

5.9 Aerosol Detection Product

5.9.1 Description

The Aerosol Detection product contains three images in the form of binary masks that identify the presence of aerosols, dust, and smoke. The aerosol mask indicates the presence of either smoke or dust. The dust and smoke masks indicate the presence of dust and smoke, respectively. Because the presence of smoke and dust are independently derived, a given pixel can be identified with both dust and smoke. The product includes data quality information for on-earth pixels, including an assessment of the validity of the smoke and dust detections, and a confidence level.

The binary aerosol, dust, and smoke mask values are dimensionless quantities.

The Aerosol Detection product images are produced on the ABI fixed grid at 2 km resolution for Full Disk, CONUS and Mesoscale coverage regions. Product data is produced under the following conditions:

- clear sky
- snow-free
- geolocated source data to local zenith angles of 90 degrees and to solar zenith angles of 87 degrees

The Aerosol Detection performance requirements are summarized in Table 5.9.1, Aerosol Detection Performance Requirements. Good quality retrievals as prescribed by the algorithm are those that satisfy the measurement range and performance conditions identified therein except as noted.

Table 5.9.1 Aerosol Detection Performance Requirements

Region	Measurement			Performance Conditions ^[1]	Mapping
	Range	Accuracy	Precision		Accuracy
Full Disk, CONUS, & Mesoscale	0 or 1	Dust over land: 80% Dust over ocean: 80% Smoke over land: 80% Smoke over ocean: 70%	N/A	LZA ≤ 60 degrees daytime ^[2] clear sky AOD > 0.2	1 km

[1] Conditions for data production prescribed by the algorithm also include snow/ice-free.

[2] Conditions for good quality prescribed by the algorithm are for SZA ≤ 60 degrees.

Metadata in the Aerosol Detection product provides statistical and other properties of the product images and supports diagnosis of algorithm anomalies. Specific metadata includes:

- Start, midpoint, and end time of the product image observation period.
- Number of pixels where geolocated source data is available to a local zenith angle of 60 degrees.
- Number of pixels where geolocated source data is available to a solar zenith angle of 60 degrees.
- Number of pixels that qualified for the smoke and dust retrievals.
- Number of pixels where each of smoke and dust are detected.

The first statistic in the list is calculated using geolocated pixels to a solar zenith angle of 87 degrees. The second statistic in the list is calculated using geolocated pixels to a local zenith angle of 90 degrees. The last two statistics in the list are calculated using good retrieved detection pixels to a local zenith angle of 90

degrees and a solar zenith angle of 87 degrees. The percentages of pixels assigned to each retrieval quality value are also included in the product.

The detailed description of the ISO series metadata for the Aerosol Detection product is located in the standalone Appendix X, ISO Series Metadata.

5.9.2 Dynamic Source Data

The Aerosol Detection product is derived using processed ABI Level 1b reflective and emissive band images from the current observation. The algorithm uses intermediate product data generated by the Cloud Mask and Snow Cover algorithms. In addition, the algorithm uses dynamic auxiliary data, specifically solar zenith angle, sunglint angle, and sun-satellite relative azimuth angle. Processed global snow and ice cover data derived from the NSIDC ancillary data is a secondary input to the algorithm.

The primary sensor data used by the Aerosol Detection algorithm is identified in Table 5.9.2-1, Primary Sensor Data.

Table 5.9.2-1 Primary Sensor Data

Dynamic Data Category	Dynamic Data Type
ABI L1b/L2+ Final Products	input_ABI_L2_brightness_temperature_band_7_2km_data input_ABI_L2_brightness_temperature_band_13_2km_data input_ABI_L2_brightness_temperature_band_14_2km_data input_ABI_L2_brightness_temperature_band_15_2km_data
ABI L2+ Intermediate Products	input_ABI_L2_intermediate_product_reflectance_band_1_2km_data input_ABI_L2_intermediate_product_reflectance_band_2_2km_data input_ABI_L2_intermediate_product_reflectance_band_3_2km_data input_ABI_L2_intermediate_product_reflectance_band_4_2km_data input_ABI_L2_intermediate_product_reflectance_band_5_2km_data input_ABI_L2_intermediate_product_reflectance_band_6_2km_data

The other dynamic source data inputs are summarized in Table 5.9.2-2, Other Dynamic Source Data.

Table 5.9.2-2 Other Dynamic Source Data

Dynamic Data Category	Dynamic Data Type
ABI L2+ Intermediate Products	input_ABI_L2_intermediate_product_4_level_cloud_mask_info_flag_data input_ABI_L2_intermediate_product_binary_snow_mask_data
Processed Dynamic Ancillary Data	input_dynamic_ancillary_global_snow_mask_data ^[1]
Dynamic Auxiliary Data	input_ABI_L2_auxiliary_solar_zenith_angle_data input_ABI_L2_auxiliary_sunglint_angle_data input_ABI_L2_auxiliary_sun_satellite_relative_azimuth_angle_data ^[2]

[1] Processed global snow mask ancillary data is used when the ABI intermediate binary snow mask product data is not available.

[2] Sun-satellite relative azimuth angle is used to compute the sunglint angle in the event that the sunglint angle is not available.

Refer to Appendix C, Dynamic Source Data, for a description of each of the individual types of dynamic source data used to generate this product.

5.9.3 Level 2+ Semi-Static Source Data

There are two categories of semi-static source data employed in the GOES-R ABI Aerosol Detection ground-processing algorithm:

- Algorithm-specific parameters
- Gridded parameters

The algorithm-specific parameters represent parameters that are unique to the Aerosol Detection algorithm. Some of these parameters may be tuned for the specific characteristics of the ABI instrument. These include:

- Qualification thresholds based on latitude, longitude, solar zenith angle, satellite zenith angle, and sunglint.
- Thresholds for retrieval over snow/ice.
- Aerosol detection test thresholds for smoke and dust over land and water backgrounds.
- Confidence values and thresholds for confidence tests.
- Thresholds for assignment of quality flags.

The categories of gridded parameters used in the generation of the Aerosol Detection product are projection and mapping, and earth surface classifications and characteristics. The specific types of gridded semi-static source data in the categories used in the generation of the Aerosol Detection product are identified in Table 5.9.3 Gridded Semi-Static Source Data.

Table 5.9.3 Gridded Semi-Static Source Data

Gridded Semi-Static Source Data Category	Gridded Semi-Static Data Type
Projection and Mapping	input_ABI_L2_slot_specific_semi_static_lat_lon_position_2km_data input_ABI_L2_semi_static_local_zenith_angle_data
Earth Surface Classification and Characteristics	input_ABI_L2_slot_specific_semi_static_land_sea_mask_data

Refer to Appendix D, Gridded Semi-Static Source Data, for a description of each of the individual types of gridded semi-static source data used to generate this product.

Semi-static source data files from the two categories above are contained in a single zip file. The filename conventions for the ABI Level 2 semi-static source data files are located in Appendix A, Table A.3-1.

Following are the file names of coverage parameters within the ABI semi-static source data zip file. In this case the file names describe the content.

- ABI_CONUS_2km_LatLonPosition.bin
- ABI_CONUS_2km_LocalAzimuth.bin
- ABI_CONUS_2km_LocalZenith.bin
- ABI_CONUS_2km_SemiStaticMasks_GM.bin
- ABI_FD_2km_LatLonPosition.bin
- ABI_FD_2km_LocalAzimuth.bin
- ABI_FD_2km_LocalZenith.bin
- ABI_FD_2km_SemiStaticMasks_GM.bin
- Auxiliary_Params.bin
- DMI_ABI_Params.bin
- Imagery_Params.bin
- L2ServicesSharedLibrary_Params.bin
- NWP_StaticMasks_GM_AllOnes.bin

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- NWP_StaticMasks_GM_OnesLt80.bin
- AI_ABI-L2-ADPSemiStaticParams.bin

5.9.4 Coordinates

The coordinates associated with data variables in the Aerosol Detection product are identified in Table 5.9.4, Aerosol Detection Product Coordinates.

Table 5.9.4 Aerosol Detection Product Coordinates

Aerosol Detection Product Data Quantity	Coordinates
aerosol detection data (including smoke and dust)	<ul style="list-style-type: none"> • Observation time period • N/S elevation and E/W scanning angles for pixel geo-location • Local zenith angle ranges for good, and good or degraded quality data production • Solar zenith angle ranges for good, and good or degraded quality data production
aerosol detection retrieval quality flags	<ul style="list-style-type: none"> • Observation time period • N/S elevation and E/W scanning angles for pixel geo-location • Local zenith angle range for good or degraded quality data production • Solar zenith angle range for good or degraded quality data production
good local zenith angle pixel count	<ul style="list-style-type: none"> • Observation time period • N/S elevation and E/W scanning angle extents for image geo-location • Local zenith angle range for good quality data production • Solar zenith angle range for good or degraded quality data production
good solar zenith angle pixel count	<ul style="list-style-type: none"> • Observation time period • N/S elevation and E/W scanning angle extents for image geo-location • Local zenith angle range for good or degraded quality data production • Solar zenith angle range for good quality data production
good smoke and dust retrieval counts	<ul style="list-style-type: none"> • Observation time period • NN/S elevation and E/W scanning angle extents for image geo-location • Local zenith angle range for good or degraded quality data production • Solar zenith angle range for good or degraded quality data production
data transmission error percentages	<ul style="list-style-type: none"> • Observation time period • N/S elevation and E/W scanning angle extents for image geo-location

5.9.5 Production Notes

The Aerosol Detection product is generated by the GOES-R ABI Aerosol Detection ground processing algorithm. The algorithm applies threshold tests to ABI reflectance bands and thermal bands over land and ocean backgrounds to obtain results. Clear sky is determined using clear and probably clear pixels indicated in the temporally coincident intermediate 4-level cloud mask generated by the Cloud Mask algorithm. Snow-free is determined using snow-free pixels indicated in the most recent intermediate binary snow mask generated by the Snow Cover algorithm.

In addition to the aerosol, dust, and smoke binary mask images, the algorithm produces a data information flag bit mask that captures the outcome of individual tests and other diagnostic information. The final and intermediate diagnostic information product files are available in the GOES-R ground system's two-day revolving storage to support anomaly resolution and algorithm analysis.

For product refresh rate and latency information, refer to Appendix B, Product Refresh Rates and Latencies.

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For additional details on the Aerosol Detection ground processing algorithm and the expected performance, refer to the NOAA NESDIS Center for Satellite Applications and Research GOES-R Advanced Baseline Imager (ABI) Algorithm Theoretical Basis Document for the ABI Aerosol Detection Product. This document is located at

http://www.goes-r.gov/products/ATBDs/baseline/AAA_AIP_v2.0_no_color.pdf

5.9.6 Data Fields

The Aerosol Detection product is delivered using the netCDF-4 file format. Its global attributes and the variables are defined in the tables that follow. Following the product specification tables is a subordinate paragraph containing tables that describe the values and meanings for the flag variables in the product.

The filename conventions for the Aerosol Detection product are located in Appendix A.

Table 5.9.6-1 Aerosol Detection: Global Attributes

Global Attribute Name	Value	Type
id	<i>attribute is added dynamically when the file is created.</i>	string
dataset_name	<i>refer to filename conventions for L2+ products in Appendix A.</i>	string
naming_authority	gov.nesdis.noaa	string
institution	DOC/NOAA/NESDIS> U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Services	string
project	GOES	string
iso_series_metadata_id	258cad90-af4b-11e1-afa6-0800200c9a66	string
Conventions	CF-1.7	string
Metadata_Conventions	Unidata Dataset Discovery v1.0	string
keywords_vocabulary	NASA Global Change Master Directory (GCMD) Earth Science Keywords, Version 7.0.0.0.0	string
standard_name_vocabulary	CF Standard Name Table (v25, 05 July 2013)	string
title	ABI L2 Aerosol Detection	string
summary	The Aerosol Detection product consists of three flags for each pixel in the image indicating the presence of aerosol and whether the type of aerosol is dust or smoke. The three flags are generated based on the results of threshold tests applied to reflectances at ABI reflective bands with central wavelengths 0.47, 0.64, 0.87, 1.38, 1.61, and 2.25 um, and brightness temperatures at ABI emissive bands with central wavelengths 3.89, 10.33, 11.19, and 12.27 um. Product data is generated during the day.	string
license	Unclassified data. Access is restricted to approved users only.	string
keywords	ATMOSPHERE > AEROSOLS > DUST/ASH/SMOKE	string
cdm_data_type	Image	string
orbital_slot	<i>possible values are GOES-East, GOES-West, GOES-Test, and GOES-Storage.</i>	string
platform_ID	<i>possible values are G16 and G17.</i>	string
instrument_type	GOES R Series Advanced Baseline Imager	string
instrument_ID	<i>serial number of the instrument.</i>	string
processing_level	National Aeronautics and Space Administration (NASA) L2	string
date_created	<i>format is YYYY-MM-DD"T"HH:MM:SS.s"Z".</i>	string
production_site	NSOF	string

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production_environment	<i>possible values are OE, ITE, and DE.</i>	string
production_data_source	<i>possible values are Realtime, Simulated, Playback, and Test.</i>	string
timeline_id	<i>possible values are ABI Mode 3, ABI Mode 4 and ABI Mode 6.</i>	string
scene_id	<i>possible values are Full Disk, CONUS, and Mesoscale.</i>	string
spatial_resolution	2km at nadir	string
time_coverage_start	<i>format is YYYY-MM-DD"T"HH:MM:SS.s"Z".</i>	string
time_coverage_end	<i>format is YYYY-MM-DD"T"HH:MM:SS.s"Z".</i>	string

Table 5.9.6-2 Aerosol Detection: Variables

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
y	short	<i>y = see note [1]</i>	long_name	GOES-R fixed grid projection y-coordinate	string
			standard_name	projection_y_coordinate	string
			scale_factor	<i>see note [1]</i>	float
			add_offset	<i>see note [1]</i>	float
			units	rad	string
			axis	Y	string
x	short	<i>x = see note [1]</i>	long_name	GOES-R fixed grid projection x-coordinate	string
			standard_name	projection_x_coordinate	string
			scale_factor	<i>see note [1]</i>	float
			add_offset	<i>see note [1]</i>	float
			units	rad	string
			axis	X	string
t	double	n/a	long_name	J2000 epoch mid-point between the start and end image scan in seconds since 2000-01-01 12:00:00	string
			standard_name	time	string
			units	seconds since 2000-01-01 12:00:00	string
			axis	T	string
			bounds	time_bounds	string
time_bounds	double	number_of_time_bounds = 2	long_name	scan start and end times in seconds since epoch (2000-01-01 12:00:00)	string
retrieval_local_zenith_angle <i>value = 90.0</i>	float	n/a	long_name	threshold angle between the line of sight to the satellite and the local zenith at the observation target for good or degraded quality aerosol detection data production	string
			standard_name	platform_zenith_angle	string
			units	degree	string
			bounds	retrieval_local_zenith_angle_bounds	string

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
quantitative_local_zenith_angle <i>value = 60.0</i>	float	n/a	long_name	threshold angle between the line of sight to the satellite and the local zenith at the observation target for good quality aerosol detection data production	string
			standard_name	platform_zenith_angle	string
			units	degree	string
			bounds	quantitative_local_zenith_angle_bounds	string
retrieval_local_zenith_angle_bounds <i>value = 0.0</i> <i>90.0</i>	float	number_of_LZA_bounds = 2	long_name	local zenith angle degree range where good or degraded quality aerosol detection data is produced	string
quantitative_local_zenith_angle_bounds <i>value = 0.0</i> <i>60.0</i>	float	number_of_LZA_bounds = 2	long_name	local zenith angle degree range where good quality aerosol detection data is produced	string
retrieval_solar_zenith_angle <i>value = 87.0</i>	float	n/a	long_name	threshold angle between the line of sight to the sun and the local zenith at the observation target for good or degraded quality aerosol detection data production	string
			standard_name	solar_zenith_angle	string
			units	degree	string
			bounds	retrieval_solar_zenith_angle_bounds	string
quantitative_solar_zenith_angle <i>value = 60.0</i>	float	n/a	long_name	threshold angle between the line of sight to the sun and the local zenith at the observation target for good quality aerosol detection data production	string
			standard_name	solar_zenith_angle	string
			units	degree	string
			bounds	quantitative_solar_zenith_angle_bounds	string
retrieval_solar_zenith_angle_bounds <i>value = 0.0</i> <i>87.0</i>	float	number_of_SZA_bounds = 2	long_name	solar zenith angle degree range where good or degraded quality aerosol detection data is produced	string
	float		long_name		string

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
quantitative_solar_zenith_angle_bounds value = 0.0 60.0		number_of_SZA_bounds = 2		solar zenith angle degree range where good quality aerosol detection data is produced	
y_image value = <i>see note [1]</i>	float	n/a	long_name	GOES-R fixed grid projection y-coordinate center of image	string
			standard_name	projection_y_coordinate	string
			units	rad	string
			axis	Y	string
			bounds	y_image_bounds	string
y_image_bounds	float	number_of_image_bounds = 2	long_name	GOES-R fixed grid projection y-coordinate north/south extent of image	string
x_image value = <i>see note [1]</i>	float	n/a	long_name	GOES-R fixed grid projection x-coordinate center of image	string
			standard_name	projection_x_coordinate	string
			units	rad	string
			axis	X	string
			bounds	x_image_bounds	string
x_image_bounds	float	number_of_image_bounds = 2	long_name	GOES-R fixed grid projection x-coordinate west/east extent of image	string
goes_imager_projection	int	n/a	long_name	GOES-R ABI fixed grid projection	string
			grid_mapping_name	geostationary	string
			perspective_point_height	35786023	double
			semi_major_axis	6378137	double
			semi_minor_axis	6356752.314	double
			inverse_flattening	298.2572221	double
			latitude_of_projection_origin	0	double
			longitude_of_projection_origin	<i>see note [1]</i>	double
sweep_angle_axis	x	string			
Aerosol	byte	y = <i>see note [1]</i> x = <i>see note [1]</i>	long_name	ABI L2+ Aerosol Detection: Aerosol	string
			standard_name	aerosol_binary_mask	string

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Variable			Attribute					
Name	Type	Shape	Name	Value	Type			
			_Unsigned	TRUE	string			
			_FillValue	255	byte			
			valid_range	0 1	byte			
			units	1	string			
			resolution	y: 0.000056 rad x: 0.000056 rad	string			
			coordinates	retrieval_local_zenith_angle quantitative_local_zenith_angle retrieval_solar_zenith_angle quantitative_solar_zenith_angle t y x	string			
			grid_mapping	goes_imager_projection	string			
			cell_methods	retrieval_local_zenith_angle: point (good or degraded quality pixel produced) quantitative_local_zenith_angle: point (good quality pixel produced) retrieval_solar_zenith_angle: point (good or degraded quality pixel produced) quantitative_solar_zenith_angle: point (good quality pixel produced) t: point area: point	string			
			flag_values	<i>see note [flags and meanings]</i>	byte			
			flag_meanings	<i>see note [flags and meanings]</i>	string			
			ancillary_variables	DQF	string			
			Smoke	byte	y = <i>see note [1]</i> x = <i>see note [1]</i>	long_name	ABI L2+ Aerosol Detection: Smoke	string
						standard_name	smoke_binary_mask	string
_Unsigned	TRUE	string						
_FillValue	255	byte						
valid_range	0 1	byte						
units	1	string						
resolution	y: 0.000056 rad x: 0.000056 rad	string						
coordinates	retrieval_local_zenith_angle quantitative_local_zenith_angle retrieval_solar_zenith_angle quantitative_solar_zenith_angle t y x	string						
grid_mapping	goes_imager_projection	string						
cell_methods	retrieval_local_zenith_angle: point (good or degraded quality pixel produced) quantitative_local_zenith_angle: point (good quality pixel produced) retrieval_solar_zenith_angle: point (good or degraded quality pixel produced) quantitative_solar_zenith_angle: point (good quality pixel produced) t: point area: point	string						
flag_values	<i>see note [flags and meanings]</i>	byte						
flag_meanings	<i>see note [flags and meanings]</i>	string						
ancillary_variables	DQF	string						
Dust	byte	y = <i>see note [1]</i> x = <i>see note [1]</i>	long_name	ABI L2+ Aerosol Detection: Dust	string			
			standard_name	dust_binary_mask	string			
			_Unsigned	TRUE	string			

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			_FillValue	255	byte
			valid_range	0 1	byte
			units	1	string
			resolution	y: 0.000056 rad x: 0.000056 rad	string
			coordinates	retrieval_local_zenith_angle quantitative_local_zenith_angle retrieval_solar_zenith_angle quantitative_solar_zenith_angle t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	retrieval_local_zenith_angle: point (good or degraded quality pixel produced) quantitative_local_zenith_angle: point (good quality pixel produced) retrieval_solar_zenith_angle: point (good or degraded quality pixel produced) quantitative_solar_zenith_angle: point (good quality pixel produced) t: point area: point	string
			flag_values	<i>see note [flags and meanings]</i>	byte
			flag_meanings	<i>see note [flags and meanings]</i>	string
			ancillary_variables	DQF	string
DQF	byte	y = <i>see note [1]</i> x = <i>see note [1]</i>	long_name	ABI L2+ Aerosol Detection data quality flags	string
			standard_name	status_flag	string
			_Unsigned	TRUE	string
			_FillValue	255	byte
			valid_range	0 60	byte
			units	1	string
			coordinates	retrieval_local_zenith_angle retrieval_solar_zenith_angle t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	retrieval_local_zenith_angle: point retrieval_solar_zenith_angle: point t: point area: point	string
			flag_masks	<i>see note [flags and meanings]</i>	byte
			flag_values	<i>see note [flags and meanings]</i>	byte
			flag_meanings	<i>see note [flags and meanings]</i>	string
			number_of_smoke_detection_qf_values	2	byte
			percent_good_smoke_detection_retrieval_qf	<i>dynamic value</i>	float
			percent_invalid_smoke_detection_due_to_snow_ice_clouds_or_bad_source_data_qf	<i>dynamic value</i>	float

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Variable			Attribute					
Name	Type	Shape	Name	Value	Type			
			number_of_dust_detection_qf_values	2	byte			
			percent_good_dust_detection_retrieval_qf	<i>dynamic value</i>	float			
			percent_invalid_dust_detection_due_to_snow_ice_clouds_or_bad_source_data_qf	<i>dynamic value</i>	float			
			number_of_smoke_confidence_qf_values	3	byte			
			percent_low_confidence_smoke_detection_qf	<i>dynamic value</i>	float			
			percent_medium_confidence_smoke_detection_qf	<i>dynamic value</i>	float			
			percent_high_confidence_smoke_detection_qf	<i>dynamic value</i>	float			
			number_of_dust_confidence_qf_values	3	byte			
			percent_low_confidence_dust_detection_qf	<i>dynamic value</i>	float			
			percent_medium_confidence_dust_detection_qf	<i>dynamic value</i>	float			
			percent_high_confidence_dust_detection_qf	<i>dynamic value</i>	float			
			number_good_LZA_pixels	int	n/a	long_name	number of pixels that do not exceed LZA threshold	string
						_FillValue	-1	int
units	count	string						
coordinates	quantitative_local_zenith_angle retrieval_solar_zenith_angle t y_image x_image	string						
grid_mapping	goes_imager_projection	string						
cell_methods	quantitative_local_zenith_angle: sum retrieval_solar_zenith_angle: sum t: sum area: sum (interval: 0.000056 rad comment: geolocated/not missing pixels only)	string						

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
number_good_SZA_pixels	int	n/a	long_name	number of pixels that do not exceed SZA threshold	string
			_FillValue	-1	int
			units	count	string
			coordinates	retrieval_local_zenith_angle quantitative_solar_zenith_angle t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	retrieval_local_zenith_angle: sum quantitative_solar_zenith_angle: sum t: sum area: sum (interval: 0.000056 rad comment: geolocated/not missing pixels only)	string
number_of_good_smoke_retrievals	int	n/a	long_name	number of smoke retrievals where smoke may or may not exist	string
			_FillValue	-1	int
			units	count	string
			coordinates	retrieval_local_zenith_angle retrieval_solar_zenith_angle t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	retrieval_local_zenith_angle: sum retrieval_solar_zenith_angle: sum t: sum area: sum (interval: 0.000056 rad comment: good smoke detection retrieval pixels only)	string
number_of_good_dust_retrievals	int	n/a	long_name	number of dust retrievals where dust may or may not exist	string
			_FillValue	-1	int
			units	count	string
			coordinates	retrieval_local_zenith_angle retrieval_solar_zenith_angle t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	retrieval_local_zenith_angle: sum retrieval_solar_zenith_angle: sum t: sum area: sum (interval: 0.000056 rad comment: good dust detection retrieval pixels only)	string
number_of_good_retrievals_where_smoke_detected	int	n/a	long_name	number of retrievals where smoke is detected	string
			_FillValue	-1	int
			units	count	string
			coordinates	retrieval_local_zenith_angle retrieval_solar_zenith_angle t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	retrieval_local_zenith_angle: sum retrieval_solar_zenith_angle: sum t: sum area: sum (interval: 0.000056 rad comment: good smoke detection retrieval pixels only) where smoke	string
	int	n/a	long_name	number of retrievals where dust is detected	string

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
number_of_good_retrievals_where_dust_detected			_FillValue	-1	int
			units	count	string
			coordinates	retrieval_local_zenith_angle retrieval_solar_zenith_angle t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	retrieval_local_zenith_angle: sum retrieval_solar_zenith_angle: sum t: sum area: sum (interval: 0.000056 rad comment: good dust detection retrieval pixels only) where dust_aerosol	string
percent_uncorrectable_GRB_errors	float	n/a	long_name	percent data lost due to uncorrectable GRB errors	string
			_FillValue	-999.0	float
			valid_range	0.0 1.0	float
			units	percent	string
			coordinates	t y_image x_image	string
			cell_methods	t: sum area: sum (uncorrectable GRB errors only)	string
percent_uncorrectable_L0_errors	float	n/a	long_name	percent data lost due to uncorrectable L0 errors	string
			_FillValue	-999.0	float
			valid_range	0.0 1.0	float
			units	percent	string
			coordinates	t y_image x_image	string
			cell_methods	t: sum area: sum (uncorrectable L0 errors only)	string
nominal_satellite_subpoint_latitude_value = 0.00	float	n/a	long_name	nominal satellite subpoint latitude (platform latitude)	string
			standard_name	latitude	string
			_FillValue	-999.0	float
			units	degrees_north	string
nominal_satellite_subpoint_longitude_value = <i>see note [1]</i>	float	n/a	long_name	nominal satellite subpoint longitude (platform longitude)	string
			standard_name	longitude	string
			_FillValue	-999.0	float
			units	degrees_east	string
nominal_satellite_height_value = 35786.023	float	n/a	long_name	nominal satellite height above GRS 80 ellipsoid (platform altitude)	string
			standard_name	height_above_reference_ellipsoid	string
			_FillValue	-999.0	float
			units	km	string
geospatial_latitude_longitude_extent	float	n/a	long_name	geospatial latitude and longitude references	string
			geospatial_westbound_longitude	<i>see note [1]</i>	float

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			geospatial_northbound_latitude	<i>see note [1]</i>	float
			geospatial_eastbound_longitude	<i>see note [1]</i>	float
			geospatial_southbound_latitude	<i>see note [1]</i>	float
			geospatial_lat_center	<i>see note [1]</i>	float
			geospatial_lon_center	<i>see note [1]</i>	float
			geospatial_lat_nadir	0	float
			geospatial_lon_nadir	<i>see note [1]</i>	float
			geospatial_lat_units	degrees_north	string
			geospatial_lon_units	degrees_east	string
algorithm_dynamic_input_data_container	int	n/a	long_name	container for filenames of dynamic algorithm input data	string
			input_ABI_L2_auxiliary_solar_zenith_angle_data	<i>refer to filename conventions for L2+ products in Appendix A.</i>	string
			input_ABI_L2_auxiliary_sunglint_angle_data	<i>refer to filename conventions for L2+ products in Appendix A.</i>	string
			input_ABI_L2_auxiliary_sun_satellite_relative_azimuth_angle_data	<i>refer to filename conventions for L2+ products in Appendix A.</i>	string
			input_ABI_L2_brightness_temperature_band_7_2km_data	<i>refer to filename conventions for L2+ products in Appendix A of PUG L2+ volume.</i>	string
			input_ABI_L2_brightness_temperature_band_13_2km_data	<i>refer to filename conventions for L2+ products in Appendix A of PUG L2+ volume.</i>	string
			input_ABI_L2_brightness_temperature_band_14_2km_data	<i>refer to filename conventions for L2+ products in Appendix A of PUG L2+ volume.</i>	string
			input_ABI_L2_brightness_temperature_band_15_2km_data	<i>refer to filename conventions for L2+ products in Appendix A of PUG L2+ volume.</i>	string

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			input_ABI_L2_intermediate_product_reflectance_band_1_2km_data	<i>refer to filename conventions for L2+ products in Appendix A of PUG L2+ volume.</i>	string
			input_ABI_L2_intermediate_product_reflectance_band_2_2km_data	<i>refer to filename conventions for L2+ products in Appendix A of PUG L2+ volume.</i>	string
			input_ABI_L2_intermediate_product_reflectance_band_3_2km_data	<i>refer to filename conventions for L2+ products in Appendix A of PUG L2+ volume.</i>	string
			input_ABI_L2_intermediate_product_reflectance_band_4_2km_data	<i>refer to filename conventions for L2+ products in Appendix A of PUG L2+ volume.</i>	string
			input_ABI_L2_intermediate_product_reflectance_band_5_2km_data	<i>refer to filename conventions for L2+ products in Appendix A of PUG L2+ volume.</i>	string
			input_ABI_L2_intermediate_product_reflectance_band_6_2km_data	<i>refer to filename conventions for L2+ products in Appendix A of PUG L2+ volume.</i>	string
			input_ABI_L2_intermediate_product_cloud_mask_info_flag_data	<i>refer to filename conventions for L2+ products in Appendix A of PUG L2+ volume.</i>	string
			input_ABI_L2_intermediate_product_binary_snow_mask_data	<i>refer to filename conventions for L2+ products in Appendix A of PUG L2+ volume.</i>	string
			input_dynamic_ancillary_global_snow_mask_data	<i>refer to filename conventions for L2+ products in Appendix A of PUG L2+ volume.</i>	string
processing_parm_version_container	int	n/a	long_name	container for processing parameter filenames	string
			L2_processing_parm_version	<i>refer to filename conventions for L2+ Semi-Static parameter filenames in Appendix A.</i>	string
	int	n/a	long_name	container for algorithm package filename and product version	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
algorithm_product_version_container			algorithm_version	<i>refer to filename conventions for L2+ algorithm packages in Appendix A.</i>	string
			product_version	<i>format is vVVrRR where VV is major release # and RR is minor revision #.</i>	string

Note 1: Coverage region and horizontal spatial resolution related sizing and extent variable and attribute values are located in paragraph 4.2.6, Product Data Structures, and paragraph 4.2.7, Standard Coordinate Data, in the ABI Fixed Grid section.

Note "flags and meanings": Flag values and meanings are located in paragraph 5.9.6.1, Aerosol Detection Product Flag Values and Meanings.

5.9.6.1 Aerosol Detection Product Flag Values and Meanings

Table 5.9.6.1-1 Aerosol Detection Product Binary Aerosol Mask Flag Values and Meanings

Aerosol (aerosol)	
Flag Value	Flag Meaning
0	aerosols_absent
1	aerosols_present

Table 5.9.6.1-2 Aerosol Detection Product Binary Smoke Mask Flag Values and Meanings

Smoke (smoke)	
Flag Value	Flag Meaning
0	smoke_absent
1	smoke_present

Table 5.9.6.1-3 Aerosol Detection Product Binary Dust Mask Flag Values and Meanings

Dust (dust)	
Flag Value	Flag Meaning
0	dust_absent
1	dust_present

Table 5.9.6.1-4 Aerosol Detection Product Data Quality Flag Values and Meanings

Data Quality Flags (DQF)		
Flag Mask	Flag Value	Flag Meaning
1	0	good_smoke_detection_retrieval_qf
1	1	invalid_smoke_detection_due_to_snow_ice_clouds_or_bad_source_data_qf
2	0	good_dust_detection_retrieval_qf
2	2	invalid_dust_detection_due_to_snow_ice_clouds_or_bad_source_data_qf
12	0	low_confidence_smoke_detection_qf
12	4	medium_confidence_smoke_detection_qf
12	12	high_confidence_smoke_detection_qf
48	0	low_confidence_dust_detection_qf
48	16	medium_confidence_dust_detection_qf
48	48	high_confidence_dust_detection_qf
64	0	out_of_sun_glint_qf
64	64	within_sun_glint_qf
128	0	within_valid_solar_and_satellite_zenith_angle_range_qf
128	128	outside_valid_solar_and_satellite_zenith_angle_range_qf