National Aeronautics and
Space Administration

DOC NUMBER RBI-SDMP-09-003

VERSION: BASELINE

RELEASE DATE: 01-08-2018

Radiation Budget Instrument
RBI

Science Data Management Plan

Approved for Public Release; Distribution is Unlimited

The electronic version is the official approved document.
Verify this is the correct version before use.

SIGNATURE PAGE

Name	Date Signature
Jonathan L. Gleason RBI Ground Systems Lead & Data Manager	September 8, 2017

Concurred By:

Name	Date	Signature
John Kusterer Head, Atmospheric Science Data Center	10/11/17	Electronic signature on file

Approved By:

Name	Date	Signature
Mike Cisewski RBI Project Manager	01/08/18	Electronic signature on file
Kory Priestley RBI Project Scientist	10/12/17	Electronic signature on file

REVISION HISTORY PAGE

Revision No.	Description	Release Date
Baseline	Initial Release – See RBI-CR-066	01/08/2018

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

1.1 BACKGROUND

RBI is a scanning radiometer capable of measuring Earth's reflected sunlight and emitted thermal radiation. Observations from RBI will help measure the effect of clouds on the Earth's energy balance, which strongly influences both weather and climate. Long-term satellite data from RBI will help scientists and researchers understand the links between the Earth's incoming solar and outgoing emitted and reflected energy, and properties of the atmosphere that affect it. The data from RBI will provide fundamental inputs to help develop a quantitative understanding of the links between Earth's radiation budget and the properties of the atmosphere and surface that define that budget. RBI will fly on the Joint Polar Satellite System 2 (JPSS-2) mission and will extend the unique global climate measurements of the Earth's radiation budget provided by the CERES instruments since 1998.

The RBI Project is responsible for the design, development and ground-based instrument characterization. The RBI Project is also responsible for the development of Level 0 to Level 1 science software. The Radiation Budget Measurements - Science Team (RBM) is responsible for the derivation and validation of the scientific algorithms used to produce the data products distributed to the atmospheric sciences community. The RBM Data Management Team (DMT) is responsible for the development and maintenance of the software that implements science algorithms in the production environment to produce all CERES data products. The Langley Atmospheric Science Data Center (ASDC) is responsible for the production environment, the data ingest, and the processing, archival, and distribution of all RBI data products.

1.2 PURPOSE AND SCOPE

The RBI Science Data Management Plan (SDMP) serves to document data supporting and produced by the RBI instrument. The purpose of this document is to identify the data that will be created by the mission, and how that data is created and dispositioned during and after the mission.

1.3 DMP DEVELOPMENT, MAINTENANCE AND MANAGEMENT RESPONSIBILITY

The RBI Project is responsible for the development, maintenance, and management of this document prior to the operational phase of the JPSS-2 mission. Beginning immediately after successful Post Launch Assessment Review (PLAR), the RBM Project will assume responsibility for maintenance and management of this document. All changes to the DMP will be controlled.

2 APPLICABLE AND REFERENCE DOCUMENTS

2.1 APPLICABLE DOCUMENTS

The documents listed in Table 2-1 are applicable to the extent specified in this document.

Table 2-1 Applicable Documents

Document Number	Document Revision	Document Title
RBI-PP-01-001		RBI Project Plan

2.2 REFERENCE DOCUMENTS

The documents in Table 2-2 are included for reference, guidance, and consideration for applicability for product requirement documents.

Table 2-2 Reference Documents

Document Number	Document Revision	Document Title
RBI-PP-01-001		Radiation Budget Instrument (RBI) Project Plan
RBI-IPA-09-002		Inter-Project Agreement Between NASA Radiation Budget Instrument (RBI) Project and the Earth Science Data and Information Systems (ESDIS) Project for Science Data Processing, Archive and Distribution Support

3 TECHNICAL SUMMARY

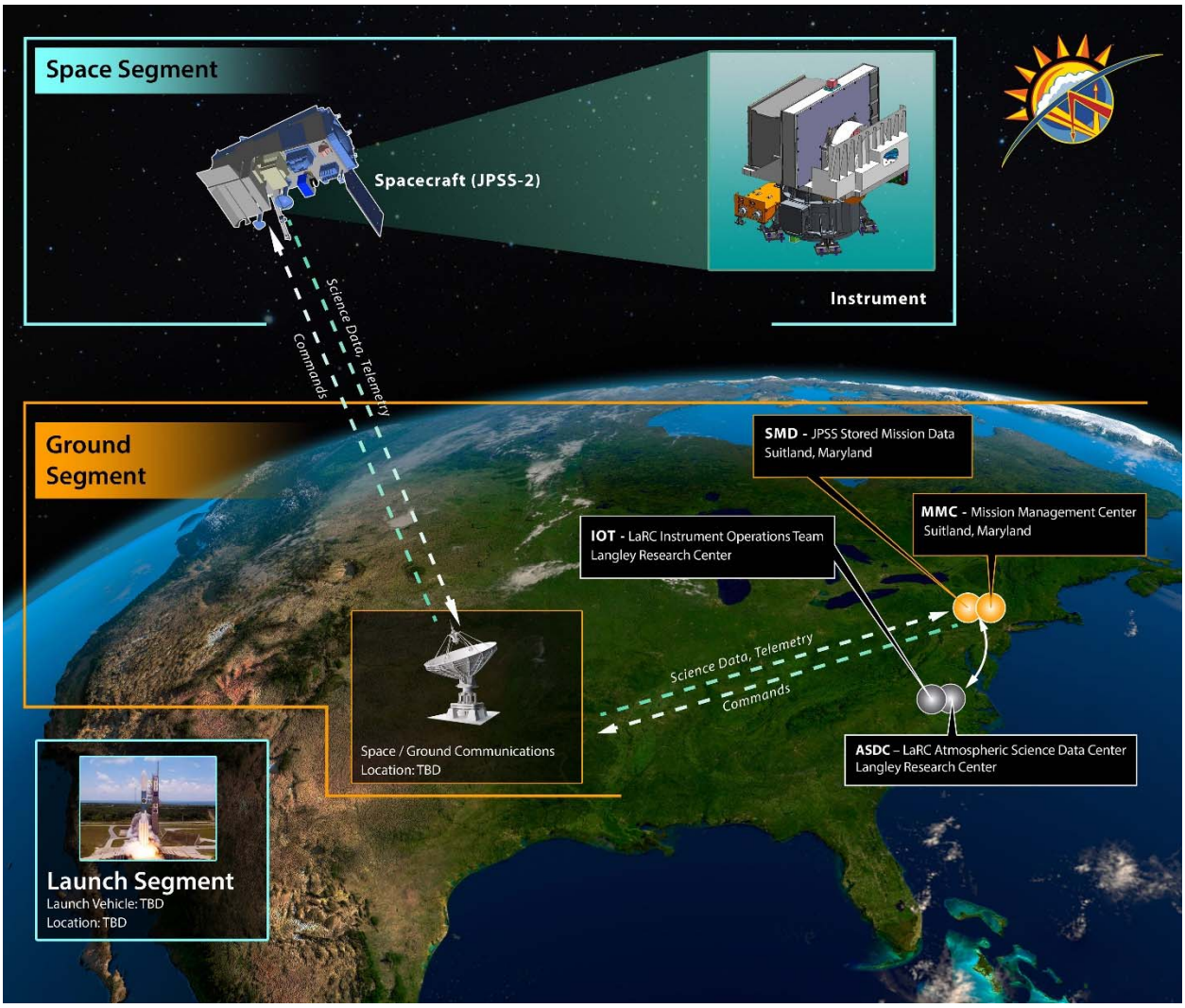

Figure 3-1 RBI Concept of Operations

3.1 MISSION AND SENSOR OVERVIEW

RBI climate data records involve an unprecedented level of data fusion: RBI measurements are combined with the Visible Infrared Imaging Radiometer (VIIRS) imager data, 4-D weather assimilation data, microwave sea-ice observations, and measurements from five geostationary satellites to produce climate-quality radiative fluxes at the top-of-atmosphere, within the atmosphere and at the surface, together with the associated cloud and aerosol properties.

RBI is the next generation CERES instrument. The RBI instrument has three channels: a short-wave channel for measuring reflected sunlight, a longwave channel for measuring Earth-emitted thermal radiation, and a total channel for total radiation. It is currently in the design phase and is scheduled to be launched on the JPSS-2 mission in 2021.

3.2 DATA PRODUCT SUMMARY

Since RBI data are intended to provide continuity to the existing CERES Earth Radiation Budget data record, RBI will produce common data products with CERES and leverage existing processing infrastructure and algorithm implementation where possible. RBI Level-0 data will vary significantly from the CERES equivalent in format, structure and size. To account for this, the RBI Level 1 science product, containing geolocated and calibrated radiances, and associated engineering telemetry, will be organized as similar as possible to the equivalent CERES Level 1 Bi-Directional Scan (BDS) data product to facilitate maximum reuse of existing CERES Level 2 and 3 algorithms. Like CERES, the RBI science software will be organized into algorithm-based subsystems, which process data starting with the raw satellite data in EOS Level-0 format, and continuing through to Level 3 gridded and time-space averaged products.

The RBI Project has the responsibility to develop the Level 0 to Level 1 science software. The RBM Project is responsible to develop Level 2 and 3 science software and to maintain all science software during the operational phase of the mission. The RBM Project is also responsible to maintain all RBI science software for the life of the mission and to and to maintain all RBI science software. The RBM Project is also responsible to maintain all RBI science software and process all science data products once the RBI is in flight and operational.

The following diagram shows planned interactions between the RBI subsystems including the data products, which are the interfaces between each of the subsystems and is based on the current CERES Earth Radiation Budget algorithm and software organization. The dotted line delineates the science software responsibilities of the RBI Project and RBM Project.

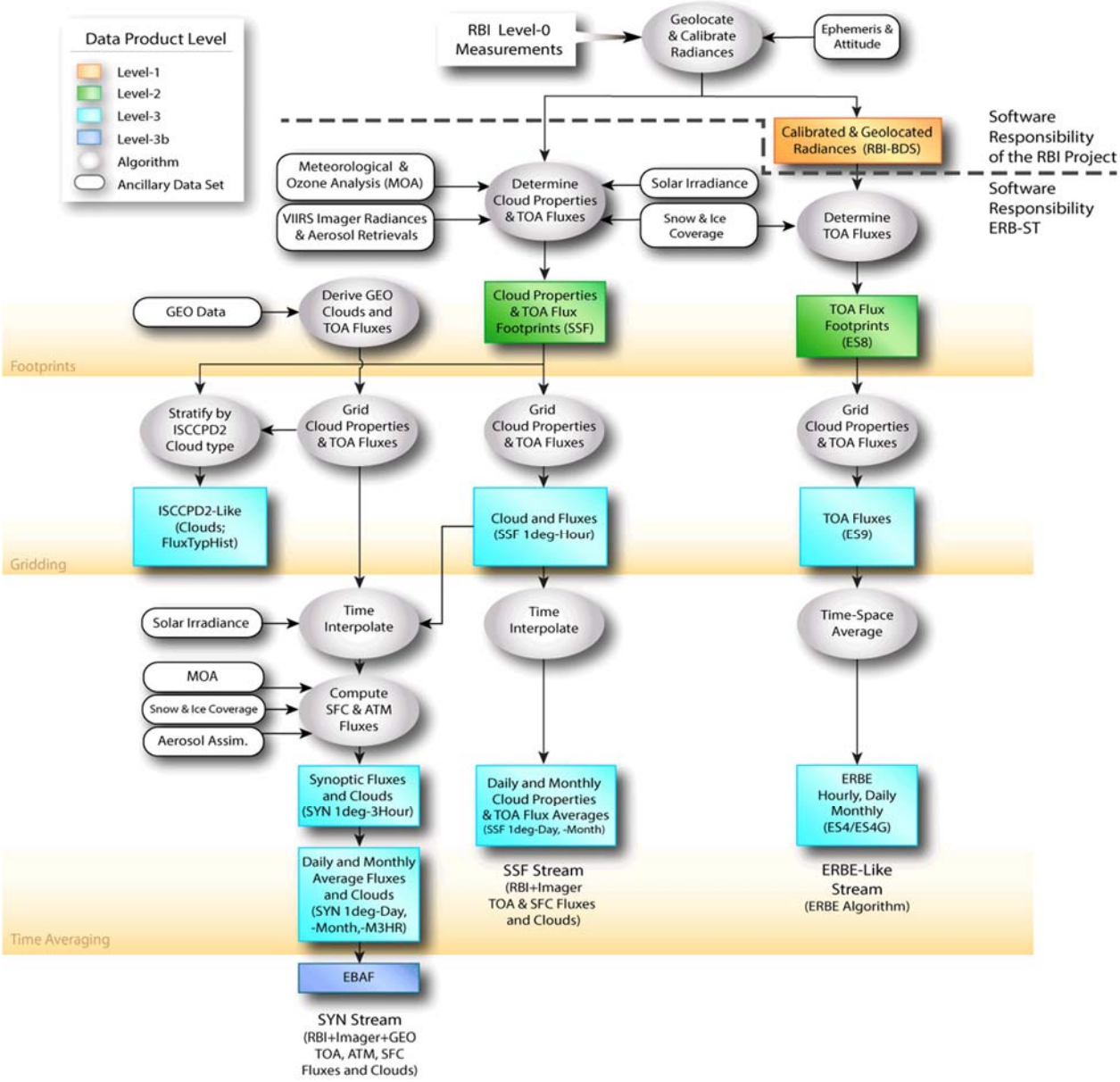

Figure 3-2 RBI Data Processing Flow Diagram

RBI data products will be described in individual Data Products Catalogs that will be made available on the NASA ERB-ST website after launch. Data Product Catalogs will be developed by the ERB-ST as individual data products are produced and released. Descriptions of the equivalent CERES Data Products are currently available at: http://ceres.larc.nasa.gov/dpc_current.php.

Table 3-1 RBI Science Data Products

Product Name	Description	Temporal Resolution	Level
BDS	RBI geolocated and calibrated TOA filtered SW, TOT, and WN radiances for views of space, internal calibration, solar calibration and Earth	24 hours	1B
ES8	RBI observed TOA fluxes using original ERBE algorithms. For comparisons between RBI, CERES & ERBE data	24 hours	2
ES9		1 month	3
ES4		1 month	3
ES4G		1 month	3
SSF	RBI observed TOA fluxes, VIIRS clouds and aerosols, and parameterized surface fluxes.	1 hour	2
SSF1deg-Hour	Instantaneous TOA and parameterized surface fluxes and cloud/aerosol properties averaged onto a regular 1° equal-area grid and sorted by local hour	1 hour	3
SSF1deg-Day	RBI observed, temporally interpolated, daily, 1° equal-area, zonal and global averages of TOA fluxes and imager-derived clouds and aerosol properties	24 hours	3
SSF1deg-Month	Same as SSF1deg-Day but averaged over an entire Month	1 month	3
SYN1deg-1Hour	GEO enhanced RBI temporally interpolated 1-hourly average 1° equal-area TOA fluxes, imager/GEO cloud and imager aerosol properties	1 Hour	3
SYN1deg-3Hour	GEO enhanced RBI temporally interpolated 3-hourly average 1° equal-area TOA fluxes, imager/GEO cloud and imager aerosol properties	3 hours	3
SYN1deg-Day	GEO enhanced RBI temporally interpolated 1-Daily average 1° equal-area TOA fluxes, imager/GEO cloud and imager aerosol properties	1 day	3
SYN1deg-Month	GEO enhanced RBI temporally interpolated monthly average 1° equal-area TOA fluxes, imager/GEO cloud and imager aerosol properties	1 month	3
SYN1deg-M3Hour	GEO enhanced RBI temporally interpolated 1° equal-area averages of all days during the month for each of the eight 3-hourly GMT time increments (monthly 3-hourly) of TOA fluxes, imager/GEO cloud properties, imager/GEO aerosol properties, and computed TOA, surface, and profile fluxes.	1 month	3
SYN1deg-MHour	GEO enhanced RBI temporally interpolated monthly-hourly average 1° equal-area TOA fluxes, imager/GEO cloud and imager aerosol properties	1 month	3
CldTypHist	Monthly 1° equal-area gridded VIIRS and GEO daytime cloud properties stratified by ISCCP cloud types that emulates the ISCCP-D2 (NASA GISS) format.	1 month	3

Product Name	Description	Temporal Resolution	Level
EBAF-TOA	1° equal-area monthly mean RBI and climatological averages of TOA clear-sky (spatially complete) fluxes, all-sky fluxes, and cloud radiative effect (CRE), where the TOA net flux is constrained to the ocean heat storage.	1 month	4
EBAF-Surface	1° equal-area monthly mean RBI and climatological averages of computed surface clear-sky fluxes, all-sky fluxes, and cloud radiative effect (CRE), consistent with the RBI EBAF-TOA fluxes..	1 month	4

3.3 DATA ACQUISITION

As a joint NASA and NOAA mission, JPSS-2 Storred Mission Data (SMD) will be downlinked from the spacecraft to the NOAA Satellite Operations Facility (NSOF) via the JPSS Common Ground System (CGS). The NSOF will directly distribute all JPSS-2 SMD to the Science Data Segment-Earth Observing System (EOS) Data Operations System (SDS-EDOS) system at Goddard Space Flight Center. The SDS-EDOS will aggregate RBI data by Application Identifier (APID) into 2-hour increments and send these files and spacecraft attitude and ephemeris data files to the ASDC for ingest and archive. Upon ingest at the ASDC, SDS-EDOS files will be renamed. Table 3-2 lists data sent from SDS-EDOS to ASDC and required as input to produce a Level 1 RBI data product. The table lists RBI input data by type (APID) and lists the filenames SDS-EDOS will send for each type and the new filename that will be assigned upon ingest into the ASDC archive system.

The SDS-EDOS will repackage all RBI instrument data in the EOS Level 0 format before sending to ASDC. Level 0 data are defined as reconstructed, unprocessed instrument data at full resolution with all communication artifacts (e.g. synchronization frames, communication headers, duplicate data) removed.

Table 3-1 Input Data Required By RBI Level 1 Software

Data Type	File Name Sent	Ingest File Name
JPSS-2 Ephemeris	P1600aaaAAAAAAAAAAAAAATYYDDDHHMMSSnn1.PDS	J01ATT.JYYYYDDD.Vyyyymmdd.DAT
JPSS-2 Attitude	P1600011AAAAAAAAAAAAAATYYDDDHHMMSSnn1.PDS	J01EPH.JYYYYDDD.Vyyyymmdd.DAT
Level-0 Science Data (APID 1052)	P1601052AAAAAAAAAAAAAATYYDDDHHMMSSnn1.PDS	J01_G1052_LZ_YYYY-MM-DDThh-mm-ssZ_V01.DAT1
	J01:P1601052AAAAAAAAAAAAAATYYDDDHHMMSSnn0.PDS	J01_G1052_LZ_YYYY-MM-DDThh-mm-ssZ_V01.CONS
Level-0 Engineering Telemetry Data (APID 1055)	P1591055AAAAAAAAAAAAAATYYDDDHHMMSSnn1.PDS	J01_G1055_LZ_YYYY-MM-DDThh-mm-ssZ_V01.DAT1
	J01:P1601055AAAAAAAAAAAAAATYYDDDHHMMSSnn0.PDS	J01_G1055_LZ_YYYY-MM-DDThh-mm-ssZ_V01.CONS
Level-0 Memory Dump TLM Data (APID 1056)	P1601056AAAAAAAAAAAAAATYYDDDHHMMSSnn1.PDS	J01_G1056_LZ_YYYY-MM-DDThh-mm-ssZ_V01.DAT1
	J01:P1601056AAAAAAAAAAAAAATYYDDDHHMMSSnn0.PDS	J01_G1056_LZ_YYYY-MM-DDThh-mm-ssZ_V01.CONS
Level-0 CSM/CE Dwell Telemetry Data (APID 1058)	P1601058AAAAAAAAAAAAAATYYDDDHHMMSSnn1.PDS	J01_G1052_LZ_YYYY-MM-DDThh-mm-ssZ_V01.DAT1
	J01:P1601058AAAAAAAAAAAAAATYYDDDHHMMSSnn0.PDS	J01_G1058_LZ_YYYY-MM-DDThh-mm-ssZ_V01.CONS
Level-0 AzCal Dwell Telemetry (APID 1059)	P1601059AAAAAAAAAAAAAATYYDDDHHMMSSnn1.PDS	J01_G1059_LZ_YYYY-MM-DDThh-mm-ssZ_V01.DAT1
	J01:P1601059AAAAAAAAAAAAAATYYDDDHHMMSSnn0.PDS	J01_G1059_LZ_YYYY-MM-DDThh-mm-ssZ_V01.CONS
Level-0 VisCal Dwell Telemetry (APID 1060)	P1601060AAAAAAAAAAAAAATYYDDDHHMMSSnn1.PDS	J01_G1060_LZ_YYYY-MM-DDThh-mm-ssZ_V01.DAT1
	J01:P1601060AAAAAAAAAAAAAATYYDDDHHMMSSnn0.PDS	J01_G1060_LZ_YYYY-MM-DDThh-mm-ssZ_V01.CONS
Level-0 DE Dwell Telemetry (APID 1061)	P1601061AAAAAAAAAAAAAATYYDDDHHMMSSnn1.PDS	J01_G1061_LZ_YYYY-MM-DDThh-mm-ssZ_V01.DAT1
	J01:P1601061AAAAAAAAAAAAAATYYDDDHHMMSSnn0.PDS	J01_G1061_LZ_YYYY-MM-DDThh-mm-ssZ_V01.CONS
Level-0 VisCal Calibration Telemetry (APID 1062)	P1601062AAAAAAAAAAAAAATYYDDDHHMMSSnn1.PDS	J01_G1062_LZ_YYYY-MM-DDThh-mm-ssZ_V01.DAT1
	J01:P1601062AAAAAAAAAAAAAATYYDDDHHMMSSnn0.PDS	J01_G1062_LZ_YYYY-MM-DDThh-mm-ssZ_V01.CONS
Level-0 Diagnostic Detector Telemetry (APID 1063)	P1601063AAAAAAAAAAAAAATYYDDDHHMMSSnn1.PDS	J01_G1063_LZ_YYYY-MM-DDThh-mm-ssZ_V01.DAT1
	J01:P1601063AAAAAAAAAAAAAATYYDDDHHMMSSnn0.PDS	J01_G1063_LZ_YYYY-MM-DDThh-mm-ssZ_V01.CONS
Level-0 Power On Self Test (POST) Telemetry (APID 1064)	P1601064AAAAAAAAAAAAAATYYDDDHHMMSSnn1.PDS	J01_G1064_LZ_YYYY-MM-DDThh-mm-ssZ_V01.DAT1
	J01:P1601064AAAAAAAAAAAAAATYYDDDHHMMSSn	J01_G1064_LZ_YYYY-MM-DDThh-mm-

	n0.PDS	ssZ_V01.CONS
Level-0 ESR Diagnostic Telemetry (APID 1065)	P1601065AAAAAAAAAAAAAATYYDDDHHMMSSnn1.PDS	J01_G1065_LZ_YYYY-MM-DDThh-mm-ssZ_V01.DAT1
	J01:P1601065AAAAAAAAAAAAAATYYDDDHHMMSSnn0.PDS	J01_G1065_LZ_YYYY-MM-DDThh-mm-ssZ_V01.CONS
Level-0 Event Log Telemetry (APID 1066)	P1601066AAAAAAAAAAAAAATYYDDDHHMMSSnn1.PDS	J01_G1066_LZ_YYYY-MM-DDThh-mm-ssZ_V01.DAT1
	J01:P1601066AAAAAAAAAAAAAATYYDDDHHMMSSnn0.PDS	J01_G1066_LZ_YYYY-MM-DDThh-mm-ssZ_V01.CONS
Level-0 Software Statistic telemetry (APID 1068)	P1601068AAAAAAAAAAAAAATYYDDDHHMMSSnn1.PDS	J01_G1068_LZ_YYYY-MM-DDThh-mm-ssZ_V01.DAT1
	J01:P1601068AAAAAAAAAAAAAATYYDDDHHMMSSnn0.PDS	J01_G1068_LZ_YYYY-MM-DDThh-mm-ssZ_V01.CONS
Level-0 Table Download Telemetry (APID 1069)	P1601069AAAAAAAAAAAAAATYYDDDHHMMSSnn1.PDS	J01_G1069_LZ_YYYY-MM-DDThh-mm-ssZ_V01.DAT1
	J01:P1601069AAAAAAAAAAAAAATYYDDDHHMMSSnn0.PDS	J01_G1069_LZ_YYYY-MM-DDThh-mm-ssZ_V01.CONS

YY – Production year
YYYY – Data date year
MM – Data date month
DDD – Production day of year
DD – Data date day
HH – Production hour
hh – Data date start minute
MM – Production minute
mm – Data date start minute
ss – Production second
SS – Data date start second
nn – File identifier

Table 3-3 Ancillary Data Required For RBI Level 2 and 3 Processing

Product	Source
Snow & Ice Extent Maps	NSIDC
1/8th mesh Snow & Ice Maps	NOAA CLASS
1/16th mesh Snow & Ice Maps	AFWA
Solar Irradiance	Laboratory for Atmosphere & Space Physics
GEO Data	U. of Wisc. SSEC, McIDAS
JPSS-2 VIIRS Radiances	SDS Land SIPS
JPSS-2 VIIRS Aerosol Retrievals	SDS Land SIPS
Meteorological Reanalysis	GMAO
MATCH Model Aerosols	Tech-X Corp.

3.4 DATA PROCESSING

All RBI science data processing will occer at the ASDC in a configuration controled production computing environment. RBI science software will leverage a common workflow management interface with CERES data processing.

The RBI Instrument subsystem software will read the Level-0, ephemeris and attitude data and create an output file containing 24 hours of geolocated and filtered radiance values for each footprint paired with a Julian date/time. Each footprint will consist of a TOA (30km) radiance value for each channel as well quality flags and view angle geometry values. The primary science data file for each 24-hour period, referred to as a BDS file, will also contain instrument health and status data that can be used to monitor instrument performance. The RBI Instrument subsystem software will also produce files for calibration and diagnostic data that will be used to determine instrument performance characteristics and calibration coefficients for reprocessing. The RBI Instrument subsystem will also create intermediate data products used by the ERBE-like and Clouds subsystems. These intermediate data products contain subsets of specific parameters from the BDS data product that are needed by the follow-on subsystems.

The ERBE-like subsystem will read an intermediate data product produced by the Instrument subsystem software and will process data in 24-hour increments. The subsystem will apply spectral correction coefficients and use unfiltering methods developed by the ERBE project to produce unfiltered radiances. ERBE unfiltering techniques will be used to maintain a consistent record of radiance data across the RBI, CERES and ERBE data records. The ERBE-like subsystem will produce Level-2 daily ES8 data products and Level-3 ES4 and ES9 monthly data products. The subsystem will produce ES4 and ES9 products by reading one month of ES8 data and applying ERBE-like time and space averaging algorithms to create monthly gridded data sets.

The Clouds subsystem will read input data from several sources to generate Level-2 imager-derived cloud properties. The satellite-based inputs will be high spectral and spatial resolution imager radiances from JPSS-2 VIIRS instrument and geolocation (Level-1B) and RBI geolocated, calibrated radiances. Additional inputs will include those that describe the Earth's surface (snow depth, ice coverage, water content, scene ID, ecosystem, and a terrain map on a 10-minute equal-angle grid), MOA information from the GMAO GEOS model (Surface temperature, surface pressure, atmospheric temperature, humidity, ozone and wind velocity profiles, precipitable water, and column ozone), and imager-based instantaneous aerosol optical depth. From the imager radiances a cloud mask, cloud macrophysical properties (cloud top and base pressure, temperature, and heights), and cloud microphysical properties (particle phase, particle size, optical, and water/ice path, and emissivity) will be produced. To support cloud identification, a daily updated overhead-sun albedo clear-sky albedo map will be produced for several imager channels. The RBI Point Spread Function (PSF) will be used to weight imager radiances, derived cloud and surface properties, and aerosol optical depths. These will be included in the output science product, the SSF. The RBI SSF will be an hourly archival product that contains RBI footprint geometry, RBI radiance and flux information, and the statistics for VIIRS-derived cloud properties at the full (surface type), clear (skin temperature and aerosol), and cloudy (macro- and microphysical properties) footprint areas.

The Inversion subsystem will calculate footprint-based estimates of the radiant flux at the TOA based on input from the preliminary SSF product to be produced by the Clouds subsystem. The inversion process will be dependent on several factors including Earth surface features, the extent of cloudiness, and the relative geometry of the spacecraft, the Sun, and the measurement field-of-view. Each radiometric measurement will be spectrally corrected to give an unfiltered measurement. Estimates of the radiant flux at the TOA will be computed based on scene information, geometrical considerations, and the unfiltered measurements. The Surface Flux Estimation will calculate footprint-based estimates of radiant flux at the Earth's surface based on input from the preliminary SSF, the TOA fluxes and meteorological data to be provided through the MOA product. Multiple algorithms will be used to generate both the LW and SW surface products.

The Instantaneous Surface and Atmospheric Radiation Budget (SARB) subsystem will read TOA and surface data from SSF and MOA products and compute vertical-flux profiles for each SSF footprint of every data hour. The profiles will be obtained from a radiative transfer model using boundary conditions at the surface and TOA.

The Synoptic SARB subsystem will read TOA and surface data from the Time & Space Interpolated data set (TSI) and MOA products and compute vertical flux and entropy data. This subsystem will use algorithms similar to the Instantaneous SARB subsystem except that the output will group the entire data month into 180 latitudinal output files.

The TISA Subsystems will consist of several component subsystems for gridding, averaging and GEO enhanced cloud properties. The TSI TISA Averaging subsystem will read Level-3 gridded instantaneous RBI and geostationary radiance data and use a temporal

interpolation process to produce hourly instantaneous Level-3 combined RBI and geostationary fluxes and cloud properties on a 1-degree equal-area grid. SYN1deg TISA Averaging subsystem will read hourly instantaneous Level-3 combined RBI and geostationary fluxes and cloud properties along with computed vertical flux profiles on a 1-degree equal-area grid. The output data products will be hourly, 3-hourly, daily, and monthly-hourly regional averages and monthly regional, zonal, and global averages of geostationary-enhanced and temporally interpolated cloud properties, combined with RBI TOA fluxes and cloud properties, and computed vertical flux profiles on a 1-degree equal-angle grid. The SSF1deg TISA Averaging subsystem will read Level-3 gridded instantaneous RBI flux and cloud properties, will temporally interpolate them, and will produce monthly and daily mean RBI TOA radiative fluxes and coincident VIIRS-derived cloud and aerosol properties at 1-degree-regional, zonal, and global scales.

The TISA Gridding Subsystem will read single scanner footprint TOA/surface fluxes and clouds data from the Level-2 SSF product. The first function will be the gridding function, in which individual footprints will be assigned to the appropriate grid box on a 1-degree equal-angle grid system. The second function will be the averaging function, in which spatial averages of TOA/surface fluxes and clouds will be computed. The output SSF1deg-Hour product will contain monthly gridded TOA fluxes, surface fluxes and cloud parameters averaged over regions in a 1.0-degree nested grid. The TISA Gridding Subsystem will also produce the ISCCP-D2like monthly product. This product will contain the RBI VIIRS-derived and geostationary-derived cloud property retrievals where the cloud properties will be stratified by optical depth and cloud pressure levels similar to the ISCCP-D2 products. The daytime JPSS-2 VIIRS-derived Level-2 SSF footprint data and VIIRS-normalized geostationary data will be assigned to the appropriate 1-degree equal-angle grid regions and the averages of cloud parameters will be computed over monthly and monthly 3-hourly temporal resolution.

The MOA Subsystem will read temperature, humidity, and ozone data from meteorological reanalysis data provided by GMAO at NASA Goddard. Data will be spatially and temporally interpolated to the grid common with RBI for every sixth data hour. Three dimensional data will be vertically interpolated to 58 pressure levels.

The Grid GEOstationary (GGEO) Subsystem will read data from geostationary satellites collected by the ISCCP. Geostationary satellites orbit the Earth at very high altitudes over the equator, and global coverage can be achieved with five strategically-located satellites. Therefore the GGEO Subsystem will read narrowband infrared, water vapor, visible-channel radiances, and cloud information from five geostationary satellites for any given data day. The visible, infrared, and water vapor data will be in the form of eight- or ten-bit counts and temperatures that can be converted to radiances using calibration formulae. Then the measurements will be assigned to the appropriate 1-degree equal-angle grid region, similar to the TISA Gridding process, and the averages of VIS and IR, WV narrowband radiances and clouds will be computed. The output product will be a monthly gridded product containing visible, IR, and WV radiances and cloud parameters averaged over a 1.0-degree nested grid at 1-hourly temporal resolution.

The EBAF-TOA and EBAF-Surface products will be produced offline by the ERB-ST and will be a continueation of the existing CERES EBAF-TOA and EBAF-Surface products. Both EBAF products are designed for climate model evaluation, estimating the Earth's global mean energy budget and to infer meridonal heat transport. The RBI-derived EBAF-TOA product will contain monthly and climatological averages of TOA clear-sky fluxes and clouds, and cloud radiative effect, where the TOA net flux is constrained to the ocean heat storage. The RBI-derieved EBAF-Surface product will contain monthly and climatological averages of computed surface clear-sky fluxes, all-sky fluxes, and CRE, consistent with the RBI-derieved EBAF-TOA fluxes.

3.5 DATA QUALITY

A Data Quality Summary will be made available for each orderable RBI data product. These Data Quality Summaries will be distributed along with orders of RBI data. RBI Data Quality Summaries will also be posted on the ERB-ST webpage. The Data Quality Summaries for equivalent CERES data products can be found at: http://ceres.larc.nasa.gov/dqs.php.

3.6 DATA ARCHIVAL

The Langley ASDC has been designated as the long-term archive for RBI data products, per NASA Headquarters. The ASDC will perform ingest, archive, and distribution of RBI data products.

Standard science data products and associated metadata will be made publicly available including the provision of Unified Metadata Model – Collection files, use of the ESDIS Common Metadata Repository and population of the Global Change Master Directory. The most up-to-date versions of science data products will remain on low-latency storage while older legacy products are deprecated to archive storage. The ASDC also performs capacity planning based on RBI project inputs.

3.7 DATA VOLUMES

Table 3-1 provides the names, frequency, expected volume and expected end of mission volume for data products planned for the RBI Mission. These are uncompressed data volume estimates. End of mission estimates assume a 7-year mission lifetime per that of the JPSS-2 spacecraft. This table does not account for any reprocessing. It is generally expected that each of the below products will be produced in an initial version and a reprocessed version would be expected roughly 3.5 years after launch adding an additional 42.38TB uncompressed.

Table 3-2 Data Products and Expected Volumes

Data Product Name	Frequency	Archive Volume (Gigabytes/Month)	End of Mission Volume (Terabytes)
Level-0**	2-hourly * 14 Data Types	45	3.75*
BDS	Daily	214.7	18.0*
ES8	Daily	23.9	2.0*
ES4/ES9	Monthly	.31	.03*
SSF	Hourly	696.7	58.5
SSF1deg-Hr	Hourly	3.4	.3
SSF1deg-Day/Month	Monthly	.94	.1
SYN1deg-Month SYN1deg-MHour SYN1deg-Day SYN1deg-3Hour SYN1deg-1Hour	Monthly	69	5.8
CldTypHist	Monthly	1.1	.1
EBAF-TOA	Monthly	.0035	.0003
EBAF-Surface	Monthly	.0042	.0004
Total		**1,085**	**88.55**

*Data volumes to be refined
**Level-0 row accounts for all Level 0 files listed in table 3-2

3.8 ANCILLARY DATA PRODUCTS

Table 3-2 lists expected ancillary data products and their estimated sizes. This table is intended for data volume planning purposes only.

Table 3-3 Ancillary Data Sets and Estimated Sizes

Data Set Description	Estimated File Size (Megabytes)	Number of Files/Day (Megabytes)	Estimated Daily Volume (Gigabytes)
J2 Spacecraft Ephemeris / Attitude Message Packet	0.5	12	.006
VIIRS L1B Radiance & Geolocation Subset	360	240	86.4
VIIRS Aerosol Dark Target	38	130	4.94
VIIRS Aerosol Deep Blue	15	130	1.95
Totals	**413.5**	**512**	**93.30**

4 PROJECT LIFECYCLE

4.1 PRE-LAUNCH RESPONSIBILITIES

The RBI Project is responsible for all instrument activities through the PLAR, including instrument development, spacecraft I&T, on-orbit operations and operational verification of the RBI instrument on-orbit. The RBI project is therefore responsible for management of all pre-flight data and has partnered with the ASDC to provide long-term archive for pre-flight test data contributing to instrument characterization.

4.2 ON-ORBIT OPERATIONS

Following PLAR, responsibility for instrument operations and data processing will transition to the RBM Project. Within the RBM Project structure, the RBM DMT will be responsible for production of data products and will be responsible for maintenance of all science software. Similary within the RBM Project, the ERB-ST will be responsible for the development and maintenance of all science algorithms.

The software to produce Level 1 data products and associated calibration and validation products will be implemented prior to launch and these data will be processed immediatedly following receipt of on-orbit instrument observations for the RBI. Level 2 and Level 3 data products will not process immediately after launch. Consistently calibrated JPSS-2 VIIRS imager data is a key input data set to process the Level 2 SSF data product. Level 2 data processing will begin once the NASA VIIRS Calibration Science Team has provided a JPSS-w VIIRS calibration.

4.3 POST-MISSION STEWARDSHIP

The RBM DMT will ensure all data products, associated scientific algorithm software, coefficients, and ancillary data used to generate these products are documented and transferred to the ASDC before the end of the project. This will ensure post-mission access to the products and provide capability to retain corporate knowledge and regenerate products as needed in the future. These products will be in accordance with the ESDIS Preservation Content Specification (423-SPEC-001). The RBM DMT will provide associated documentation and software as each new product is released to ensure the post-mission availability of data and supporting information, on a timely basis for use by the science community. These products are defined in the RBI Data Products Catalogs. The individual subsystem's Operator's Manual provides tables, for each Product Generation Executive (PGE), showing which data products will be archived at the LaRC ASDC.

5 APPENDICES

5.1 ADDITIONAL REFERENCES

1. Reference "Sampling Strategy, Production Strategy, and Configuration Code Implementation at the Langley TRMM and Terra Information System (LATIS)" internal paper for detail description of the CERES environment parameters. http://ceres.larc.nasa.gov/Internal/intern_docs.php

2. Reference to RBI Data Quality Summaries: http://ceres.larc.nasa.gov/dqs.php
3. Reference to RBI Data Products Catalogs: http://ceres.larc.nasa.gov/dpc_current.php
4. Reference to RBI Collection Guides: http://ceres.larc.nasa.gov/collect_guide.php
5. Referenced to NASA Earth Science Data Preservation Spec, 423-SPEC-002: https://earthdata.nasa.gov/files/423-SPEC-001_NASA%20ESD_Preservation_Spec_OriginalCh01_0.pdf

5.2 ACRONYMS & ABBREVIATIONS

Acronym	Definition
AFWA	Air Force Weather Agency
ASDC	Atmospheric Science Data Center
BDS	Science Bi-Directional Scan HDF data product
CERES	Clouds and the Earth's Radiant Energy System
CLASS	Comprehensive Large Array-data Stewardship System
CRE	Cloud Radiative Effect
DAAC	Distributed Active Archive Center
DMP	Data Management Plan
DMT	Data Management Team
EBAF	Energy Balanced And Filled, CERES net balanced Top-of-Atmosphere fluxes
EDOS	EOS Data and Operations System
ERBE	Earth Radiation Budget Experiment
ERB-ST	Earth Radiation Budget – Science Team
ES4	ERBE-like S-4 data product
ES4G	ERBE-like Regional, Zonal, and Global Averages
ES8	ERBE-like daily data product
ES9	ERBE-like S-9 data product
ESDIS	Earth Science Data and Information System
GEO	Geostationary Earth Orbiting (satellite)
GEOS	Goddard Earth Observing System
GGEO	Grid GEOstationary data subsystem
GISS	Goddard Institute for Space Studies
GMAO	Global Modeling and Assimilation Office
GMT	Greenwich Mean Time
HDF	Hierarchical Data Format
IOT	Instrument Operations Team
IR	Infrared

Acronym	Definition
ISCCP	International Satellite Cloud Climatology Project
JPSS	Joint Polar Satelite System
LaRC	Langley Research Center
LW	Longwave
MATCH	Model of Atmosphere Aerosol Transport and CHemestry
McIDAS	Man computer Interactive Data Access System
MMC	Mission Management Center
MOA	Meteorological, Ozone, and Aerosol
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
NSIDC	National Snow and Ice Data Center
NSOF	NOAA Satellite Operations Facility
PGE	Product Generation Executives
PLAR	Post Launch Assessment Review
PSF	Point Spread Function
RBI	Radiation Budget Instrument
RBM	Radiation Budget Measurements
SARB	Surface and Atmospheric Radiation Budget
SDMP	Science Data Management Plan
SDS	Science Data Segment
SIPS	Science Investigator-led Processing System
SMD	Stored Mission Data
SSEC	Space Science and Engineering Center
SSF	Single Satellite CERES Footprint TOA and Surface Fluxes, Clouds
SW	Shortwave
SYN	Synoptic Radiative Fluxes and Clouds
TBD	To Be Determined
TISA	Time Interpolation and Space Averaging
TOA	Top-of-Atmosphere
TOT	Total
TSI	Time & Space Interpolated data set
VIIRS	Visible Infrared Imaging Radiometer
VIS	Visible
WN	Window
WV	Water Vapor