



**PRODUCT DEFINITION AND USERS' GUIDE
(PUG)
VOLUME 2: L0 PRODUCTS**

**FOR
GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE
R SERIES (GOES-R) CORE GROUND SEGMENT**

**CONTRACT NO: DG133E-09-CN-0094
DOCUMENT CONTROL NUMBER: 7035538**

**CDRL SE-16
REVISION D
13 MAY 2015**

**PREPARED FOR
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NOAA LIAISON OFFICE/NASA GSFC
GOES-R SERIES CODE 417
BLDG. 6, RM. C100
GREENBELT, MD 20771**

**PREPARED BY:
HARRIS CORPORATION
GOVERNMENT COMMUNICATIONS SYSTEMS
P.O. BOX 9800
MELBOURNE, FLORIDA 32902-9800
CAGE NUMBER: 91417**

NON-EXPORT CONTROLLED

THESE ITEM(S) / DATA HAVE BEEN REVIEWED IN ACCORDANCE WITH THE INTERNATIONAL TRAFFIC IN ARMS REGULATIONS (ITAR), 22 CFR PART 120.11, AND THE EXPORT ADMINISTRATION REGULATIONS (EAR), 15 CFR 734(3)(b)(3), AND MAY BE RELEASED WITHOUT EXPORT RESTRICTIONS.

PRODUCT DEFINITION AND USERS' GUIDE (PUG) VOLUME 2: L0 PRODUCTS

FOR GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE R SERIES (GOES-R) CORE GROUND SEGMENT

Prepared By: _____
Michael Carlomusto
GOES-R SEIT Systems Engineering

Reviewed By: _____
David Brozyna
GOES-R Security Manager

Matt Pahl
GOES-R Mission Assurance Manager

Susan Jones
GOES-R Configuration Manager

Anita Hudson
GOES-R Chief Software Engineer

Robert Basta
GOES-R Chief Systems Engineer

Mike Blanton
GOES-R Integration & Test Manager

Don Myers
GOES-R Deputy Project Manager

Approved By: _____
Romy Olaisen
GOES-R VP, Project Manager

ALL SIGNATURES ON FILE

RECORD OF CHANGE

REVISION	DATE	DESCRIPTION
-	08 February 2011	Initial Release Pre-ECP5
-.1	25 August 2011	Interim Release includes ECP5 PTR-2871 Incorporate GSP comments & organize document structure into volumes PTR-2872 Update content for TBDs/Action Items PTR-2874 Incorporate monthly work-in-progress comments
A	06 February 2012	Pre-CDR Release PTR 3226 Update per BCN_046 ATP for BCR 049 Metadata Delivery PTR-3525 Incorporate GSP Comments (from Interim Release) PTR-3525 Incorporate GSP Comments (CDR Release) PTR-3526 Update Content for TBDs/Action Items (CDR Release)
B	26 July 2012	CDR+90 Release PTR-3239 SE-16 PUG – Update External File Naming Convention for New Static Metadata Files from Metadata BCR PTR-4138 Remove ITAR from Volume 4, GRB PTR-3576 Remove Reference to AWG Ancillary Data PTR-3409 Update Content for TBD-11, TBD-17 and TBD-20 PTR-4039 Update Content for TBDs/Action Items PTR-4203 PUG Update for SUVI Image Refresh and Snow Ice Metadata PTR-4298 GSP Comments Rev A PTR-4204 SE-16 PUG Feedback on PUG for L1b Volume 3

13 May 2015

REVISION	DATE	DESCRIPTION
		PTR-4845 SE-16 PUG Incorporate Peer Review Comments Deferred from Rev A (Note: Updated NcML files are from 6/12 for CMI and 6/11 for all others)
B.1	17 December 2012	Post-CDR Interim Release PTR-4841 SE-16 PUG - Deferred Comments from Release A PTR-4946 SE-16 PUG - Deferred Comments from PostCDR+90 Peer Review PTR-5318 SE-16 PUG: BCN_067 ATP for ECP007 RFP Amend 4 PTR-5373 SE-16 PUG - Update PUG Vol 5 Product Algorithm Output Tables PTR-5403 Incorporate customer comments against Rev. B
B.2	20 May 2013	Post-CDR Interim Release PTR-6419 SE-16_Product Definition and Users' Guide (PUG) Release Update Rev B.2 Update due to BCR75 PTR-6158 UMB_Delivery_SE-16_Product Definition and Users' Guide (PUG) Release Update Rev B.2 PTR-6159 SE-16 PUG - Deferred Comments from Rev. B.1 Peer Review PTR-6837 SE-16 PUG Incorporate Customer Comments Against Rev B.1 PTR-6877 SE-16 Product Definition and Users' Guide (PUG) - BCN_085 ATP for MAG SEISS L1b Changes
C	06 December 2013	Post-CDR Interim Release PTR-9218 Delivery_SE-16_Product Definition and Users' Guide (PUG) Release Update Rev C 1) ITAR content and markings removed from this volume. 2) No other changes made for this version.
C.1	05 December 2014	Post-CDR Interim Release Vol 1, Main: <ul style="list-style-type: none"> • Added FITS format section (SUVI) Vol 2, L0: <ul style="list-style-type: none"> • Minor editorial changes

13 May 2015

REVISION	DATE	DESCRIPTION
		<p>Vol 3, L1b:</p> <ul style="list-style-type: none"> • Revised Space Weather and Solar instrument sections • Co-located Instrument Calibration Data with instrument section <p>Vol 4, GRB:</p> <ul style="list-style-type: none"> • Revised Space Weather and Solar instrument sections • Corrected APID list <p>Vol 5, L2+:</p> <ul style="list-style-type: none"> • Combined Volumes 5A and 5B • Added section for Latitude/Longitude grid (Radiation products) • Added Appendix for dynamic source data • Miscellaneous changes to CMI product <p>Appendix X, ISO Series Metadata:</p> <ul style="list-style-type: none"> • Revised L1b, L2+, Instrument Calibration Data sections <p>PTR-12388 UMB_Delivery_SE-16_ Product Definition and Users' Guide (PUG) Release Update Rev C.1</p> <ul style="list-style-type: none"> • Incorporates PTR-7028, PTR-7556, PTR-7557, PTR-7553, PTR-8055, PTR-8742, PTR-9027, PTR-9518, PTR-11701 • Combined Vol 5A and Vol 5B into a single volume • Rearranged major sections of the document (consolidated File Naming conventions, consolidated APID lists, etc.), for usability <p>PTR-7028 Update Cumulative ERB/PCRB Changes in Next Rev of Document</p> <ul style="list-style-type: none"> • ERB: delete the Rainfall Rate Coefficient Algorithm • PCRB: change GLM Lightning Event Peak L1b/GRB update • PCRB: change Radiation Grid from ABI Grid to Latitude/Longitude <p>PTR-7556 Deferred Comments from Rev. B.2 Peer Review</p> <ul style="list-style-type: none"> • Incorporate comments deferred from Revision B.2 Peer Review <p>PTR-7753 SE-16: Updates to PUG Rev C for next Release</p> <ul style="list-style-type: none"> • Fixed MAG L1b OMAS/GRB/PD periodicity

13 May 2015

REVISION	DATE	DESCRIPTION
		<p>PTR-8055 SE-16 PUG BCR # 127 + BCR #129 + BCR 124 + BCN_120 ATP for NcML/Product Definition for non-ABI Sensors + BCN_149, BCR 115 Update GLM L2 NcML + BCR 119 + BCR #127 and 129 (IPS and Product Set 1 NcML Corrections)</p> <ul style="list-style-type: none"> • BCR#127: incorporated IPS Product NcML corrections • BCR#129: incorporated IPS and Product Set 1 NcML corrections • BCR#124: changed SUVI, SEISS, MAG NcML • BCN_120: NcML/product definition for non-ABI instruments • BCN_149 / BCR#115: updated GLM L2+ NcML definition • BCR#119: changed SUVI GLM INR report design • ECP-9a: added aggregation criteria for Geomagnetic Field, Solar Flux: X-Ray products • BCR#212: incorporated Product Set 2 NcML corrections <p>PTR-8742 SE-16 PUG - Scheduled Science Instrument Products definitions</p> <ul style="list-style-type: none"> • Updated SUVI, EXIS, SEISS, MAG, GLM product definitions <p>PTR-9027 SE-16 PUG - Evaluate Customer Comments Against Rev B.2</p> <ul style="list-style-type: none"> • Incorporated customer comments not previously addressed in PUG Rev C <p>PTR-9518 SE-16 PUG, Evaluate Customer Comments from Rev C</p> <ul style="list-style-type: none"> • Incorporated customer comments against PUG Rev C <p>PTR-11701 SE-16 PUG - Update for BCR # 227, Non-ABI product Corrections Incorporated non-ABI Product NcML corrections</p>
D		<p>PTR-7557 UMB_Delivery_SE-16_Product Definition and Users' Guide (PUG) Release Update Rev D</p> <ul style="list-style-type: none"> • Incorporate customer comments against PUG Rev C.1 <p>PTR-13600 SE-16 PUG - Miscellaneous Corrections</p>

13 May 2015

REVISION	DATE	DESCRIPTION
		<p>Appendix X</p> <ul style="list-style-type: none">• New content – L0 and GRB Info ISO Series Metadata <p>Vol 2, L0</p> <ul style="list-style-type: none">• Restructured to be consistent with other volumes <p>Vol 3, L1b</p> <ul style="list-style-type: none">• New content – dynamic and semi-static processing parameters <p>Vol 4, GRB</p> <ul style="list-style-type: none">• New content – GRB Information <p>Vol 5, L2+</p> <ul style="list-style-type: none">• New content – dynamic and semi-static processing parameters

TABLE OF CONTENTS FOR VOLUME 2: L0 PRODUCTS

<u>Paragraph</u>	<u>Title</u>	<u>Page</u>
1.0	SCOPE	9
2.0	GOES-R INSTRUMENT OVERVIEW	9
3.0	LEVEL 0 PRODUCTS OVERVIEW AND CHARACTERISTICS.....	11
4.0	LEVEL 0 PRODUCT DESCRIPTIONS	12
4.1	ABI Level 0 Product	13
4.1.1	Description.....	13
4.1.2	Data Fields	14
4.2	EXIS Level 0 Product	17
4.2.1	Description.....	17
4.2.2	Data Fields	18
4.3	GLM Level 0 Product	21
4.3.1	Description.....	21
4.3.2	Data Fields	22
4.4	Magnetometer Level 0 Product.....	25
4.4.1	Description.....	25
4.4.2	Data Fields	26
4.5	SEISS Level 0 Product	29
4.5.1	Description.....	29
4.5.2	Data Fields	30
4.6	SUVI Level 0 Product.....	33
4.6.1	Description.....	33
4.6.2	Data Fields	34
5.0	APPENDIX A - L0 PRODUCT FILENAME CONVENTIONS	37
A.1	LEVEL 0 PRODUCT FILENAMES	37

LIST OF TABLES

<u>Table</u>	<u>Title</u>	<u>Page</u>
Table 4.1.2-1	ABI Level 0 Product: Global Attributes	14
Table 4.1.2-2	ABI Level 0 Product: Variables.....	15
Table 4.2.2-1	EXIS Level 0 Product: Global Attributes	18
Table 4.2.2-2	EXIS Level 0 Product: Variables.....	19
Table 4.3.2-1	GLM Level 0 Product: Global Attributes	22
Table 4.3.2-2	GLM Level 0 Product: Variables.....	23
Table 4.4.2-1	Magnetometer Level 0 Product: Global Attributes.....	26
Table 4.4.2-2	Magnetometer Level 0 Product: Variables	27
Table 4.5.2-1	SEISS Level 0 Product: Global Attributes.....	30
Table 4.5.2-2	SEISS Level 0 Product: Variables	31
Table 4.6.2-1	SUVI Level 0 Product: Global Attributes.....	34
Table 4.6.2-2	SUVI Level 0 Product: Variables	35

1.0 SCOPE

The Product Definition and Users' Guide (PUG) document provides a product description and format user guide for all data and products produced and made available to users by the Geostationary Operational Environmental Satellite R Series (GOES-R) Core Ground Segment (GS), developed under contract DG133E-09-CN-0094. This includes the GOES-R Rebroadcast (GRB), Level 0 data, Level 1b products and all Level 2+ end-products. This also includes ISO series metadata, instrument calibration data, and semi-static source data and algorithm packages.

The PUG is divided into five volumes. This volume, Volume 2: Level 0 Products, contains Level 0 product descriptions, and format information. Detailed Level 0 product field-level content information provided by the GOES-R instruments is located in the GOES-R instrument command and telemetry handbooks. Note that there is a separate standalone Appendix X containing detailed descriptions of the ISO series metadata associated with Level 0 products.

2.0 GOES-R INSTRUMENT OVERVIEW

The six instruments on the Geostationary Operational Environmental Satellite-R series (GOES-R) offer unique observations of the environment and consist of the Advanced Baseline Imager (ABI), Extreme Ultra-Violet and X-Ray Irradiance Sensors (EXIS), Geostationary Lightning Mapper (GLM), Magnetometer (MAG), Solar Ultraviolet Imager (SUVI) and Space Environment In-Situ Suite (SEISS).

The ABI instrument is a multi-spectral channel, two-axis scanning radiometer designed to provide variable area imagery and radiometric information of the Earth's surface and atmosphere as well as the capability for star sensing. The ABI measures emitted and solar reflected radiance simultaneously in all spectral channels, but channels 1-6 sense primarily solar reflected radiance, and channels 7-16 sense primarily emitted radiance. Data availability, radiometric quality, simultaneous data collection, coverage rates, scan flexibility, and minimizing data loss due to the sun, are prime capability requirements of the ABI system. The ABI scans the Earth with three different geographic coverage areas: Full Disk, Continental United States (CONUS), and Mesoscale. The ABI utilizes the concepts of scenes and timelines in defining its scanner operations. For ABI timeline details, reference Volume 2, Section 2.2 Level 0 ABI. Correspondingly, the L1b algorithm generates L1b data product from L0 product for the three coverages. Consequently, Level 2+ (L2+) output products are generated for these same coverage areas.

The Full Disk is defined as a circle, with a 17.4 degree angular diameter from the perspective of the ABI centered at the instrument's nadir that reaches the Earth's limb. Overscan is required to deal with the non-ideal orbit and image motion compensation. CONUS is defined as a nadir-viewed rectangle 8.0215 x 4.8129 degrees, approximately 5000 E/W x 3000 North/South kilometers, in the geographic area of 10N-60N latitude and 60W-125W longitude; Mesoscale is defined as the equivalent of a 1.6043 x 1.6043 degree, approximately 1000 x 1000 kilometer region. Full Disk images are generated in ABI scanning Mode 3 and 4, while Mesoscale and CONUS images are only generated in ABI scanning Mode 3. Note that CONUS images are extracted from Full Disk images in Mode 4 for distribution to PDA.

The X-ray Sensor (XRS) and the Extreme Ultraviolet Sensor (EUVS) are packaged together in one instrument called the EXIS. EXIS is designed to be pointed at the sun to acquire space weather data at all times except for brief calibration and maintenance activities.

EUVS consists of three spherical grating spectrometer channels. The three channels, denoted A, B and C, give coverage in the bands of 16-37nm (1.4nm resolution), 115-135nm (1.3nm resolution) and 275-285nm (0.2nm resolution). From these, a reconstruction of the full spectrum between 5nm and 127 nm will be possible.

XRS: X-ray Sensor consists of three photodiode-based photometer channels, two active (A and B) and one inactive. Channel A covers 0.05-0.4nm and channel B covers 0.1-0.8nm. The "dark" diode channel allows background subtraction. All active channels view the sun through two Beryllium (Be) filters. Each XRS

channel consists of a low-sensitivity and a high-sensitivity detector whose responses overlap in order to span the required total dynamic range. The low-sensitivity detectors are quadrant photodiodes which view the sun through a small aperture, allowing X and Y position information to be extracted for bright, localized events such as solar flares.

The GLM instrument is a single-channel, near-infrared optical detector, used to detect, locate and measure the optical pulses associated with lightning over the Full Disk Earth. The instrument has sufficient spatial and temporal resolution to allow tracking of each lightning flash within a specific storm cell and calculation of the cell's optical center over time.

The Magnetometer instrument provides three orthogonal measurements of the geomagnetic field in space at a refresh rate of at least 0.5 seconds, a dynamic range of ± 512 nT in each of the three orthogonal axes and field measurements with a resolution of at least 0.016 nT per axis. The sampling rate of the product data is 10 Hz. This measurement data is used to map the space environment that controls charged particle dynamics in the outer region of the magnetosphere and provide information on the general level of geomagnetic activity, monitor current systems in space, and permit detection of magnetopause crossings, sudden storm commencements, and sub storms.

The SEISS instrument consists of a suite of sensors that monitors the proton, electron, and heavy ion fluxes at geosynchronous orbit. The information provided by the SEISS is critical for assessing the radiation hazard to astronauts and satellites. In addition to hazard assessment, the information from the SEISS can be used to warn of high flux events, mitigating any damage to radio communication. The SEISS instrument suite consists of the Energetic Heavy Ion Sensor (EHIS), the Magnetospheric Particle Sensor -High and Low (MPS-HI and MPS-LO), and the Solar and Galactic Proton Sensor (SGPS). There are two SGPSs in each suite, one looking east and one looking west.

The SUVI instrument is designed to provide a view of the solar corona, taking the Full Disk solar images at high cadence around the clock, except for brief periods during an eclipse, in the soft XUV to EUV wavelength range. Available combinations of exposures and filters allows the coverage of the entire dynamic range of solar XUV features, from coronal holes to X-class flares, as well as the estimate of temperature and solar emissions.

3.0 LEVEL 0 PRODUCTS OVERVIEW AND CHARACTERISTICS

GOES-R Level 0 (L0) products are composed of Consultative Committee for Space Data Systems (CCSDS) packets containing all science, housekeeping, engineering, and diagnostic telemetry data downlinked by the ABI, GLM, SUVI, EXIS, SEISS, and Magnetometer (MAG) instruments. The content and form of the CCSDS space packets in the Level 0 product files are exactly as generated by the instruments. There are separate Level 0 product files for each of these instrument or instrument suites. The Level 0 product files also contain orbit and attitude/angular rate packets generated by the spacecraft. Each packet contains a unique Application Process Identifier (APID).

The Level 0 products conform to Unidata's Attribute Conventions for Data Discovery (ACDD). Unidata's ACDD are identified and described in the main volume of the PUG. Conforming to this set of conventions facilitates cataloguing product files based on information contained in the product files.

The ACDD recommended global attributes, `time_coverage_start` and `time_coverage_end`, contain the start and end time, respectively, associated with each instance of a Level 0 product file. These times do not correlate precisely to the time frame associated with the data in a Level 0 product file's packets. There are two reasons for this. CCSDS space packets containing telemetry data from the instruments are written to the instrument-specific Level 0 product files as they are received by the ground system. It is possible for packets in the Level 0 product files to not be in time order because they are not transmitted by the satellite in the order they were generated or time-stamped. As a result, it is possible for the time frames of temporally adjacent Level 0 product files from the same instrument to have packets that slightly overlapping (i.e. seconds) in time. In addition, the approach to populating time fields in CCSDS packets varies across the instruments. In the case of ABI, several approaches are used when populating the standard time fields in the CCSDS secondary header.

It is also important to note that the Level 0 product files contain all telemetry received from the instruments, not just observation data, which complicates the time-stamping semantics.

Rather than incorporate sophisticated rules for populating the `time_coverage_start` and `time_coverage_end` global attributes in the Level 0 product files, the standard time fields from the first and last packets' CCSDS secondary headers in a Level 0 product file are used. Typically, these fields contain the spacecraft time of when the packet is generated. Tenth second resolution is provided for these global attributes because it is satisfactory from a cataloguing standpoint, and is consistent with the use of these same global attributes in Level 1b and Level 2+ products. When the time interval associated with a user's retrieval request of Level 0 product file is within a few seconds of the `time_coverage_start` and `time_coverage_end` global attributes, the temporally adjacent Level 0 product files should also be accessed.

Once the size of these files reaches a certain size, the file is closed, and a new file is opened for writing. The size of these Level 0 product files is configurable for each instrument.

The Level 0 products use the netCDF-4 file format. The telemetry data in the constituent CCSDS space packets is stored in a byte array, making the data opaque from a netCDF-4 format standpoint. In addition to the byte array used for storing the CCSDS space packets, there are two other arrays that capture the offset into the byte array where each packet starts and its size. Refer to Figure 3.0, netCDF-4 Level 0 Product File Design.

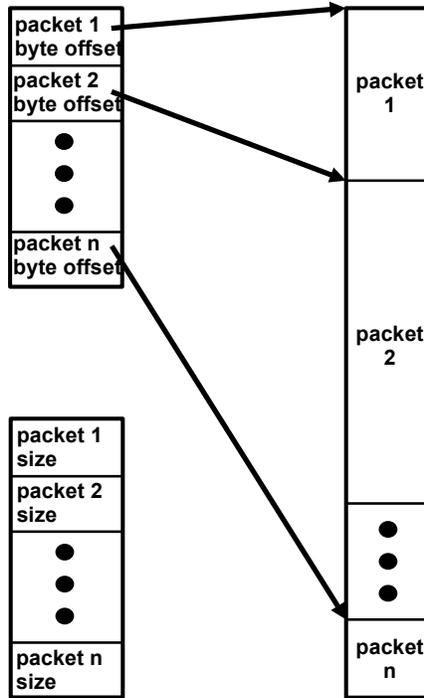


Figure 3.0 netCDF-4 Level 0 Product File Design

In the primary header of the CCSDS space packet is an eleven bit Application Process Identifier (APID) field. The APID field identifies the specific type of packet, and is used to support interpretation of its contents. Dedicated APID value ranges are associated with each instrument, except for the Magnetometer whose telemetry packets use spacecraft APIDs.

Due to spacecraft and instrument anomalies, and uncorrectable communication errors associated with the downlink of CCSDS space packets from the satellite, it is possible for Level 0 product files to be missing packets.

4.0 LEVEL 0 PRODUCT DESCRIPTIONS

This section describes the content of the GOES-R Level 0 product files, and defines their format. In addition, this section defines the netCDF global attributes contained in the Level 0 product files.

The Level 0 products include a metadata field identifying the percentage of product data lost due to uncorrectable Level 0 data errors. This metadata field is not specifically discussed in the product description paragraphs.

Tables are used to communicate the detailed definition of the global attributes, and the netCDF variables used to store and provide access to the CCSDS space packets containing instrument or spacecraft orbit and attitude/angular rate telemetry data. Refer to Table 4.0, Types of Level 0 Product Files.

Table 4.0 Types of Level 0 Product Files

Advanced Baseline Imager (ABI)
Geostationary Lightning Mapper (GLM)

Solar Ultraviolet Imager (SUVI)
Extreme Ultraviolet and X-ray Irradiance Sensor (EXIS)
Space Environment In-Situ Suite (SEISS)
Magnetometer (MAG)

For each type of Level 0 product file, one table defines their global attributes. Another table defines their variables and their variables' attributes. By default, in the product tables included in the volume, the values of the variables are dynamic and the values of the attributes are static. However, there are situations when an attribute value is selected from a list of valid values, has a fixed format, or is a dynamic value. Furthermore, there are situations where a variable or attribute value contains spatial coordinates, dimensioning information related to coverage areas and resolution, band dependent values, or flag values. For all these cases, ***bold italic text*** is used to convey how to properly interpret what the value of the variable or attribute should be.

4.1 ABI Level 0 Product

4.1.1 Description

The ABI Level 0 product contains CCSDS science, housekeeping, engineering, and diagnostic telemetry data packets received from the ABI, and repackaged orbit and attitude, and attitude angular rate telemetry data packets from the spacecraft. The range of CCSDS Application Identifiers (APIDs) used in the ABI telemetry packets is defined in Table 4.1.1, ABI L0 Product APIDs.

Table 4.1.1 ABI L0 Product APIDs

Type	Hex		Decimal	
	Start	End	Start	End
ABI allocation	100	1FF	256	511

Note: Orbit, attitude, and attitude angular rate telemetry is downlinked by the ABI using APIDs with hexadecimal values 180 and 181 (decimal 384 and 385).

The format, approach to populating time fields used for cataloguing, and uncorrectable downlink errors metadata are identical for each of the instrument-specific Level 0 product files. These characteristics are defined above in Paragraph 3.0, Level 0 Products Overview and Characteristics.

The detailed description and definition of the ABI Level 0 product file's constituent packets are located in the GOES-R ABI Flight Telemetry and Command Handbook (CDRL 43).

The detailed description of the ISO series metadata for the ABI Level 0 product is located in Appendix X, ISO Series Metadata.

4.1.2 Data Fields

The ABI Level 0 product is delivered using the netCDF-4 file format. Its global attributes and the variables are defined in the tables that follow.

The filename conventions for the ABI Level 0 product are located in Appendix A.

Table 4.1.2-1 ABI Level 0 Product: Global Attributes

Global Attribute Name	Value	Type
id	<i>universally unique identifier (UUID) for the instance of the product.</i>	string
dataset_name	<i>refer to filename conventions for L0 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	405cba30-aba1-11e3-a5e2-0800200c9a66	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
title	ABI L0 Raw Packet Data	string
summary	CCSDS science, housekeeping, engineering, and diagnostic telemetry data packets received from the ABI, and repackaged orbit and attitude telemetry data packets from the spacecraft.	string
license	Unclassified data. Access is restricted to approved users only.	string
keywords	SPECTRAL/ENGINEERING > VISIBLE WAVELENGTHS > SENSOR COUNTS, SPECTRAL/ENGINEERING > INFRARED WAVELENGTHS > SENSOR COUNTS, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS > THERMAL PROPERTIES, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS > ELECTRICAL PROPERTIES, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS > PHASE AND AMPLITUDE, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS > VIEWING GEOMETRY, SPECTRAL/ENGINEERING > PLATFORM CHARACTERISTICS > ORBITAL CHARACTERISTICS, SPECTRAL/ENGINEERING > PLATFORM CHARACTERISTICS > ATTITUDE CHARACTERISTICS	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

Global Attribute Name	Value	Type
processing_level	National Aeronautics and Space Administration (NASA) L0	
date_created	<i>format is YYYY-MM-DD"T"HH:MM:SS.s"Z".</i>	string
production_site	<i>possible values are WCDAS and RBU.</i>	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
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 4.1.2-2 ABI Level 0 Product: Variables

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
offset_to_packet	int	<i>number_of_packets = unlimited</i>	long_name	byte offset for each downlinked ABI CCSDS packet	string
			_FillValue	-1	int
			valid_range	0 2147483628	int
			units	1	string
size_of_packet	int	<i>number_of_packets = unlimited</i>	long_name	byte count for each downlinked ABI CCSDS packet	string
			_FillValue	-1	int
			valid_range	20 8198	int
			units	count	string
abi_space_packet_data	byte	<i>number_of_data_bytes = unlimited</i>	long_name	ABI CCSDS level 0 packet data	string
			_Unsigned	TRUE	string
			units	1	string
percent_uncorrectable_L0_errors	float	n/a	long_name	percent data lost due to uncorrectable L0 errors	string
			_FillValue	-999	float
			valid_range	0.0 1.0	float
			units	percent	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
product_version_container	int	n/a	long_name	container for product version	string
			product_version	<i>format is vVVrRR where VV is major release # and RR is minor revision #.</i>	string

4.2 EXIS Level 0 Product

4.2.1 Description

The EXIS Level 0 product contains CCSDS science, housekeeping, and diagnostic telemetry data packets received from the EXIS, and orbit and attitude, and eclipse of the sun related and yaw flip state telemetry data packets received from the spacecraft. The range of CCSDS Application Identifiers (APIDs) used in the EXIS telemetry packets is defined in Table 4.2.1, EXIS L0 Product APIDs.

Table 4.2.1 EXIS L0 Product APIDs

Type	Hex		Decimal	
	Start	End	Start	End
EXIS allocation	380	3BF	896	959
Spacecraft orbit and attitude data	<i>TBS</i>		<i>TBS</i>	
Eclipse data	<i>TBS</i>		<i>TBS</i>	
Solar array current data	<i>TBS</i>		<i>TBS</i>	
Yaw flip data	<i>TBS</i>		<i>TBS</i>	

The format, approach to populating time fields used for cataloguing, and uncorrectable downlink errors metadata are identical for each of the instrument-specific Level 0 product files. These characteristics are defined above in Paragraph 3.0, Level 0 Products Overview and Characteristics.

The detailed description and definition of the EXIS Level 0 product file's constituent packets are located in the GOES-R EXIS Flight Telemetry and Command Handbook (CDRL 43).

The detailed description of the ISO series metadata for the EXIS Level 0 product is located in Appendix X, ISO Series Metadata.

13 May 2015

4.2.2 Data Fields

The EXIS Level 0 product is delivered using the netCDF-4 file format. Its global attributes and the variables are defined in the tables that follow.

The filename conventions for the EXIS Level 0 product are located in Appendix A.

Table 4.2.2-1 EXIS Level 0 Product: Global Attributes

Global Attribute Name	Value	Type
id	<i>universally unique identifier (UUID) for the instance of the product.</i>	string
dataset_name	<i>refer to filename conventions for L0 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	542948c0-a561-11e4-bcd8-0800200c9a66	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
title	EXIS L0 Raw Packet Data	string
summary	CCSDS science, housekeeping, and diagnostic telemetry data packets received from the EXIS, including the EUVS, XRS, and SPS, and orbit and attitude telemetry data packets received from the spacecraft.	string
license	Unclassified data. Access is restricted to approved users only.	string
keywords	SPECTRAL/ENGINEERING > ULTRAVIOLET WAVELENGTHS > SENSOR COUNTS, SPECTRAL/ENGINEERING > X-RAY > SENSOR COUNTS, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS > THERMAL PROPERTIES, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS > ELECTRICAL PROPERTIES, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS > VIEWING GEOMETRY, SPECTRAL/ENGINEERING > PLATFORM CHARACTERISTICS > ORBITAL CHARACTERISTICS, SPECTRAL/ENGINEERING > PLATFORM CHARACTERISTICS > ATTITUDE CHARACTERISTICS	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 Extreme Ultraviolet and X-ray Irradiance Sensor	string
EUVS_instrument_ID	<i>serial number of the EXIS EUVS instrument (sensor).</i>	string
XRS_instrument_ID	<i>serial number of the EXIS XRS instrument (sensor).</i>	string

13 May 2015

Global Attribute Name	Value	Type
processing_level	National Aeronautics and Space Administration (NASA) L0	string
date_created	<i>format is YYYY-MM-DD"T"HH:MM:SS.s"Z".</i>	string
production_site	<i>possible values are WCDAS and RBU.</i>	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
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 4.2.2-2 EXIS Level 0 Product: Variables

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
offset_to_packet	int	<i>number_of_packets = unlimited</i>	long_name	byte offset for each downlinked EXIS or spacecraft orbit and attitude CCSDS packet	string
			_FillValue	-1	int
			valid_range	0 2147483628	int
			units	1	string
size_of_packet	int	<i>number_of_packets = unlimited</i>	long_name	byte count for each downlinked EXIS or spacecraft orbit and attitude CCSDS packet	string
			_FillValue	-1	int
			valid_range	20 256	int
			units	count	string
exis_space_packet_data	byte	<i>number_of_data_bytes = unlimited</i>	long_name	EXIS or spacecraft orbit and attitude CCSDS level 0 packet data	string
			_Unsigned	TRUE	string
			units	1	string
percent_uncorrectable_L0_errors	float	n/a	long_name	percent data lost due to uncorrectable L0 errors	string
			_FillValue	-999	float
			valid_range	0.0 1.0	float

13 May 2015

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			units	percent	string
product_version_containe r	int	n/a	long_name	container for product version	string
			product_ver sion	<i>format is vVVrRR where VV is major release # and RR is minor revision #.</i>	string

4.3 GLM Level 0 Product

4.3.1 Description

The GLM Level 0 product contains CCSDS science, including lightning event, housekeeping, engineering, and diagnostic telemetry data packets received from the GLM, and orbit and attitude, and attitude angular rate telemetry data packets received from the spacecraft. The range of CCSDS Application Identifiers (APIDs) used in the GLM telemetry packets is defined in Table 4.3.1, GLM L0 Product APIDs.

Table 4.3.1 GLM L0 Product APIDs

Type	Hex		Decimal	
	Start	End	Start	End
GLM allocation	200	2FF	512	767
Spacecraft orbit, attitude, and angular rate data	<i>TBS</i>		<i>TBS</i>	

The format, approach to populating time fields used for cataloguing, and uncorrectable downlink errors metadata are identical for each of the instrument-specific Level 0 product files. These characteristics are defined above in Paragraph 3.0, Level 0 Products Overview and Characteristics.

The detailed description and definition of the GLM Level 0 product file's constituent packets are located in the GOES-R GLM Flight Telemetry and Command Handbook (CDRL 43).

The detailed description of the ISO series metadata for the GLM Level 0 product is located in Appendix X, ISO Series Metadata.

4.3.2 Data Fields

The GLM Level 0 product is delivered using the netCDF-4 file format. Its global attributes and the variables are defined in the tables that follow. The filename conventions for the GLM Level 0 product are located in Appendix A.

Table 4.3.2-1 GLM Level 0 Product: Global Attributes

Global Attribute Name	Value	Type
id	<i>universally unique identifier (UUID) for the instance of the product.</i>	string
dataset_name	<i>refer to filename conventions for L0 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	f82fc080-a560-11e4-bcd8-0800200c9a66	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
title	GLM L0 Raw Packet Data	string
summary	CCSDS science, including lightning event, housekeeping, engineering, and diagnostic telemetry data packets received from the GLM, and orbit and attitude telemetry data packets received from the spacecraft.	string
license	Unclassified data. Access is restricted to approved users only.	string
keywords	SPECTRAL/ENGINEERING > VISIBLE WAVELENGTHS > SENSOR COUNTS, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS > THERMAL PROPERTIES, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS > ELECTRICAL PROPERTIES, SPECTRAL/ENGINEERING > PLATFORM CHARACTERISTICS > ORBITAL CHARACTERISTICS, SPECTRAL/ENGINEERING > PLATFORM CHARACTERISTICS > ATTITUDE CHARACTERISTICS	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 Geostationary Lightning Mapper	string
instrument_ID	<i>serial number of the instrument.</i>	string

13 May 2015

Global Attribute Name	Value	Type
processing_level	National Aeronautics and Space Administration (NASA) L0	string
date_created	<i>format is YYYY-MM-DD"T"HH:MM:SS.s"Z".</i>	string
production_site	<i>possible values are WCDAS and RBU.</i>	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
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 4.3.2-2 GLM Level 0 Product: Variables

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
offset_to_packet	int	<i>number_of_packets = unlimited</i>	long_name	byte offset for each downlinked GLM or spacecraft orbit and attitude CCSDS packet	string
			_FillValue	-1	int
			valid_range	0 2147483628	int
			units	1	string
size_of_packet	int	<i>number_of_packets = unlimited</i>	long_name	byte count for each downlinked GLM or spacecraft orbit and attitude CCSDS packet	string
			_FillValue	-1	int
			valid_range	20 8198	int
			units	count	string
glm_space_packet_data	byte	<i>number_of_data_bytes = unlimited</i>	long_name	GLM or spacecraft orbit and attitude CCSDS level 0 packet data	string
			_Unsigned	TRUE	string
			units	1	string
percent_uncorrectable_L0_errors	float	n/a	long_name	percent data lost due to uncorrectable L0 errors	string
			_FillValue	-999	float
			valid_range	0.0 1.0	float

13 May 2015

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			units	percent	string
			long_name	container for product version	string
product_version_container	int	n/a	product_version	<i>format is vVVrRR where VV is major release # and RR is minor revision #.</i>	string

4.4 Magnetometer Level 0 Product

4.4.1 Description

The Magnetometer Level 0 product contains CCSDS science, engineering, and diagnostic telemetry data packets received from the Magnetometer, and orbit and attitude, and eclipse of the sun related and yaw flip state telemetry data packets received from the spacecraft. The range of CCSDS Application Identifiers (APIDs) used in the Magnetometer telemetry packets is defined in Table 4.4.1, Magnetometer L0 Product APIDs.

Table 4.4.1 Magnetometer L0 Product APIDs

Type	Hex		Decimal	
	Start	End	Start	End
Magnetometer sub-allocation in spacecraft allocation (science and maintenance mode data)	C8	CB	200	203
Spacecraft orbit and attitude data	<i>TBS</i>		<i>TBS</i>	
Eclipse data	<i>TBS</i>		<i>TBS</i>	
Solar array current data	<i>TBS</i>		<i>TBS</i>	
Yaw flip data	<i>TBS</i>		<i>TBS</i>	

The format, approach to populating time fields used for cataloguing, and uncorrectable downlink errors metadata are identical for each of the instrument-specific Level 0 product files. These characteristics are defined above in Paragraph 3.0, Level 0 Products Overview and Characteristics.

The detailed description and definition of the Magnetometer Level 0 product file's constituent packets are located in the GOES-R Spacecraft Telemetry and Command Handbook.

The detailed description of the ISO series metadata for the Magnetometer Level 0 product is located in Appendix X, ISO Series Metadata.

13 May 2015

4.4.2 Data Fields

The Magnetometer Level 0 product is delivered using the netCDF-4 file format. Its global attributes and the variables are defined in the tables that follow.

The filename conventions for the Magnetometer Level 0 product are located in Appendix A.

Table 4.4.2-1 Magnetometer Level 0 Product: Global Attributes

Global Attribute Name	Value	Type
id	<i>universally unique identifier (UUID) for the instance of the product.</i>	string
dataset_name	<i>refer to filename conventions for L0 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	389e80c0-a561-11e4-bcd8-0800200c9a66	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
title	Magnetometer L0 Raw Packet Data	string
summary	CCSDS science, engineering, and diagnostic telemetry data packets received from the inboard and outboard Magnetometer, and orbit and attitude telemetry data packets received from the spacecraft.	string
license	Unclassified data. Access is restricted to approved users only.	string
keywords	SUN-EARTH INTERACTIONS > IONOSPHERE/MAGNETOSPHERE DYNAMICS > SENSOR COUNTS, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS > THERMAL PROPERTIES, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS > ELECTRICAL PROPERTIES, SPECTRAL/ENGINEERING > PLATFORM CHARACTERISTICS > ORBITAL CHARACTERISTICS, SPECTRAL/ENGINEERING > PLATFORM CHARACTERISTICS > ATTITUDE CHARACTERISTICS	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 Magnetometer	string

13 May 2015

Global Attribute Name	Value	Type
inboard_MAG_instrument_ID	<i>serial number of the inboard magnetometer.</i>	string
outboard_MAG_instrument_ID	<i>serial number of the inboard magnetometer.</i>	string
processing_level	National Aeronautics and Space Administration (NASA) L0	string
date_created	<i>format is YYYY-MM-DD"T"HH:MM:SS.s"Z".</i>	string
production_site	<i>possible values are WCDAS and RBU.</i>	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
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 4.4.2-2 Magnetometer Level 0 Product: Variables

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
offset_to_packet	int	<i>number_of_packets = unlimited</i>	long_name	byte offset for each downlinked Magnetometer or spacecraft orbit and attitude CCSDS packet	string
			_FillValue	-1	int
			valid_range	0 2147483628	int
			units	1	string
size_of_packet	int	<i>number_of_packets = unlimited</i>	long_name	byte count for each downlinked Magnetometer or spacecraft orbit and attitude CCSDS packet	string
			_FillValue	-1	int
			valid_range	20 256	int
			units	count	string
mag_space_packet_data	byte	<i>number_of_data_bytes = unlimited</i>	long_name	Magnetometer or spacecraft orbit and attitude CCSDS level 0 packet data	string
			_Unsigned	TRUE	string

13 May 2015

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			units	1	string
percent_uncorrectable_L0_errors	float	n/a	long_name	percent data lost due to uncorrectable L0 errors	string
			_FillValue	-999	float
			valid_range	0.0 1.0	float
			units	percent	string
product_version_container	int	n/a	long_name	container for product version	string
			product_version	<i>format is vVvRR where VV is major release # and RR is minor revision #.</i>	string

4.5 SEISS Level 0 Product

4.5.1 Description

The SEISS Level 0 product contains CCSDS science, housekeeping, engineering, and diagnostic telemetry data packets received from the SEISS, and orbit and attitude, and eclipse of the sun related and yaw flip state telemetry data packets received from the spacecraft. The range of CCSDS Application Identifiers (APIDs) used in the SEISS telemetry packets is defined in Table 4.5.1, SEISS L0 Product APIDs.

Table 4.5.1 SEISS L0 Product APIDs

Type	Hex		Decimal	
	Start	End	Start	End
SEISS allocation	400	43F	1024	1087
Spacecraft orbit and attitude data	<i>TBS</i>		<i>TBS</i>	
Eclipse data	<i>TBS</i>		<i>TBS</i>	
Solar array current data	<i>TBS</i>		<i>TBS</i>	
Yaw flip data	<i>TBS</i>		<i>TBS</i>	

The format, approach to populating time fields used for cataloguing, and uncorrectable downlink errors metadata are identical for each of the instrument-specific Level 0 product files. These characteristics are defined above in Paragraph 3.0, Level 0 Products Overview and Characteristics.

The detailed description and definition of the SEISS Level 0 product file's constituent packets are located in the GOES-R SEISS Flight Telemetry and Command Handbook (CDRL 43).

The detailed description of the ISO series metadata for the SEISS Level 0 product is located in Appendix X, ISO Series Metadata.

13 May 2015

4.5.2 Data Fields

The SEISS Level 0 product is delivered using the netCDF-4 file format. Its global attributes and the variables are defined in the tables that follow. The filename conventions for the SEISS Level 0 product are located in Appendix A.

Table 4.5.2-1 SEISS Level 0 Product: Global Attributes

Global Attribute Name	Value	Type
id	<i>universally unique identifier (UUID) for the instance of the product.</i>	string
dataset_name	<i>refer to filename conventions for L0 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	85e0f200-a561-11e4-bcd8-0800200c9a66	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
title	SEISS L0 Raw Packet Data	string
summary	CCSDS science, housekeeping, engineering, and diagnostic telemetry data packets received from the SEISS, including the EHIS, MPS-HI, MPS-LO and SGPS, and orbit and attitude telemetry data packets received from the spacecraft.	string
license	Unclassified data. Access is restricted to approved users only.	string
keywords	SUN-EARTH INTERACTIONS > IONOSPHERE/MAGNETOSPHERE DYNAMICS > SENSOR COUNTS, SUN-EARTH INTERACTIONS > SOLAR ENERGETIC PARTICLE FLUX > SENSOR COUNTS, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS > THERMAL PROPERTIES, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS > ELECTRICAL PROPERTIES, SPECTRAL/ENGINEERING > PLATFORM CHARACTERISTICS > ORBITAL CHARACTERISTICS, SPECTRAL/ENGINEERING > PLATFORM CHARACTERISTICS > ATTITUDE CHARACTERISTICS	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 Space Environment In-Situ Suite	string
EHIS_instrument_ID	<i>serial number of the SEISS EHIS instrument (sensor).</i>	string
MPS-HI_instrument_ID	<i>serial number of the SEISS MPS-HI instrument (sensor).</i>	string

13 May 2015

Global Attribute Name	Value	Type
MPS-LO_instrument_ID	<i>serial number of the SEISS MPS-LO instrument (sensor).</i>	string
SGPS-X_instrument_ID	<i>serial number of the SEISS SGPS-X instrument (sensor).</i>	string
SGPS+X_instrument_ID	<i>serial number of the SEISS SGPS+X instrument (sensor).</i>	string
processing_level	National Aeronautics and Space Administration (NASA) L0	string
date_created	<i>format is YYYY-MM-DD"T"HH:MM:SS.s"Z".</i>	string
production_site	<i>possible values are WCDAS and RBU.</i>	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
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 4.5.2-2 SEISS Level 0 Product: Variables

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
offset_to_packet	int	<i>number_of_packets = unlimited</i>	long_name	byte offset for each downlinked SEISS or spacecraft orbit and attitude CCSDS packet	string
			_FillValue	-1	int
			valid_range	0 2147483628	int
			units	1	string
size_of_packet	int	<i>number_of_packets = unlimited</i>	long_name	byte count for each downlinked SEISS or spacecraft orbit and attitude CCSDS packet	string
			_FillValue	-1	int
			valid_range	20 475	int
			units	count	string
seiss_space_packet_data	byte	<i>number_of_data_bytes = unlimited</i>	long_name	SEISS or spacecraft orbit and attitude CCSDS level 0 packet data	string
			Unsigned	TRUE	string
			units	1	string

13 May 2015

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
percent_uncorrectable_L0_errors	float	n/a	long_name	percent data lost due to uncorrectable L0 errors	string
			FillValue	-999	float
			valid_range	0.0 1.0	float
			units	percent	string
product_version_container	int	n/a	long_name	container for product version	string
			product_version	<i>format is vVVrRR where VV is major release # and RR is minor revision #.</i>	string

4.6 SUVI Level 0 Product

4.6.1 Description

The SUVI Level 0 product contains science, including processed guide telescope, housekeeping, including event message, engineering, and diagnostic telemetry data packets received from the SUVI, and orbit, and eclipse of the sun related and yaw flip state telemetry data packets received from the spacecraft. The range of CCSDS Application Identifiers (APIDs) used in the SUVI telemetry packets is defined in Table 4.6.1, SUVI L0 Product APIDs.

Table 4.6.1 SUVI L0 Product APIDs

Type	Hex		Decimal	
	Start	End	Start	End
SUVI allocation	300	37F	768	895
Spacecraft orbit data	<i>TBS</i>		<i>TBS</i>	
Eclipse data	<i>TBS</i>		<i>TBS</i>	
Solar array current data	<i>TBS</i>		<i>TBS</i>	
Yaw flip data	<i>TBS</i>		<i>TBS</i>	

The format, approach to populating time fields used for cataloguing, and uncorrectable downlink errors metadata are identical for each of the instrument-specific Level 0 product files. These characteristics are defined above in Paragraph 3.0, Level 0 Products Overview and Characteristics.

The detailed description and definition of the SUVI Level 0 product file's constituent packets are located in the GOES-R SUVI Flight Telemetry and Command Handbook (CDRL 43).

The detailed description of the ISO series metadata for the SUVI Level 0 product is located in Appendix X, ISO Series Metadata.

13 May 2015

4.6.2 Data Fields

The SUVI Level 0 product is delivered using the netCDF-4 file format. Its global attributes and the variables are defined in the tables that follow.

The filename conventions for the SUVI Level 0 product are located in Appendix A.

Table 4.6.2-1 SUVI Level 0 Product: Global Attributes

Global Attribute Name	Value	Type
id	<i>universally unique identifier (UUID) for the instance of the product.</i>	string
dataset_name	<i>refer to filename conventions for L0 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	1a47ee90-a561-11e4-bcd8-0800200c9a66	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
title	SUVI L0 Raw Packet Data	string
summary	CCSDS science, including processed guide telescope, housekeeping, including event message, engineering, and diagnostic telemetry data packets received from the SUVI, and orbit and attitude telemetry data packets received from the spacecraft.	string
license	Unclassified data. Access is restricted to approved users only.	string
keywords	SPECTRAL/ENGINEERING > ULTRAVIOLET WAVELENGTHS > SENSOR COUNTS, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS > THERMAL PROPERTIES, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS > ELECTRICAL PROPERTIES, SPECTRAL/ENGINEERING > SENSOR CHARACTERISTICS > VIEWING GEOMETRY, SPECTRAL/ENGINEERING > PLATFORM CHARACTERISTICS > ORBITAL CHARACTERISTICS, SPECTRAL/ENGINEERING > PLATFORM CHARACTERISTICS > ATTITUDE CHARACTERISTICS	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 Solar Ultraviolet Imager	string
instrument_ID	<i>serial number of the instrument.</i>	string
processing_level	National Aeronautics and Space Administration (NASA) L0	string
date_created	<i>format is YYYY-MM-DD" T"HH:MM:SS.s"Z".</i>	string

13 May 2015

Global Attribute Name	Value	Type
production_site	<i>possible values are WCDAS and RBU.</i>	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
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 4.6.2-2 SUVI Level 0 Product: Variables

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
offset_to_packet	int	<i>number_of_packets = unlimited</i>	long_name	byte offset for each downlinked SUVI or spacecraft orbit and attitude CCSDS packet	string
			_FillValue	-1	int
			valid_range	0 2147483628	int
			units	1	string
size_of_packet	int	<i>number_of_packets = unlimited</i>	long_name	byte count for each downlinked SUVI or spacecraft orbit and attitude CCSDS packet	string
			_FillValue	-1	int
			valid_range	20 8198	int
			units	count	string
suvi_space_packet_data	byte	<i>number_of_data_bytes = unlimited</i>	long_name	SUVI or spacecraft orbit and attitude CCSDS level 0 packet data	string
			_Unsigned	TRUE	string
			units	1	string
percent_uncorrectable_L0_errors	float	n/a	long_name	percent data lost due to uncorrectable L0 errors	string
			_FillValue	-999	float
			valid_range	0.0 1.0	float
			units	percent	string
	int	n/a	long_name	container for product version	string

13 May 2015

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
product_version_containe r			product_ver sion	<i>format is vVvRR where VV is major release # and RR is minor revision #.</i>	string

5.0 APPENDIX A - L0 PRODUCT FILENAME CONVENTIONS

The main volume of the PUG contains a summary level description of the filename conventions used for all GOES-R product and data files. This appendix contains the detailed filename conventions for Level 0 products defined in this volume of the PUG.

As discussed in the main volume of the PUG, filenames consist of a set of string fields delimited by an underscore or a period that are concatenated together. The content and format of several of the filename string fields are common across more than one of the Level 0 product filenames. Refer to Table A-1, Common Filename String Fields.

Table A-1 Common Filename String Fields

Common String Field	Description	Values and Meanings
System Environment	Defines whether the file is created by the operational system or a test system. Also defines whether the data in the file is real-time, test, playback, or simulated data.	"OR" = operational system real-time data "OT" = operational system test data "IR" = test system real-time data "IT" = test system test data "IP" = test system playback data "IS" = test system simulated data Note: Real-time data created by the operational system (i.e., "OR") support the operational mission.
Data Short Name	Product identifier	(See Table A.1)
Platform Identifier	Identifies the applicable GOES-R series satellite.	"G16" = GOES-16 (R) "G17" = GOES-17 (S)
Observation Period Date & Time	Start & end date & time of the raw or processed observation data in the file.	"sYYYYDDDDHHMMSSs" = start date & time "eYYYYDDDDHHMMSSs" = end date & time Notes: <ul style="list-style-type: none"> ➤ YYYY = year: e.g., 2015 ➤ DDD = day of year: 001-366 ➤ HH = UTC hour of day: 00-23 ➤ SSs = second of minute: 00-60 (60 indicates leap second and third "s" is tenth of second) ➤ GRB Information file Status Date and Time uses same content and format as observation start date & time
Creation Date & Time	Date & time the file is created.	"cYYYYDDDDHHMMSSs" Notes: <ul style="list-style-type: none"> ➤ YYYY = year: e.g., 2015 ➤ DDD = day of year: 001-366 ➤ HH = UTC hour of day: 00-23 ➤ MM = minute of hour: 00-59 ➤ SSs = second of minute: 00-59 (60 indicates leap second and third "s" is tenth of second)

A.1 LEVEL 0 PRODUCT FILENAMES

Level 0 product filenames are assembled using filename string fields as follows:

*<System Environment>_<DSN>_<Platform ID>_<Observation Period Start Date & Time>
 <Observation Period End Date & Time><Creation Date & Time>.<File Extension>*

The string fields other than Data Short Name and file extension are defined above in Table A-1, Common Filename String Fields. The Data Short Names for Level 0 products are defined in Table A.1.

Table A.1 Level 0 Product File Data Short Names

Level 0 Product File Type	Data Short Name
Advanced Baseline Imager (ABI)	ABI-L0
Geostationary Lightning Mapper (GLM)	GLM-L0
Solar Ultraviolet Imager (SUVI)	SUVI-L0
Extreme Ultraviolet and X-ray Irradiance Sensor (EXIS)	EXIS-L0
Space Environment In-Situ Suite (SEISS)	SEIS-L0
Magnetometer (MAG)	MAG-L0

The file extension for a Level 0 product file is “.nc” (netCDF-4 file).

The filename for a GOES R satellite operational GLM Level 0 product on February 4, 2016 with an observation start and end time of midnight UTC, and 12 minutes past midnight, respectively, with a file creation time of 15 minutes past midnight is:

“OR_GLM-L0_G16_s20160350000000_e20160350012000_c20160350015000.nc”.