

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.

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.

- 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

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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

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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	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
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_parameter_version_container	int	n/a	long_name	container for processing parameter filenames	string
			L2_processing_parameter_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

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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

5.10 Aerosol Optical Depth Product

5.10.1 Description

The Aerosol Optical Depth product contains an image with pixel values identifying a measure of the extinction due to atmospheric aerosols at a wavelength of 550 nm over land and ocean. The product includes data quality information that provides an assessment of the quality of the algorithm retrievals for on-earth pixels.

The aerosol optical depth value is a dimensionless quantity.

The Aerosol Optical Depth product image is produced on the ABI fixed grid at 2 km resolution for Full Disk and CONUS coverage regions. Product data is produced under the following conditions:

- clear sky
- snow-free
- geolocated source data to local zenith angles of 90 degrees, to solar zenith angles of 90 degrees, and sunglint angles greater than 40 degrees when over the ocean
- surface with reflectance not greater than 0.25 at ABI band with ABI band 6 central wavelength of 2.25 um when over the land

The Aerosol Optical Depth performance requirements are summarized in Table 5.10.1, Aerosol Optical Depth Performance Requirements. High quality retrievals as prescribed by the algorithm are those that satisfy the measurement performance conditions identified therein except as noted.

Table 5.10.1 Aerosol Optical Depth Performance Requirements

Region	Surface Type	Measurement				Mapping
		Range	Accuracy	Precision	Performance Conditions ^[1]	Accuracy
Full Disk & CONUS	Over Land	-1 to 5	(1) AOD < 0.04: 0.06 (2) 0.04 ≤ AOD ≤ 0.80: 0.04 (3) AOD > 0.80: 0.12	(1) AOD < 0.04: 0.13 (2) 0.04 ≤ AOD ≤ 0.80: 0.25 (3) AOD > 0.80: 0.35	LZA ≤ 60 degrees daytime ^[2] clear sky	1 km
Full Disk & CONUS	Over Ocean	-1 to 5	(1) AOD < 0.40: 0.02 (2) AOD > 0.40: 0.10	(1) AOD < 0.40: 0.15 (2) AOD > 0.40: 0.23	LZA ≤ 60 degrees daytime ^[2] clear sky	1 km

[1] Conditions for data production prescribed by the algorithm also include snow/ice-free and, when over ocean, sunglint angle > 40 degrees.

[2] Conditions for high quality prescribed by the algorithm are for SZA ≤ 80 degrees.

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

- Start, midpoint, and end time of the product image observation period.
- Percentages of each of high quality and bad aerosol optical depth pixels over land and over ocean for the eighteen, 10 degree latitude bands in the product image.

- Minimum, maximum, mean, and standard deviation of the surface reflectivity values at the ABI reflective band wavelengths associated with source level 1b data used by the algorithm over land for the eighteen, 10 degree latitude bands in the product image.
- Number of attempted retrievals over land and over ocean for the eighteen, 10 degree latitude bands.
- Number of attempted retrievals over land and over ocean within the local zenith angle performance specification limit of 60 degrees for the eighteen, 10 degree latitude bands.

These statistics are calculated using geolocated pixels to a solar zenith angle of 80 degrees, which is associated with high quality pixels. These statistics are calculated using geolocated pixels to a local zenith angle of 90 degrees, except for the number of attempted retrievals over land and over ocean within the local zenith angle performance specification limit of 60 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 Optical Depth product is located in the standalone Appendix X, ISO Series Metadata.

5.10.2 Dynamic Source Data

The Aerosol Optical Depth product is derived using processed ABI L1b reflective band images from the current observation. The algorithm uses final and intermediate product data generated by the Cloud Mask, Legacy Atmospheric Profiles, and Snow Cover algorithms. In addition, processed surface wind, total column ozone, and surface pressure data derived from the NWP model ancillary data are used. Furthermore, the algorithm uses dynamic auxiliary data, specifically solar zenith angle, solar azimuth angles, and sun-satellite relative azimuth angle data. Processed global snow and ice cover data derived from the NSIDC ancillary data and processed total precipitable water derived from the NWP model ancillary data are secondary inputs to the algorithm.

The primary sensor data used by the Aerosol Optical Depth algorithm is identified in Table 5.10.2-1, Primary Sensor Data.

Table 5.10.2-1 Primary Sensor Data

Dynamic Data Category	Dynamic Data Type
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_data input_ABI_L2_intermediate_product_brightness_temperature_band_14_2km_data

The other dynamic source data inputs are summarized in Table 5.10.2-2, Other Dynamic Source Data.

Table 5.10.2-2 Other Dynamic Source Data

Dynamic Data Category	Dynamic Data Type
ABI L1b/L2+ Final Products	input_ABI_L2_total_precipitable_water_data
ABI L2+ Intermediate Products	input_ABI_L2_intermediate_product_4_level_cloud_mask_data

input ABI L2 auxiliary sun satellite relative azimuth angle data
--

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

[2] Processed NWP total precipitable water ancillary data is used when the ABI total precipitable water product data 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.

5.10.3 Level 2+ Semi-Static Source Data

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

- Algorithm-specific parameters.
- Gridded parameters.

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

- Qualification thresholds based on sunglint, surface reflectance, solar and satellite zenith angles, etc.
- Default physical values for missing inputs (for graceful degradation).
- Aerosol optical depth LUT and fiducials for normalized atmospheric extinction coefficients, atmospheric spherical albedo, atmospheric transmittance, and atmospheric reflectance over land.
- Aerosol optical depth LUT and fiducials for normalized atmospheric extinction coefficients, atmospheric spherical albedo, atmospheric transmittance, and atmospheric reflectance over ocean.
- Mass extinction coefficient LUTs and fiducials for land and for ocean.
- Real and imaginary components of the water vapor refractive index.
- Coefficients used in the correction for extinction by atmospheric gases and for determination of water vapor transmittance.
- Coefficients used in computation of Rayleigh multiple scattering reflectance.
- In-water reflectance and whitecap reflectance parameters for ocean.
- Ocean sunglint surface reflectance LUT and fiducials for diffuse reflectance and spherical albedo.
- Coefficients in Cox Munk ocean directional reflectance model.
- Coefficients used in the NDVI-based association between VIS and SWIR band reflectance.
- Thresholds used in setting product quality.
- Minimum/maximum valid range / outlier limits on aerosol optical depth.
- Minimum/maximum brightness temperature parameters.

The categories of gridded parameters used in the generation of the Aerosol Optical Depth product are projection and mapping, earth surface classifications and characteristics, and atmospheric climatology.

The specific types of gridded semi-static source data in the categories used in the generation of the

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	input_ABI_L2_semi_static_local_azimuth_angle_data input_ABI_L2_slot_specific_semi_static_NWP_grid_mapping_for_fixed_grid_data
Earth Surface Classification and Characteristics	input_ABI_L2_slot_specific_semi_static_surface_elevation_data input_ABI_L2_slot_specific_semi_static_land_sea_mask_data
Atmospheric Climatology	input_ABI_L2_slot_specific_semi_static_monthly_aerosol_climatology_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
- NWP_StaticMasks_GM_OnesLt80.bin
- AI_ABI-L2-SMAODSemiStaticParams.bin

5.10.4 Coordinates

The coordinates associated with data variables in the Aerosol Optical Depth product are identified in Table 5.10.4, Aerosol Optical Depth Product Coordinates.

Table 5.10.4 Aerosol Optical Depth Product Coordinates

Aerosol Optical Depth Product Data Quantity	Coordinates
aerosol optical depth at wavelength of 550 nm data	<ul style="list-style-type: none"> • Observation time period • N/S elevation and E/W scanning angles for pixel geo-location

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Aerosol Optical Depth Product Data Quantity	Coordinates
	<ul style="list-style-type: none"> • Wavelength associated with data • Local zenith angle range for good or degraded quality data production • Solar zenith angle range for good or degraded quality data production • Sunlint angle range for no data production over sea
aerosol optical depth at wavelength of 550 nm retrievals attempted over land	<ul style="list-style-type: none"> • Observation time period • N/S elevation and E/W scanning angle extents for image geo-location • Wavelength associated with data • Local zenith angle range for good or degraded quality data production • Solar zenith angle range for good quality data production
aerosol optical depth at wavelength of 550 nm retrievals attempted over sea	<ul style="list-style-type: none"> • Observation time period • N/S elevation and E/W scanning angle extents for image geo-location
aerosol optical depth at wavelength of 550 nm outlier pixel count	<ul style="list-style-type: none"> • Wavelength associated with data • Local zenith angle range for good or degraded quality data production • Solar zenith angle range for good quality data production • Sunlint angle range for no data production over sea
aerosol optical depth at wavelength of 550 nm good local zenith angle retrievals attempted	<ul style="list-style-type: none"> • Observation time period • N/S elevation and E/W scanning angle extents for image geo-location • Wavelength associated with data • Local zenith angle range for good quality data production • Solar zenith angle range for good quality data production • Sunlint angle range for no data production over sea
latitude band aerosol optical depth at wavelength of 550 nm retrievals attempted over land	<ul style="list-style-type: none"> • Observation time period • Latitude band (10 degree) statistics geo-location • N/S elevation and E/W scanning angle extents for image perimeter associated with band statistics geo-location
latitude band aerosol optical depth at wavelength of 550 nm percent good and bad retrievals over land	<ul style="list-style-type: none"> • Wavelength associated with data • Local zenith angle range for good or degraded quality data production
latitude band aerosol optical depth at wavelength of 550 nm minimum, maximum, mean, and standard deviation values over land	<ul style="list-style-type: none"> • Solar zenith angle range for good quality data production
latitude band aerosol optical depth at wavelength of 550 nm retrievals attempted over sea	<ul style="list-style-type: none"> • Observation time period • Latitude band (10 degree) statistics geo-location • N/S elevation and E/W scanning angle extents for image perimeter associated with band statistics geo-location
latitude band aerosol optical depth at	

Aerosol Optical Depth Product Data Quantity	Coordinates
	<ul style="list-style-type: none"> • N/S elevation and E/W scanning angle extents for image perimeter associated with band statistics geo-location • Local zenith angle range for good quality data production • Solar zenith angle range for good quality data production
latitude band AOD at wavelength of 550 nm good local zenith angle retrievals attempted over sea	<ul style="list-style-type: none"> • Observation time period • Latitude band (10 degree) statistics geo-location • N/S elevation and E/W scanning angle extents for image perimeter associated with band statistics geo-location • Wavelength associated with data • Local zenith angle range for good quality data production • Solar zenith angle range for good quality data production • Sunlint angle range for no data production over sea
AOD at wavelength of 550 nm minimum, maximum, mean, and standard deviation values over land	<ul style="list-style-type: none"> • Observation time period • N/S elevation and E/W scanning angle extents for image geo-location • Wavelength associated with data • Local zenith angle range for good or degraded quality data production • Solar zenith angle range for good quality data production
AOD at wavelength of 550 nm minimum, maximum, mean, and standard deviation values over sea	<ul style="list-style-type: none"> • Observation time period • N/S elevation and E/W scanning angle extents for image geo-location • Wavelength associated with data • Local zenith angle range for good or degraded quality data production • Solar zenith angle range for good quality data production • Sunlint angle range for no data production over sea
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

5.10.5 Production Notes

The Aerosol Optical Depth product is generated by the GOES-R ABI Aerosol Optical Depth ground processing algorithm. The algorithm determines ABI reflectance measurements using physical retrievals that utilize a lookup table of TOA reflectance that is pre-calculated from a radiative transfer model. The physical retrievals are performed separately over land and ocean. The algorithm computes the optical thickness of aerosols at wavelengths that depend on the surface type. ABI bands 1, 2, and 6 with central wavelengths of 0.47, 0.64, and 2.25 μm are used for land retrievals over dark vegetated surfaces. ABI bands 2, 3, 5, and 6 with central wavelengths of 0.64, 0.87, 1.61, and 2.25 μm are used for ocean retrievals. The aerosol type is evaluated based on the selection of an aerosol model from four prescribed land aerosol models, generic, dust, smoke, and urban, or for a pair of fine and coarse marine aerosol modes selected

The latitude band statistics, whose extents are a function of the ABI's fixed grid field of regard and latitude, use the CF metadata conventions hybrid grid mapping that includes both the grid_mapping for the "geostationary" and "latitude_longitude" projections.

Intermediate output and diagnostic information data are output by the algorithm, including:

- Quality information
- Aerosol optical depth in ABI bands 1, 2, 3, 5, and 6
- Land surface reflectance in ABI bands 1, 2, and 6
- Aerosol model index over land
- Coarse-mode aerosol index over ocean
- Fine-mode aerosol index over ocean
- Fine-mode weight over ocean
- Suspended matter

The fine-mode aerosol index over ocean is an intermediate product that supports the generation of the GOES-R Level 2+ shortwave radiation products. The Aerosol Optical Depth algorithm final, and intermediate data and 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.

For additional details on the Aerosol Optical Depth 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 Suspended Matter / Aerosol Optical Depth and Aerosol Size Parameter. This document is located at

http://www.goes-r.gov/products/ATBDs/baseline/AAA_AODASP_v2.0_no_color.pdf.

5.10.6 Data Fields

The Aerosol Optical Depth 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 a table that describes the values and meanings for the flag variable in the product.

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

Table 5.10.6-1 Aerosol Optical Depth: 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	6aae4020-af4e-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 Optical Depth	string
summary	The Aerosol Optical Depth at 550 nm product consists of pixels containing a dimensionless quantity representing the atmospheric absorption optical thickness due to ambient aerosol. The product is derived from ABI reflectance measurements through physical retrievals that utilize a lookup table of top of the atmosphere reflectance that is calculated from a radiative transfer model. The product is reported at 0.55 um, and 10 degree latitude band statistics are included for aerosol optical depth at 0.55 um, and ABI bands with central wavelengths 0.47, 0.64, and 2.25 um, respectively, over land, and ABI bands with central wavelengths 0.64, 0.87, 1.61, and 2.25 um, respectively, over sea. Product data is generated during the day.	string
license	Unclassified data. Access is restricted to approved users only.	string
keywords	ATMOSPHERE > AEROSOLS > AEROSOL OPTICAL DEPTH/THICKNESS	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

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production_site	NSOF	string
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 and CONUS.</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 5.10.6-2 Aerosol Optical Depth: 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
sunglint_angle <i>value = 40.0</i>	float	n/a	long_name	threshold angle between the line of sight to the satellite and the direction of the beam of incident solar radiation for aerosol optical depth data production	string
			standard_name	sunglint_angle	string
			units	degree	string

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			bounds	sunlint angle bounds	string
sunlint_angle_bounds <i>value = 0.0 40.0</i>	float	number_of_sunlint_angle_bounds = 2	long_name	sunlint angle degree range where aerosol optical depth data is not produced	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 optical depth data production	string
			standard_name	platform zenith angle	string
			units	degree	string
			bounds	retrieval local zenith angle bounds	string
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 optical depth 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 90.0</i>	float	number_of_LZA_bounds = 2	long_name	local zenith angle degree range where good or degraded quality aerosol optical depth data is produced	string
quantitative_local_zenith_angle_bounds <i>value = 0.0 60.0</i>	float	number_of_LZA_bounds = 2	long_name	local zenith angle degree range where good quality aerosol optical depth data is produced	string
retrieval_solar_zenith_angle <i>value = 90.0</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 optical depth 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 = 80.0</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 optical depth 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 90.0</i>	float	number_of_SZA_bounds = 2	long_name	solar zenith angle degree range where good or degraded quality aerosol optical depth 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 <i>value = 0.0 80.0</i>		number_of_SZA_bounds = 2		solar zenith angle degree range where good quality aerosol optical depth data is produced	
aod_product_wavelength <i>value = 0.55</i>	float	n/a	long_name	aerosol optical depth product data wavelength	string
			standard_name	radiation_wavelength	string
			units	um	string
land_sensor_band_wavelengths <i>value = 0.47 0.64 2.25</i>	float	land_sensor_bands = 3	long_name	ABI band central wavelengths for aerosol optical depth statistics over land	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string
sea_sensor_band_wavelengths <i>value = 0.64 0.87 1.61 2.25</i>	float	sea_sensor_bands = 4	long_name	ABI band central wavelengths for aerosol optical depth statistics over sea	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string
land_sensor_band_ids <i>value = 1 2 6</i>	byte	land_sensor_bands = 3	long_name	ABI band identifiers for aerosol optical depth statistics over land	string
			standard_name	sensor_band_identifier	string
			units	1	string
sea_sensor_band_ids <i>value = 2 3 5 6</i>	byte	sea_sensor_bands = 4	long_name	ABI band identifiers for aerosol optical depth statistics over sea	string
			standard_name	sensor_band_identifier	string
			units	1	string
latitude_bands <i>value = 85.0 75.0 65.0 55.0 45.0 35.0 25.0 15.0 5.0 -5.0 -15.0 -25.0 -35.0 -45.0 -55.0 -65.0 -75.0 -85.0</i>	float	latitude_bands = 18	long_name	midpoint of 10 degree latitude bands	string
			standard_name	latitude	string
			units	degrees_north	string
			axis	Y	string
latitude_band_bounds	float	n/a	long_name	latitude band degree ranges	string

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
<i>value = 90.0 80.0 80.0 70.0 70.0 60.0 60.0 50.0 50.0 40.0 40.0 30.0 30.0 20.0 20.0 10.0 10.0 0.0 0.0 -10.0 -10.0 -20.0 -20.0 -30.0 -30.0 -40.0 -40.0 -50.0 -50.0 -60.0 -60.0 -70.0 -70.0 -80.0 -80.0 -90.0</i>					
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 value = <i>see note [1]</i>	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 value = <i>see note [1]</i>	float	number_of_image_bounds = 2	long_name	GOES-R fixed grid projection x-coordinate west/east extent of image	string
snow_free_land_and_ice_free_sea value = <i>snow_free_land ice_free_sea</i>	char	n/a	long_name	CF area_types where AOD retrievals occur	string
			standard_name	area_type	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

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			longitude_of_projection_origin	<i>see note [1]</i>	double
			sweep_angle_axis	x	string
goes_lat_lon_projection	int	n/a	long_name	GOES-R latitude / longitude projection	string
			grid_mapping_name	<i>see note [1]</i>	string
			semi_major_axis	6378137	double
			semi_minor_axis	6356752.314	double
			inverse_flattening	298.2572221	double
			longitude_of_prime_meridian	0	double
AOD	short	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Aerosol Optical Depth at 550 nm	string
			standard_name	atmosphere_extinction_optical_thickness_due_to_ambient_aerosol	string
			Unsigned	TRUE	string
			FillValue	65535	short
			valid_range	0 65530	short
			scale_factor	0.00007706	float
			add_offset	-0.05	float
			units	1	string
			resolution	y: 0.000056 rad x: 0.000056 rad	string
			coordinates	sunlint_angle 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	sunlint_angle: point (no pixel produced over sea only) retrieval_local_zenith_angle: point (high or degraded quality pixel produced) quantitative_local_zenith_angle: point (high quality pixel produced) retrieval_solar_zenith_angle: point (high or degraded quality pixel produced) quantitative_solar_zenith_angle: point (high quality pixel produced) t: point area: point	string
			ancillary_variables	DQF	string
DQF	byte	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Aerosol Optical Depth at 550 nm data quality flags	string
			standard_name	status_flag	string
			Unsigned	TRUE	string
			FillValue	255	byte

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			valid_range	0 3	byte
			units	1	string
			coordinates	sunlint_angle retrieval_local_zenith_angle retrieval_solar_zenith_angle t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	sunlint_angle: point (no retrieval over sea only) retrieval_local_zenith_angle: point retrieval_solar_zenith_angle: point 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
			number_of_qf_values	4	byte
			percent_high_quality_retrieval_qf	<i>dynamic value</i>	float
			percent_medium_quality_retrieval_qf	<i>dynamic value</i>	float
			percent_low_quality_retrieval_qf	<i>dynamic value</i>	float
			percent_no_retrieval_qf	<i>dynamic value</i>	float
aod550_retrievals_attempted_land	int	n/a	long_name	number of ABI L2+ Aerosol Optical Depth at 550 nm over land retrievals attempted	string
			_FillValue	-1	int
			units	count	string
			coordinates	retrieval_local_zenith_angle quantitative_solar_zenith_angle t y image x image	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) where clear_sky over snow_free_land	string
aod550_retrievals_attempted_sea	int	n/a	long_name	number of ABI L2+ Aerosol Optical Depth at 550 nm over sea retrievals attempted	string
			_FillValue	-1	int
			units	count	string

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			coordinates	sunlint_angle retrieval_local_zenith_angle quantitative_solar_zenith_angle t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	sunlint_angle: sum (no data retrievals attempted for pixels) retrieval_local_zenith_angle : sum quantitative_solar_zenith_angle: sum t: sum area: sum (interval: 0.000056 rad comment: geolocated/not missing pixels only) where clear_sky over ice_free_sea	string
aod550_good_LZA_retrievals_attempted	int	n/a	long_name	number of ABI L2+ Aerosol Optical Depth at 550 nm retrievals attempted that do not exceed LZA threshold	string
			_FillValue	-1	int
			units	count	string
			coordinates	sunlint_angle quantitative_local_zenith_angle quantitative_solar_zenith_angle t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	sunlint_angle: sum (no data retrievals attempted for pixels over sea only) quantitative_local_zenith_angle: sum quantitative_solar_zenith_angle: sum t: sum area: sum (interval: 0.000056 rad comment: geolocated/not missing pixels only) where clear_sky over snow_free_land and ice_free_sea	string
aod550_outlier_pixel_count	int	n/a	long_name	number of aerosol optical depth at 550 nm pixels over land whose value is outside valid measurement range	string
			_FillValue	-1	int
			units	count	string
			coordinates	sunlint_angle retrieval_local_zenith_angle quantitative_solar_zenith_angle t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	sunlint_angle: sum (no data retrievals attempted for pixels over sea only) retrieval_local_zenith_angle: sum quantitative_solar_zenith_angle: sum t: sum area: sum (interval: 0.000056 rad comment: high quality retrieval pixels whose values are outside valid measurement range only) where clear_sky over snow_free_land and ice_free_sea	string
lat_band_aod550_retrievals_attempted_land	int	latitude_bands = 18	long_name	number of ABI L2+ Aerosol Optical Depth at 550 nm over land retrievals attempted in latitude band	string
			_FillValue	-1	int

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			units	count	string
			coordinates	retrieval_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string
			cell_methods	retrieval_local_zenith_angle : sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude_bands: sum (interval: 0.000056 rad comment: geolocated/not missing pixels only) where clear_sky over snow_free_land	string
lat_band_aod550_retrievals_attempted_sea	int	latitude_bands = 18	long_name	number of ABI L2+ Aerosol Optical Depth at 550 nm over sea retrievals attempted in latitude band	string
			_FillValue	-1	int
			units	count	string
			coordinates	sunlint_angle retrieval_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string
			cell_methods	sunlint_angle: sum (no data retrievals attempted for pixels) retrieval_local_zenith_angle : sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude_bands: sum (interval: 0.000056 rad comment: geolocated/not missing pixels only) where clear_sky over ice_free_sea	string
lat_band_aod550_good_LZA_retrievals_attempted_land	int	latitude_bands = 18	long_name	number of ABI L2+ Aerosol Optical Depth at 550 nm over land retrievals attempted that do not exceed LZA threshold in latitude band	string
			_FillValue	-1	int
			units	count	string
			coordinates	quantitative_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			cell_methods	quantitative_local_zenith_angle: sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude_bands: sum (interval: 0.000056 rad comment: geolocated/not missing pixels only) where clear_sky over snow_free_land	string
lat_band_aod550_good_L ZA_retrievals_attempted_s ea	int	latitude_bands = 18	long_name	number of ABI L2+ Aerosol Optical Depth at 550 nm over sea retrievals attempted that do not exceed LZA threshold in latitude band	string
			_FillValue	-1	int
			units	count	string
			coordinates	sunlint_angle quantitative_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string
			cell_methods	sunlint_angle: sum (no data retrievals attempted for pixels) quantitative_local_zenith_angle: sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude_bands: sum (interval: 0.000056 rad comment: geolocated/not missing pixels only) where clear_sky over ice_free_sea	string
lat_band_aod550_percent_ high_quality_retrievals_la nd	float	latitude_bands = 18	long_name	percent high quality retrievals of ABI L2+ Aerosol Optical Depth at 550 nm over land in latitude band	string
			_FillValue	-999.0	float
			valid_range	0.0 1.0	float
			units	percent	string
			coordinates	retrieval_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string
			cell_methods	retrieval_local_zenith_angle : sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude_bands: sum (interval: 0.000056 rad comment: high quality retrieval pixels only) where clear_sky over snow_free_land	string
	float	latitude_bands = 18	long_name	percent medium quality retrievals of ABI L2+ Aerosol Optical Depth at 550 nm over land in latitude band	string

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
lat_band_aod550_percent_medium_quality_retrievals_land			FillValue	-999.0	float
			valid_range	0.0 1.0	float
			units	percent	string
			coordinates	retrieval_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string
			cell_methods	retrieval_local_zenith_angle : sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude_bands: sum (interval: 0.000056 rad comment: medium quality retrieval pixels only) where clear_sky over snow_free_land	string
lat_band_aod550_percent_low_quality_retrievals_land	float	latitude_bands = 18	long_name	percent low quality retrievals of ABI L2+ Aerosol Optical Depth at 550 nm over land in latitude band	string
			FillValue	-999.0	float
			valid_range	0.0 1.0	float
			units	percent	string
			coordinates	retrieval_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string
lat_band_aod550_percent_no_retrievals_land	float	latitude_bands = 18	long_name	percent no retrievals of ABI L2+ Aerosol Optical Depth at 550 nm over land in latitude band	string
			FillValue	-999.0	float
			valid_range	0.0 1.0	float
			units	percent	string
			coordinates	retrieval_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			cell_methods	retrieval_local_zenith_angle : sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude bands: sum (interval: 0.000056 rad comment: no retrieval pixels only) where clear_sky over snow_free_land	string
lat_band_aod550_percent_high_quality_retrievals_sea	float	latitude_bands = 18	long_name	percent high quality retrievals of ABI L2+ Aerosol Optical Depth at 550 nm over sea in latitude band	string
			FillValue	-999.0	float
			valid_range	0.0 1.0	float
			units	percent	string
			coordinates	sunlint_angle retrieval_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string
lat_band_aod550_percent_medium_quality_retrievals_sea	float	latitude_bands = 18	cell_methods	sunlint_angle: sum (no pixels produced) retrieval_local_zenith_angle : sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude bands: sum (interval: 0.000056 rad comment: high quality retrieval pixels only) where clear_sky over ice_free_sea	string
			long_name	percent medium quality retrievals of ABI L2+ Aerosol Optical Depth at 550 nm over sea in latitude band	string
			FillValue	-999.0	float
			valid_range	0.0 1.0	float
			units	percent	string
			coordinates	sunlint_angle retrieval_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string
			cell_methods	sunlint_angle: sum (no pixels produced) retrieval_local_zenith_angle : sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude bands: sum (interval: 0.000056 rad comment: medium quality retrieval pixels only) where clear_sky over ice_free_sea	string

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
lat_band_aod550_percent_low_quality_retrievals_sea	float	latitude_bands = 18	long_name	percent low quality retrievals of ABI L2+ Aerosol Optical Depth at 550 nm over sea in latitude band	string
			FillValue	-999.0	float
			valid_range	0.0 1.0	float
			units	percent	string
			coordinates	sunlint_angle retrieval_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string
			cell_methods	sunlint_angle: sum (no pixels produced) retrieval_local_zenith_angle : sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude_bands: sum (interval: 0.000056 rad comment: low quality retrieval pixels only) where clear_sky over ice_free_sea	string
lat_band_aod550_percent_no_retrievals_sea	float	latitude_bands = 18	long_name	percent no retrievals of ABI L2+ Aerosol Optical Depth at 550 nm over sea in latitude band	string
			FillValue	-999.0	float
			valid_range	0.0 1.0	float
			units	percent	string
			coordinates	sunlint_angle retrieval_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string
			cell_methods	sunlint_angle: sum (no pixels produced) retrieval_local_zenith_angle : sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude_bands: sum (interval: 0.000056 rad comment: no retrieval pixels only) where clear_sky over ice_free_sea	string
lat_band_min_aod550_land	float	latitude_bands = 18	long_name	minimum ABI L2+ Aerosol Optical Depth at 550 nm over land in latitude band	string
			standard_name	atmosphere_extinction_optical_thickness_due_to_ambient_aerosol	string
			FillValue	-999.0	float

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			valid_range	-1.0 5.0	float
			units	1	string
			coordinates	retrieval_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string
			cell_methods	retrieval_local_zenith_angle: sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude_bands: minimum (interval: 0.000056 rad comment: high quality retrieval pixels only) where clear_sky over snow_free_land	string
lat_band_max_aod550_land	float	latitude_bands = 18	long_name	maximum ABI L2+ Aerosol Optical Depth at 550 nm over land in latitude band	string
			standard_name	atmosphere_extinction_optical_thickness_due_to_ambient_ae rosol	string
			_FillValue	-999.0	float
			valid_range	-1.0 5.0	float
			units	1	string
			coordinates	retrieval_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string
			cell_methods	retrieval_local_zenith_angle: sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude_bands: maximum (interval: 0.000056 rad comment: high quality retrieval pixels only) where clear_sky over snow_free_land	string
lat_band_mean_aod550_land	float	latitude_bands = 18	long_name	mean ABI L2+ Aerosol Optical Depth at 550 nm over land in latitude band	string
			standard_name	atmosphere_extinction_optical_thickness_due_to_ambient_ae rosol	string
			_FillValue	-999.0	float
			valid_range	-1.0 5.0	float
			units	1	string
			coordinates	retrieval_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string
			cell_methods	retrieval_local_zenith_angle: sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude_bands: mean (interval: 0.000056 rad comment: high quality retrieval pixels only) where clear_sky over snow free land	string
lat_band_std_dev_aod550_land	float	latitude_bands = 18	long_name	standard_deviation of the ABI L2+ Aerosol Optical Depth at 550 nm values over land in latitude band	string
			standard_name	atmosphere_extinction_optical_thickness_due_to_ambient_aerosol	string
			_FillValue	-999.0	float
			units	1	string
			coordinates	retrieval_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string
			cell_methods	retrieval_local_zenith_angle: sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude_bands: standard_deviation (interval: 0.000056 rad comment: high quality retrieval pixels only) where clear_sky over snow free land	string
lat_band_min_aod550_sea	float	latitude_bands = 18	long_name	minimum ABI L2+ Aerosol Optical Depth at 550 nm over sea in latitude band	string
			standard_name	atmosphere_extinction_optical_thickness_due_to_ambient_aerosol	string
			_FillValue	-999.0	float
			valid_range	-1.0 5.0	float
			units	1	string
			coordinates	sun glint_angle retrieval_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			cell_methods	sunlint_angle: sum (no pixels produced) retrieval_local_zenith_angle: sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude_bands: minimum (interval: 0.000056 rad comment: high quality retrieval pixels only) where clear_sky over ice_free sea	string
lat_band_max_aod550_sea	float	latitude_bands = 18	long_name	maximum ABI L2+ Aerosol Optical Depth at 550 nm over sea in latitude band	string
			standard_name	atmosphere_extinction_optical_thickness_due_to_ambient_ae rosol	string
			_FillValue	-999.0	float
			valid_range	-1.0 5.0	float
			units	1	string
			coordinates	sunlint_angle retrieval_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string
lat_band_mean_aod550_sea	float	latitude_bands = 18	cell_methods	sunlint_angle: sum (no pixels produced) retrieval_local_zenith_angle: sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude_bands: maximum (interval: 0.000056 rad comment: high quality retrieval pixels only) where clear_sky over ice_free sea	string
			long_name	mean ABI L2+ Aerosol Optical Depth at 550 nm over sea in latitude band	string
			standard_name	atmosphere_extinction_optical_thickness_due_to_ambient_ae rosol	string
			_FillValue	-999.0	float
			valid_range	-1.0 5.0	float
			units	1	string
			coordinates	sunlint_angle retrieval_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string			

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			cell_methods	sunlint_angle: sum (no pixels produced) retrieval_local_zenith_angle: sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude_bands: mean (interval: 0.000056 rad comment: high quality retrieval pixels only) where clear_sky over ice_free_sea	string
lat_band_std_dev_aod550 _sea	float	latitude_bands = 18	long_name	standard_deviation of the ABI L2+ Aerosol Optical Depth at 550 nm values over sea in latitude band	string
			standard_name	atmosphere_extinction_optical_thickness_due_to_ambient_ae rosol	string
			_FillValue	-999.0	float
			units	1	string
			coordinates	sunlint_angle retrieval_local_zenith_angle quantitative_solar_zenith_angle t latitude_bands y_image x_image	string
			grid_mapping	goes_lat_lon_projection: latitude_bands goes_imager_projection: y_image x_image	string
			cell_methods	sunlint_angle: sum (no pixels produced) retrieval_local_zenith_angle : sum quantitative_solar_zenith_angle: sum t: sum y_image: x_image: sum latitude_bands: standard_deviation (interval: 0.000056 rad comment: high quality retrieval pixels only) where clear_sky over ice_free_sea	string
min_aod550_land	float	n/a	long_name	minimum ABI L2+ Aerosol Optical Depth at 550 nm over land	string
			standard_name	atmosphere_extinction_optical_thickness_due_to_ambient_ae rosol	string
			_FillValue	-999.0	float
			valid_range	-1.0 5.0	float
			units	1	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: minimum (interval: 0.000056 rad comment: high quality retrieval pixels only) where clear_sky over snow_free_land	string			

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
max_aod550_land	float	n/a	long_name	maximum ABI L2+ Aerosol Optical Depth at 550 nm over land	string
			standard_name	atmosphere_extinction_optical_thickness_due_to_ambient_aerosol	string
			FillValue	-999.0	float
			valid_range	-1.0 5.0	float
			units	1	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: maximum (interval: 0.000056 rad comment: high quality retrieval pixels only) where clear_sky over snow_free_land	string			
mean_aod550_land	float	n/a	long_name	mean ABI L2+ Aerosol Optical Depth at 550 nm over land	string
			standard_name	atmosphere_extinction_optical_thickness_due_to_ambient_aerosol	string
			FillValue	-999.0	float
			valid_range	-1.0 5.0	float
			units	1	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: mean (interval: 0.000056 rad comment: high quality retrieval pixels only) where clear_sky over snow_free_land	string			
std_dev_aod550_land	float	n/a	long_name	standard deviation of ABI L2+ Aerosol Optical Depth values at 550 nm over land	string
			standard_name	atmosphere_extinction_optical_thickness_due_to_ambient_aerosol	string
			FillValue	-999.0	float
			units	1	string
			coordinates	retrieval_local_zenith_angle quantitative_solar_zenith_angle t y image x image	string
			grid_mapping	goes_imager_projection	string

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			cell_methods	retrieval_local_zenith_angle: sum quantitative_solar_zenith_angle: sum t: sum area: standard_deviation (interval: 0.000056 rad comment: high quality retrieval pixels only) where clear_sky over snow_free_land	string
min_aod550_sea	float	n/a	long_name	minimum ABI L2+ Aerosol Optical Depth at 550 nm over sea	string
			standard_name	atmosphere_extinction_optical_thickness_due_to_ambient_ae rosol	string
			_FillValue	-999.0	float
			valid_range	-1.0 5.0	float
			units	1	string
			coordinates	sunlint_angle retrieval_local_zenith_angle quantitative_solar_zenith_angle t y_image x_image	string
			grid_mapping	goes_imager_projection	string
max_aod550_sea	float	n/a	cell_methods	sunlint_angle: sum (no pixels produced) retrieval_local_zenith_angle: sum quantitative_solar_zenith_angle: sum t: sum area: minimum (interval: 0.000056 rad comment: high quality retrieval pixels only) where clear_sky over ice_free_sea	string
			long_name	maximum ABI L2+ Aerosol Optical Depth at 550 nm over sea	string
			standard_name	atmosphere_extinction_optical_thickness_due_to_ambient_ae rosol	string
			_FillValue	-999.0	float
			valid_range	-1.0 5.0	float
			units	1	string
			coordinates	sunlint_angle retrieval_local_zenith_angle quantitative_solar_zenith_angle t y_image x_image	string
grid_mapping	goes_imager_projection	string			
mean_aod550_sea	float	n/a	cell_methods	sunlint_angle: sum (no pixels produced) retrieval_local_zenith_angle: sum quantitative_solar_zenith_angle: sum t: sum area: maximum (interval: 0.000056 rad comment: high quality retrieval pixels only) where clear_sky over ice_free_sea	string
			long_name	mean ABI L2+ Aerosol Optical Depth at 550 nm over sea	string
			standard_name	atmosphere_extinction_optical_thickness_due_to_ambient_ae rosol	string

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			FillValue	-999.0	float
			valid_range	-1.0 5.0	float
			units	1	string
			coordinates	sunlint_angle retrieval_local_zenith_angle quantitative_solar_zenith_angle t y image x image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	sunlint_angle: sum (no pixels produced) retrieval_local_zenith_angle: sum quantitative_solar_zenith_angle: sum t: sum area: mean (interval: 0.000056 rad comment: high quality retrieval pixels only) where clear_sky over ice_free_sea	string
			std_dev_aod550_sea	float	n/a
			standard_name	atmosphere_extinction_optical_thickness_due_to_ambient_ae rosol	string
			FillValue	-999.0	float
			units	1	string
			coordinates	sunlint_angle retrieval_local_zenith_angle quantitative_solar_zenith_angle t y image x image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	sunlint_angle: sum (no pixels produced) retrieval_local_zenith_angle: sum quantitative_solar_zenith_angle: sum t: sum area: standard_deviation (interval: 0.000056 rad comment: high quality retrieval pixels only) where clear_sky over ice_free_sea	string
			percent_uncorrectable_GRB_errors	float	n/a
FillValue	-999.0	float			
valid_range	0.0 1.0	float			
units	percent	string			
coordinates	t y image x image	string			
grid_mapping	goes_imager_projection	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

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			coordinates	t y image x image	string
			grid_mapping	goes imager_projection	string
			cell_methods	t: sum area: sum (uncorrectable L0 errors only)	string
nominal_satellite_subpoint_lat 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_lon value = see note [1]	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_lat_lon_extent	float	n/a	long_name	geospatial latitude and longitude references	string
			geospatial_westbound_longitude	see note [1]	float
			geospatial_northbound_latitude	see note [1]	float
			geospatial_eastbound_longitude	see note [1]	float
			geospatial_southbound_latitude	see note [1]	float
			geospatial_lat_center	see note [1]	float
			geospatial_lon_center	see note [1]	float
			geospatial_lat_nadir	0	float
			geospatial_lon_nadir	see note [1]	float
			geospatial_lat_units	degrees_north	string
			geospatial_lon_units	degrees_east	string

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Variable			Attribute		
Name	Type	Shape	Name	Value	Type
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_solar_azimuth_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_total_precipitable_water_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_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_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_4_level_cloud_mask_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_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
			input_dynamic_ancillary_NWP_total_precipitable_water_data	<i>refer to filename conventions for L2+ products in Appendix A of PUG L2+ volume.</i>	string
			input_dynamic_ancillary_NWP_total_column_ozone_data	<i>refer to filename conventions for L2+ products in Appendix A of PUG L2+ volume.</i>	string
			input_dynamic_ancillary_NWP_surface_wind_vector_data	<i>refer to filename conventions for L2+ products in Appendix A of PUG L2+ volume.</i>	string
			input_dynamic_ancillary_NWP_surface_pressure_data	<i>refer to filename conventions for L2+ products in Appendix A of PUG L2+ volume.</i>	string
			input_dynamic_ancillary_NWP_surface_geopotential_height_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
algorithm_product_version_container	int	n/a	long_name	container for algorithm package filename and product version	string
			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 5.10.6.1, Aerosol Optical Depth Product Flag Values and Meanings.

5.10.6.1 Aerosol Optical Depth Product Flag Values and Meanings**Table 5.10.6.1 Aerosol Optical Depth Product Retrieval Quality Flag Values and Meanings**

Retrieval Quality Flags (DQF)	
Flag Value	Flag Meaning
0	high quality retrieval qf
1	medium quality retrieval qf
2	low quality retrieval qf
3	no retrieval qf

