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OFFICE of COMMON SERVICES

Regional Advanced Baseline Imager and Visible Infrared Imaging Radiometer Suite Emissions (RAVE) External Users Manual (EUM)

Version 2.2

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TITLE: REGIONAL ADVANCED BASELINE IMAGER AND VISIBLE INFRARED IMAGING RADIOMETER SUITE EMISSIONS EXTERNAL USERS MANUAL VERSION 2.2

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DOCUMENT HISTORY
DOCUMENT REVISION LOG

The Document Revision Log identifies the series of revisions to this document since the baseline release. Please refer to the above page for version number information.

DOCUMENT TITLE: Regional Advanced Baseline Imager and Visible Infrared Imaging Radiometer Suite Emissions External Users Manual			
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2.2	9/26/2024	OCS	

LIST OF CHANGES

Significant alterations made to this document are annotated in the List of Changes table.

DOCUMENT TITLE: RAVE External Users Manual					
LIST OF CHANGE-AFFECTED PAGES/SECTIONS/APPENDICES					
Version Number	**Date**	**Changed By**	**Page**	**Section**	**Description of Change(s)**
1.0	4/26/2023	Doss	ALL	ALL	N/A, Original Version of the document
1.1	8/02/2023	Doss	p. 12 - p. 22	1.3	Updated “Description of RAVE Output File Contents” and “Description of RAVE Output File Metadata” tables and accompanying text
1.2	8/15/2023	Doss	p. 23, p. 29	2.1, 3.3	Updated sources of satellite data
2.0	11/07/2023	Doss	ALL	ALL	Inputs updated from VIIRS Active Fires data to VIIRS Enterprise Fires data
2.1	1/25/2024	Doss	p. 9, p. 25, p. 25-26	1.1.2, 2.2.1.2, 2.2.3	Updated product team, Updated sources of satellite data
2.2	9/26/2024	Doss	p. 9 - 10, p. 23, p. 26	1.1.2, 2.1, 2.2.3	Updated product team member information; Updated satellite information to include GOES-19

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1 PRODUCTS

This is an External Users Manual (EUM) describing the Regional Advanced Baseline Imager and Visible Infrared Imaging Radiometer Suite Emissions (RAVE) algorithm package. There are three types of expected output files. Each of the following expected output files will be produced hourly:

- 3 km Biomass Burning Emissions NetCDF4 File
- 13 km Biomass Burning Emissions NetCDF4 File
- Fine Particulate Matter PNG File

The intended users of this EUM are the end users of the RAVE expected output files and the product verification and validation (V&V) teams. External users are users who do not have direct access to the processing system. The purpose of this EUM is to provide the document's users with information that will enable them to acquire the products, understand the product's features, and use any associated data or files included in the products.

1.1 Product Overview

1.1.1 Product Requirements

The RAVE expected output files must contain the information shown in Table 1-1. The algorithm package must be capable of conforming to the additional requirements listed in Table 1-2.

Table 1-1 - Required RAVE Output File Information

Requirement Number	Requirement
1	Fire Radiative Power
2	Hourly Emissions of $PM_{2.5}$
3	Hourly Emissions of Organic Carbon
4	Hourly Emissions of Black Carbon
5	Hourly Emissions of Methane
6	Hourly Emissions of Carbon Dioxide
7	Hourly Emissions of Nitrogen Dioxide
8	Hourly Emissions of Carbon Monoxide
9	Hourly Emissions of Total Particulate Matter

10	Hourly Emissions of Volatile Organic Compounds
11	Hourly Emissions of Sulfur Dioxide
12	Hourly Emissions of Ammonia

Table 1-2 - Additional RAVE Requirements

Requirement	Value
Domain	North America
Latency	1 Hour
Refresh Rate	1 Hour
Spatial Resolution	3 km, 13 km
Product Accuracy	20%

1.1.2 Product Team

Table 1-3 - Product Team Member Information

Team Member	Organization	Role	Contact Information
Walter Wolf	OCS	Product Management Division Chief	walter.wolf@noaa.gov
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1.1.3 Product Description

Table 1-4 displays the different emissions that the RAVE Science Algorithm (SA) is capable of monitoring.

Table 1-4 - Species of Emissions Monitored by RAVE

Emission Abbreviation	Meaning
CH_4	Methane
CO_2	Carbon Dioxide
CO	Carbon Monoxide
$PM_{2.5}$	Fine Particulate Matter
TPM	Total Particulate Matter
SO_2	Sulfur Dioxide
OC	Organic Carbon
BC	Black Carbon
NO_x	Nitrogen Oxides
NH_3	Ammonia
VOC	Volatile Organic Compound

RAVE expected output files can also provide the following information:

- Hourly Mean Fire Radiative Power (FRP)
- Hourly Fire Radiative Energy (FRE)
- Dry Mass (DM) Consumed

All NetCDF4 expected output files will have a 0.03° X 0.03° gridded resolution. The domain of interest will cover 3.5°N to 81.8°N and 144.96°E to 27.84°W (i.e., North America).

1.2 Product History

The initial delivery of the RAVE algorithm package was delivered in April of 2023. The second version of this algorithm package was delivered in November of 2023 and updates the algorithm package to use VIIRS Enterprise Fires products as inputs rather than VIIRS Active Fires products.

1.3 Product Access

The NESDIS Policy on Access and Distribution of Environmental Data and Products is provided at:
http://www.ospo.noaa.gov/Organization/About/access.html

Users need to fill out the Data Access Request Form. This form can be downloaded from the same webpage where the NESDIS Policy on Access and Distribution of Environmental

Data and Products is displayed. A completed copy of the form should be sent to both the PAL and the OSPO Data Access Team (nesdis.data.access@noaa.gov). Once the request is approved, the data will be delivered using the Product Distribution and Access (PDA) system. For any data accessibility and distribution problems, please contact the ESPC Data Distribution Manager (Donna McNamara, donna.mcnamara@noaa.gov).

The 3 km and 13 km NetCDF4 expected output files will be archived at CLASS/NCEI. The PNG expected output file will not be archived.

Table 1-5 describes the file naming convention associated with the RAVE expected output files.

Table 1-5 - RAVE Output File Naming Conventions

Type of File	Naming Convention
3 km NetCDF4 Output File	RAVE-HrlyEmiss-3km_<v#r#>_blend_s<YYYYMMDDHHMMSSS>_e<YYYYMMDDHHMMSSS>_c<YYYYMMDDHHMMSSS>.nc
13 km NetCDF4 Output File	RAVE-HrlyEmiss-13km_<v#r#>_blend_s<YYYYMMDDHHMMSSS>_e<YYYYMMDDHHMMSSS>_c<YYYYMMDDHHMMSSS>.nc
PNG Output File	PM25_<v#r#>_blend_s<YYYYMMDDHHMMSSS>_e<YYYYMMDDHHMMSSS>_c<YYYYMMDDHHMMSSS>.png

Where:

<v#r#>		the version and release numbers associated with the algorithm package formatted as a v, version number, r, release number (e.g., v3r2 is the 3rd version, 2nd release of the algorithm package)
<YYYYMMDDHHMMSSS>	→	the 4-digit year, 2-digit month, 2-digit day, 2-digit hour, 2-digit minute, 3-digit second timestamp representing the start, end, and creation time of the product file

Table 1-6 provides a description of the expected contents of all NetCDF4 output files produced by the RAVE algorithm package. For some variables listed in the output variable table, the 3 km and 13 km NetCDF4 expected output files will have different ranges. When applicable, this will be indicated in the “Range” column.

Table 1-6 - Description of RAVE Output File Contents

Variable	Type	Description	Dimensions	Units	Range
BC	32-bit floating point	BC Biomass Emissions	3	kg	3km: 0.01, 1.50000005E10 13km: 0.01, 2.99999986E11
BC_scaled	32-bit floating point	Scaled BC Biomass Emissions	3	kg	3km: 0.01, 6.7499999E10 13km: 0.01, 2.99999986E11
CH4	32-bit floating point	CH4 Biomass Emissions	3	kg	3km: 0.01, 1.50000005E10 13km: 0.01, 2.99999986E11
CO	32-bit floating point	CO Biomass Emissions	3	kg	3km: 0.01, 1.50000005E10 13km: 0.01, 2.99999986E11
CO2	32-bit floating point	CO2 Biomass Emissions	3	kg	3km: 0.01, 1.50000005E10 13km: 0.01, 2.99999986E11
Cloud_Fraction	16-bit integer	Cloud Fraction	3	1	0, 100

FRE	32-bit floating point	Fire Radiative Energy	3	MJ	3km: 36.0, 2.0E8 13km: 36.0, 4.0E9
FRP_MEAN	32-bit floating point	Mean Fire Radiative Power	3	MW	3km: 0.01, 500000.0 13km: 0.01, 2000000.0
FRP_SD	32-bit floating point	Standard Deviation of Fire Radiative Power	3	MW	0.0, 500000.0
Metadata	32-bit integer	Maximum PM2.5 mass (kg), column and row of maximum PM2.5, mean PM2.5 mass (kg), total PM2.5 mass (kg)	N/A	N/A	N/A
NH3	32-bit floating point	NH3 Biomass Emissions	3	kg	3km: 0.01, 1.50000005E10 13km: 0.01, 2.99999986E11
NOx	32-bit floating point	NOx Biomass Emissions	3	kg	3km: 0.01, 1.50000005E10

					13km: 0.01, 2.99999986E11
OC	32-bit floating point	OC Biomass Emissions	3	kg	3km: 0.01, 1.50000005E10 13km: 0.01, 2.99999986E11
OC_scaled	32-bit floating point	Scaled OC Biomass Emissions	3	kg	3km: 0.01, 6.7499999E10 13km: 0.01, 2.99999986E11
PM25	32-bit floating point	PM2.5 Biomass Emissions	3	kg	3km: 0.01, 1.50000005E10 13km: 0.01, 2.99999986E11
PM25_scaled	32-bit floating point	Scaled PM2.5 Biomass Emissions	3	kg	3km: 0.01, 6.7499999E10 13km: 0.01, 2.99999986E11
QA	8-bit character	Quality Assurance	3	1	1, 3
SO2	320bit floating point	SO2 Biomass Emissions	3	kg	3km: 0.01, 1.50000005E10 13km: 0.01, 2.99999986E11

TPM	32-bit floating point	TPM Biomass Emissions	3	kg	3km: 0.01, 1.50000005E10 13km: 0.01, 2.99999986E11
VOCs	32-bit floating point	VOCs Biomass Emissions	3	kg	3km: 0.01, 1.50000005E10 13km: 0.01, 2.99999986E11
area	32-bit floating point	cell area	2	km**2	N/A
grid_lat	32-bit floating point	latitude	2	degrees_north	3km: 3.5, 81.8 13km: 7.1445, 81.7786
grid_latt	32-bit floating point	latitude	2	degrees_north	3km: 3.515, 81.785 13km: 7.22291, 81.7184
grid_lon	32-bit floating point	longitude	2	degrees_east	3km: 144.96, 332.16 13km: 151.874, 332.126
grid_lont	32-bit floating point	longitude	2	degrees_east	3km: 144.975, 332.145 13km: 151.981, 332.019

grid_x	32-bit floating point	cell corner longitude	N/A	1	3km: 1.0, 6241.0 13km: 1, 801
grid_xt	32-bit floating point	T-cell longitude	N/A	1	3km: 1.0, 6240.0 13km: 1, 800
grid_y	32-bit floating point	cell corner latitude	N/A	1	3km: 1.0, 2611.0 13km: 1, 545
grid_yt	32-bit floating point	T-cell latitude	N/A	1	3km: 1.0, 2610.0 13km: 1, 544
land_cover	8-bit character	land cover type	2	1	N/A
quality_information	32-bit integer	total number of retrievals, percentage of optimal retrievals, percentage of sub optimal retrievals, percentage of bad retrievals	N/A	N/A	N/A
time	16-bit integer	time	N/A	hours since coverage start time	N/A

Product monitoring metadata is included with each NetCDF output file produced by the RAVE algorithm package. These files include both collection and geographic level metadata. Table 1-7 provides a description of the metadata associated with the RAVE NetCDF4 expected output files.

Table 1-7 - Description of RAVE Output File Metadata

Name	Value	Type	Array Size
Conventions	Indicates the conventions associated with the file	String	Scalar
PRODUCT_ALGORITHM_VERSION	Provides the product-specific algorithm version	String	Scalar
RangeBeginningDate	Provides the beginning date of the range	String	Scalar
RangeBeginningTime	Provides the beginning time of the range	String	Scalar
RangeEndingDate	Provides the ending date of the range	String	Scalar
RangeEndingTime	Provides the ending time of the range	String	Scalar
TIME_RANGE	Provides the time range	String	Scalar
_NCProperties	NetCDF and HDF version numbers, will be automatically generated	String	Scalar
cdm_data_type	States the geographic category the product represents	String	Scalar
creator_email	Email for the algorithm development team	String	Scalar
creator_name	Indicates the line office and algorithm team responsible for product development	String	Scalar
creator_url	Provides a URL to a website meant for end users	String	Scalar
date_created	UTC time the product file was created in 4-digit year, 2-digit month, 2-digit day, 2-	String	Scalar

	digit hour, 2-digit minute, 2-digit second format		
day_night_data_flag	Will be set to "0" for night, "1" for day, or "2" for both depending on the sunlight conditions of the observation	String	Scalar
geospatial_lat_max	Describes the maximum latitude of the geospatial coverage of the grid, includes -90 (south) to 90 (north)	32-bit floating point	1
geospatial_lat_min	Describes the minimum latitude of geospatial coverage of the grid, includes -90 (south) to 90 (north)	32-bit floating point	1
geospatial_lat_resolution	Indicates resolution associated with geospatial latitude	3km: 32-bit floating point 13km: String	3km: 1 13km: Scalar
geospatial_lat_units	Indicates unit associated with geospatial latitude	String	Scalar
geospatial_lon_max	Describes the maximum longitude of the geospatial coverage of the grid, includes -180 (west) to 180 (east)	32-bit floating point	1
geospatial_lon_min	Describes the minimum longitude of the geospatial coverage of the grid, includes -180 (west) to 180 (east)	32-bit floating point	1

geospatial_lon_resolution	Indicates resolution associated with geospatial longitude	3km: 32-bit floating point 13km: String	3km: 1 13km: Scalar
geospatial_lon_units	Indicates units associated with geospatial longitude	String	Scalar
history	Indicates algorithm name and version responsible for creating the file	String	Scalar
id	Unique identifier for the product	String	Scalar
institution	Indicates institution responsible for the product file	String	Scalar
instrument	Provides the name of the instrument(s) used in the creation of the product	String	Scalar
keywords	List of comma-separated keywords associated with the product system	String	Scalar
metadata_link	Contains a URL where detailed metadata information or a product information page is located	String	Scalar
naming_authority	Organization responsible for providing the “id” attribute	String	Scalar
platform	Indicates the satellite(s) used to create the product	String	Scalar
processing_level	Level of processing associated with the product file	String	Scalar

production_environment	Processing string responsible for generating the product	String	Scalar
production_site	Processing site for the product	String	Scalar
project	Indicates the name(s) of the project(s) responsible for generating the original data used as input to the algorithm package	String	Scalar
publisher_email	Provides an email that can be used to contact the person or entity who is responsible for publishing the output files to the proper end users	String	Scalar
publisher_name	Provides the name of the organization responsible for the product’s publication	String	Scalar
publisher_url	Provides URL of the publisher’s website	String	Scalar
source	Provides a list of all significant input files into the product system as a comma separated list	String	Scalar
standard_name_vocabulary	Provides the name and corresponding version number of the controlled vocabulary used	String	Scalar
summary	Provides a brief summary of the product	String	Scalar
time_coverage_end	Indicates the end time of the observation associated with the file	String	Scalar

	in 4-digit year, 2-digit month, 2-digit day, 2-digit hour, 2-digit minute, 2-digit second format		
time_coverage_start	Indicates the start time of the observation associated with the file in 4-digit year, 2-digit month, 2-digit day, 2-digit hour, 2-digit minute, 2-digit second format	String	Scalar
title	Provides the short name for the product	String	Scalar

Figure 1-1 displays a sample PNG output file covering the domain of interest of the RAVE algorithm package.

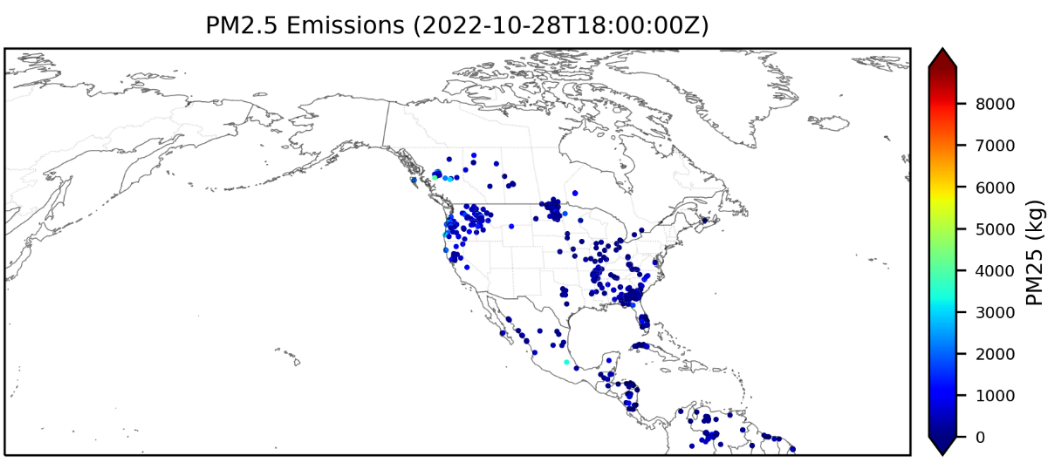

Figure 1-1 - Sample PNG Output File

2 ALGORITHM

This section provides an overview of the RAVE SA. For further details concerning this algorithm, please refer to the RAVE ATBD (NOAA/NESDIS/STAR, 2023) or the System Maintenance Manual (SMM) associated with this version of the algorithm package.

2.1 Algorithm Overview

Figure 2-1 provides an overview of the RAVE algorithm package's processing. This figure is originally from the RAVE ATBD (NOAA/NESDIS/STAR, 2023).

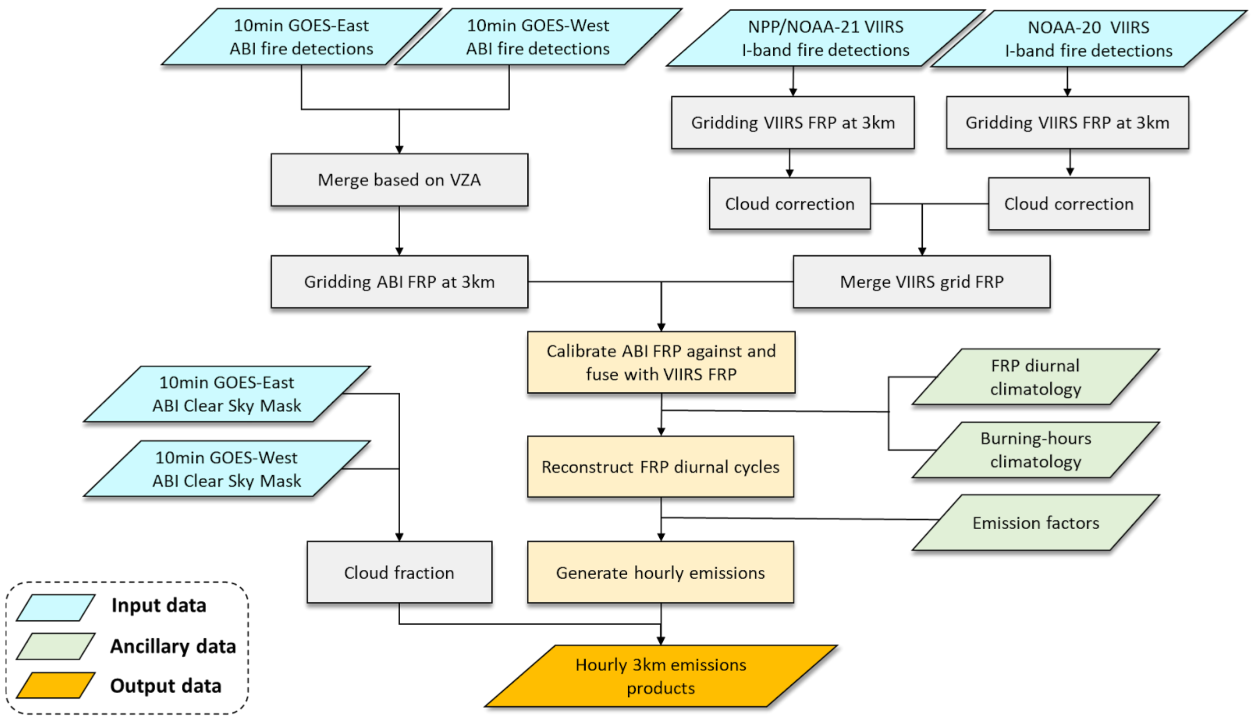

Figure 2-1 - Processing Overview of RAVE

The RAVE algorithm package processing merges ABI FRP datasets from GOES-16 (i.e., GOES-East) and GOES-18 (i.e., GOES-West) are merged. The GOES-17 satellite serves as a source of backup data for both GOES-16 and GOES-18. Then, this merged dataset is mapped to a 3 km grid. The VIIRS data from NPP/NOAA-21 and NOAA-20 is also mapped to a 3 km grid before it is corrected for clouds. After any needed corrections are made, the VIIRS datasets are merged.

Please note that, once GOES-19 becomes operational, it will replace GOES-16 as the primary satellite for GOES-EAST. GOES-16 will become the primary backup satellite for GOES-EAST and GOES-WEST. GOES-17 will become the secondary backup satellite for GOES-EAST and GOES-WEST.

Once both the ABI and VIIRS merged datasets are available, the ABI merged dataset is calibrated against the VIIRS merged dataset. Then, the ABI and VIIRS datasets are combined to create one merged FRP dataset. The FRP merged dataset allows for reconstruction of diurnal FRP cycles, and consequently, calculation of hourly emission data for each emission seen in Figure 2-1. While all hourly emissions product files are mapped to a 3 km grid, some end users require a 13 km grid to support existing air quality models. To meet the needs of these end users, the hourly emissions product files can be mapped to a 13 km grid.

2.2 Input Satellite Data

2.2.1 Satellite Instrument Overview

2.2.1.1 Advanced Baseline Imager (ABI)

The ABI instrument is currently flying on the GOES-R series of satellites. ABI can observe the domain of interest (i.e., North America) every ten minutes (Schmit et al., 2017). [1] These observations provide key fire detection data used by the algorithm package to calculate FRP. The following information is provided with each fire detection by the ABI instrument (Schmidt et al., 2012):

- Coordinates of Observation Location
- Time of Observation
- FRP
- Fire Flag
- Legacy Instantaneous Fire Size
- Fire Temperature Estimate

Table 2-1 lists the categorization groups for the ABI fire observations (Schmidt et al., 2012).

Table 2-1 - ABI Fire Observation Categories

Group Number	Group Type	Is FRP Provided?
1	Processed / Good Quality	Yes
2	Saturated	High Probability
3	Cloud/Smoke Partially Contaminated	High Probability
4	High Probability	High Probability
5	Medium Probability	High Probability
6	Low Probability	Medium Probability

[1] This is a portion of the Full Disk scan covering the domain of interest.

The first three categorization groups (i.e., Table 2-1 Groups 1, 2, & 3) contain data that will very likely meet all requirements for observed data. The second three categorization groups (i.e., Table 2-1 Groups 4, 5, & 6) may still meet some requirements for observed data, but is not expected to meet all requirements.

2.2.1.2 Visible Infrared Imaging Radiometer Suite (VIIRS)

The VIIRS instrument is currently flying onboard the S-NPP, NOAA-20, and NOAA-21 satellites, which are part of the Joint Polar Satellite System (JPSS). The wide swath width of the VIIRS data allows for observation of the whole domain of interest (Cao et al., 2014). VIIRS has a unique band configuration that allows for detection of the majority of fire pixels within the swath (Csiszar et al., 2014). These bands are listed below:

- Moderate Resolution 4 µm Band (750 m)
- Imaging Resolution I-4 Band (375 m)

2.2.2 Satellite Data Preprocessing Overview

There are no preprocessing steps required for satellite data files ingested into the RAVE algorithm package.

2.2.3 Input Satellite Data Description

Table 2-2 describes the file naming conventions of the satellite input data files required by the RAVE algorithm package.

Table 2-2 - Input File Naming Conventions

Type of Input	File Naming Convention
ABI L2 Full Disk Clear Sky Mask Product	OR_ABI-L2-ACMF-M6_<abi_sat>_s<start_date>_e<end_date>_c<creation_date>.nc
ABI L2 Full Disk Active Fire Product	OR_ABI-L2-FDCF-M6_<abi_sat>_s<start_date>_e<end_date>_c<creation_date>.nc
VIIRS I-Band L2 Enterprise Fire Products	EFIRE-VIIRSI_<v#r#>_<eviirs_sat>_s<vstart_date>_e<vend_date>_c<vcreation_date>.nc
VIIRS I-Band L1b Geolocation Products	GITCO_<viirs_sat>_d< f1 >_t< f2>_e<f3>_b<f4>_c<f5>_oebc_ops.h5

Where:

<abi_sat>	→	the satellite for ABI input data; will be G16, G17, G18, or G19
<start_date>	→	the starting timestamp of the data observations in 4-digit year, 3-digit Julian day, 2-digit hour, 2-digit minute, 3-digit second format
<end_date>	→	the ending timestamp of the data observations in 4-digit year, 3-digit Julian day, 2-digit hour, 2-digit minute, 3-digit second format
<creation_date>	→	the creation timestamp of the data observations in 4-digit year, 3-digit Julian day, 2-digit hour, 2-digit minute, 3-digit second format
<vstart_date>	→	the starting timestamp of the VIIRS data observations in 4-digit year, 2-digit month, 2-digit day, 2-digit hour, 2-digit minute, 3-digit second format
<vend_date>	→	the ending timestamp of the VIIRS data observations in 4-digit year, 2-digit month, 2-digit day, 2-digit hour, 2-digit minute, 3-digit second format
<vcreation_date>	→	the creation timestamp of the VIIRS data observations in 4-digit year, 2-digit month, 2-digit day, 2-digit hour, 2-digit minute, 3-digit second format
<v#r#>	→	the version number and release number (e.g., v3r2 indicates the third version, second release)
<viirs_sat>	→	the satellite for VIIRS input data; will be j01, j02, or npp
<eviirs_sat>	→	the satellite for VIIRS Enterprise Fire input data; will be n20, n21, or npp
<f1>	→	the 4-digit year, 2-digit month, 2-digit day of the earliest granule in the file’s dataset; based on the Beginning_Date metadata of the 1st granule in the HDF5 file
<f2>	→	the 2-digit hour, 2-digit minute, 3-digit second of the earliest granule in the file’s dataset; based on the Beginning_Time metadata of the 1st granule in the HDF5 file

<f3>	→	the 2-digit hour, 2-digit minute, 3-digit second of the latest granule in the file's dataset; based on the Ending_Time metadata of the last granule in the HDF5 file
<f4>	→	the 5-digit orbit number that the dataset originated from; orbit begins at the ascending node and the number indicates the earliest granule produced in the data product
<f5>	→	the creation date in 4-digit year, 2-digit month, 2-digit day, 2-digit hour, 2-digit minute, 8-digit second format

2.3 Input Ancillary Data

The RAVE algorithm package does not require any dynamic ancillary datasets. All static ancillary files needed by the algorithm package are in the directory listed below, where $CODE is the root directory of the RAVE algorithm package:

$CODE/ancillary_data/

Please note that the static ancillary data files must be found in this directory. If the files are missing from this location, the algorithm package may not be able to successfully run and generate the expected output product files.

3 PERFORMANCE

3.1 Product Testing

3.1.1 Test Data Description

Test cases are provided with each algorithm package for product verification before the algorithm package is transitioned into operations. These test cases provide input, any needed ancillary data, and any additional product datasets required for product verification. Please refer to the RAVE ATBD (NOAA/NESDIS/STAR, 2023).

3.1.2 Unit Test Plans

All expected output product files will be tested with each update to the algorithm package. The science teams, who are responsible for developing the product files, will test them for accuracy and validity. Each algorithm package will be tested to ensure all necessary requirements are met. Operations personnel must test the products to ensure the expected output files can be generated on the intended system. If any issues arise during the testing procedures, they must be dealt with and resolved before the algorithm package can be transitioned into operations.

3.2 Product Accuracy

3.2.1 Test Results

For more information concerning the test results, please refer to the RAVE ATBD (NOAA/NESDIS/STAR, 2023).

3.2.2 Product Accuracy

All RAVE expected output product files have been validated against observations to ensure their accuracy and precision falls within all requirements and specifications. For more information concerning product accuracy, please contact the Product Area Lead (PAL).

3.3 Product Quality Output

Table 3-1 provides a description of the quality flags used throughout the RAVE algorithm package. Please note that if data has a lower quality flag, it should be used with caution. Table 3-1 was originally provided in the RAVE ATBD (NOAA/NESDIS/STAR, 2023).

Table 3-1 - RAVE Quality Flag Information

Quality Flag	Description
High	• Hours when ABI and/or VIIRS have confident fire observations (i.e., the “Processed” category for ABI) in clear-sky condition (for both fire grid and 8 neighboring grids)
Medium	• Hours when “High” class (above) spatially neighboring to more than one cloudy grid (determined based on “cloud fraction” information). • Hours when with saturated/cloudy/smoky ABI fire detections. • Hours when high/medium/low possibility in ABI fire detection, with fires detected by VIIRS during the past 24 hours. • Hours when predicted FRP (from climatology) temporally neighboring to the “high” or “medium” quality class from above.
Low	• Hours with medium/low possibility in ABI fire detections and without VIIRS fires during past 24 hours • Hours with predicted FRP from climatology • Open shrub and barren grids where only ABI observed fires (without VIIRS fire detections) during past 24 hours (false alarms in ABI fire detections frequently occur in the southwest CONUS) • Grids where both GOES-East and GOES-West ABI’s view zenith angle > 60° • Solar zenith angle (80° < SZA < 90°)

3.4 External Product Tools

There are no external product tools provided with the RAVE algorithm package. For the NetCDF4 expected output files, end users can use a tool of their choice to view, or visualize, these files.

4 PRODUCT STATUS

4.1 Operations Documentation

Cao, C., Luccia, F.J.D., Xiong, X., Wolfe, R., & Weng, F. (2014). Early On-Orbit Performance of the Visible Infrared Imaging Radiometer Suite Onboard the Suomi National Polar-Orbiting Partnership (S-NPP) Satellite. Ieee Transactions on Geoscience and Remote Sensing, 52, 1142-1156, https://doi.org/10.1109/TGRS.2013.2247768.

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Li, F., Zhang, X., Kondragunta, S., Lu, X., Csiszar, I. and Schmidt, C.C. (2022). Hourly biomass burning emissions product from blended geostationary and polar-orbiting satellites for air quality forecasting applications. Remote Sensing of Environment, 281, p.113237. https://doi.org/10.1016/j.rse.2022.113237.

NOAA/NESDIS/STAR (2023), Regional Advanced Baseline Imager and Visible Infrared Imaging and Radiometer Suite Emissions (RAVE) Algorithm Theoretical Basis Document (ATBD), Version 1.0

NOAA/NESDIS/STAR (2023), Regional Advanced Baseline Imager and Visible Infrared Imaging and Radiometer Suite Emissions (RAVE) Algorithm Theoretical Basis Document (ATBD), Version 2.0

Schmidt, C.C., Hoffman, J., & Prins, E.M. (2012). GOES-R Advanced Baseline Imager (ABI) Algorithm Theoretical Basis Document For Fire / Hot Spot Characterization Version 2.5. In (pp. 1-97): NOAA NESDIS STAR

Schmit, T.J., Griffith, P., Gunshor, M.M., Daniels, J.M., Goodman, S.J., & Lebair, W.J. (2017). A Closer Look at the ABI on the GOES-R Series. Bulletin of the American Meteorological Society, 98, 681-698, https://doi.org/10.1016/10.1175/bams-d-15-00230.1.

4.2 Maintenance History

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