut	
aerosol_forcing_efficiency_10um	Aerosol forcing per unit optical depth, 10 µm size cut	unitless
qc_aerosol_forcing_efficiency_1	Quality check results on field: Aerosol forcing per	unitless
0um	unit optical depth, 10 µm size cut	
aerosol_forcing_efficiency_1um	Aerosol forcing per unit optical depth, 1 µm size cut	unitless
qc_aerosol_forcing_efficiency_1	Quality check results on field: Aerosol forcing per	unitless
um	unit optical depth, 1 µm size cut	
submicron_fraction_absorption_	Submicron absorption fraction, red wavelength, low	unitless
R	RH	
qc_submicron_fraction_absorptio	Quality check results on field: Submicron absorption	unitless
n_R	fraction, red wavelength, low RH	
submicron_fraction_absorption_	Submicron absorption fraction, green wavelength,	unitless
G	low KH	
qc_submicron_traction_absorptio	Quality check results on field: Submicron absorption	unitless
n_U	Iracuon, green wavelength, low KH	
submicron_traction_absorption_	Submicron absorption fraction, blue wavelength, low	unitless
D	КП	1

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Fieldname	Description	Units
qc_submicron_fraction_absorptio	Quality check results on field: Submicron absorption	unitless
n_B	fraction, blue wavelength, low RH	
submicron_fraction_scattering_R	Submicron scattering fraction, red wavelength, low	unitless
	RH	
qc_submicron_fraction_scatterin	Quality check results on field: Submicron scattering	unitless
g_R	fraction, red wavelength, low RH	
submicron_fraction_scattering_G	Submicron scattering fraction, green wavelength, low	unitless
	RH	
qc_submicron_fraction_scatterin	Quality check results on field: Submicron scattering	unitless
g_G	fraction, green wavelength, low RH	
submicron_fraction_scattering_B	Submicron scattering fraction, blue wavelength, low	unitless
	RH	
qc_submicron_fraction_scatterin	Quality check results on field: Submicron scattering	unitless
g_B	fraction, blue wavelength, low RH	
lat	north latitude	degrees
lon	east longitude	degrees
alt	altitude	meters above Mean Sea
		Level

3.1 Data Plots

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

Description	Quicklook Plot
Hemispheric backscatter	HemispBackscat.png
Asymmetry parameter	Asymmetry.png
Average upscatter fraction	<u>AvgUpscat.png</u>
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

 Table 7.
 Quicklook plots generated by the aip1ogren VAP.

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 aiplogren 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 aiplogren 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 <u>data policy of the U.S. Global Change Research Program</u> 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 "<u>free and open</u>" 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 <u>online registration</u> 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, sgpaiplogrenC1.c1 and sgpaipavglogrenC1.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 <u>Unidata netCDF Home Page</u> 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 <u>ARM-Tested Tools</u> 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
- <u>Release History</u>

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 aiplogren 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 aiplogren 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, <u>doi:10.1175/1520-0469(2002)059<1135:VOAOPA>2.0.CO;2</u>.

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