

## 2.1 Bidirectional Scans (BDS)

### EOSDIS Product Code: CER01

The BiDirectional Scans (BDS) product contains 24 hours of instantaneous Level-1b CERES data for a single scanner instrument. The BDS contains instantaneous radiance measurements recorded every 0.01-second for views of space, internal calibration, solar calibration and Earth. It contains all elevation scan modes which include the normal Earth scan and the short Earth scan modes and both the fixed and rotating azimuth plane scan modes.

The BDS product includes:

- Filtered broadband radiances for the total, shortwave, and window channels for each 0.01 second measurement
- Geolocation and viewing geometry for every Earth-viewing measurement
- Instrument status, engineering temperatures and voltages for each 6.6 second scan
- Sun geometry, satellite position and velocity for each scan
- All raw engineering and status data from the instrument

A more detailed listing of the data parameters for this product can be found in the [BDS Collection Guide: http://asd-www.larc.nasa.gov/ceres/collect\\_guide/list.html](http://asd-www.larc.nasa.gov/ceres/collect_guide/list.html) (Reference 3).

**Level:** 1B

**Frequency:** 1/Day

**Configuration Code:** 009001 and greater

**Portion of Globe Covered**

**File:** Satellite Swath

**Record:** N/A

**Time Interval Covered**

**File:** 24 Hours

**Record:** Single 6.6-Second Scans

**Portion of Atmosphere Covered**

**File:** Satellite Altitude

### Bidirection Scans (BDS) Definition

Table 2.1-1 summarizes the contents and estimated product size of each data structure type contained within an BDS file. Each BDS product contains three metadata structures, 35 SDS structures, and eight VData structures.

Table 2.1-1. BDS HDF Structure Summary

Name	Description Table	Records	Number of Fields	Nominal Size (Bytes)
CERES Baseline Header Metadata	<a href="#">Table B-1</a>	1	36	~25907
CERES_metadata Vdata	<a href="#">Table B-2</a>	1	14	~1024

Table 2.1-1. BDS HDF Structure Summary

Name	Description Table	Records	Number of Fields	Nominal Size (Bytes)
BDS Product-specific Metadata	<a href="#">Table 2.1-2</a>	1	11	~66
BDS SDS Summary	<a href="#">Table 2.1-3</a>	1 .. 13091	35	852,124,870
BDS Vdata Summary	<a href="#">Table 2.1-4</a>	1 .. 13091	178	31,811,250
<b>Total Size (Bytes):</b>				<b>883,963,117</b>
<b>Total Size (MBytes, including ~0.2% HDF overhead; 1MByte = 1024<sup>2</sup>Bytes):</b>				<b>844.7</b>

### BDS Metadata

The BDS product includes three data structures. These include the CERES Baseline Header Metadata and the CERES\_metadata Vdata parameters, which are listed in [Appendix B](#). The BDS-specific metadata parameters are listed in [Table 2.1-2](#).

Table 2.1-2. BDS Product-Specific Metadata

Item	Parameter Name	Units	Range	Data Type
1	ScanMode	N/A	XtrkOnly, RapsOnly, FapsOnly, Raps/Faps, Xtrk/Raps, Xtrk/Faps, Xtrk/Raps/Faps	s(14)
2	Second Time Constant Mode	N/A	Off, On	s(3)
3	Ephemeris Data Used	N/A	Real, Pred, Sim	s(4)
4	Attitude Data Used	N/A	Real, Sim	s(4)
5	Percent Total Channel Bad	N/A	0.0 .. 100.0	F11.6
6	Percent Window Channel Bad	N/A	0.0 .. 100.0	F11.6
7	Percent Short Wave Channel Bad	N/A	0.0 .. 100.0	F11.6
8	Percent FAPS	N/A	0.0 .. 100.0	F11.6
9	Percent RAPS	N/A	0.0 .. 100.0	F11.6
10	Percent Transitional	N/A	0.0 .. 100.0	F11.6
11	Percent Crosstrack	N/A	0.0 .. 100.0	F11.6
12	TOA_Model_Used	N/A	CERES-TOA or WGS 84	s(9)
13	Number Input Files	N/A	1 .. n	uint32

### BDS Scientific Data Sets

Every Scientific Data Set (SDS) in the BDS file represents a time ordered collection of data where each row in the SDS corresponds to a packet of data, and each column corresponds to a single sample within a packet. Most of the SDSs have 660 samples per packet of a single parameter arranged as shown in [Figure 2.1-1](#).

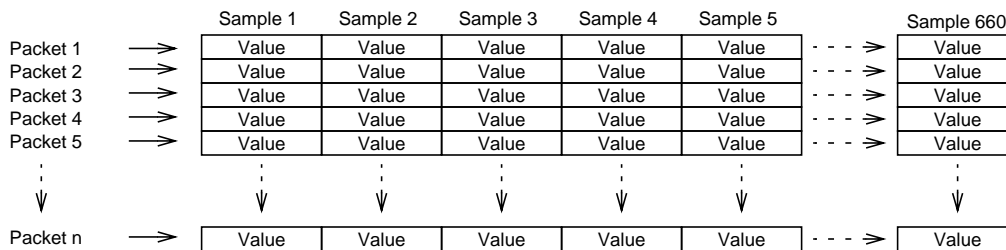


Figure 2.1-1. BDS SDS Schematic

Table 2.1-3 summarizes the contents of each SDS structure contained within the BDS file (listed in alphabetical order by their SDS structure name). All SDS parameters have an HDF Rank = 2 and the maximum number of SDS elements corresponds to the number of rows by the number of columns. Data types are referenced by their HDF classification (e.g. char8, float32, float64, int8, uint8, int16, uint16, int32, uint32, int64, uint64).

Table 2.1-3. BDS SDS Summary (1 of 2)

SDS Name	Maximum SDS Elements	Data Type	Range	Units	Maximum Size (Bytes)
Ancillary QA Flags Set 1	13091x660	uint32	Reference 3	N/A	34,560,240
Ancillary QA Flags Set 2	13091x660	uint32	Reference 3	N/A	34,560,240
Azimuth Position Count	13091x660	uint16	0 .. 4095	count	17,280,120
CERES Relative Azimuth at Surface	13091x660	float32	0.0 .. 360.0	deg	34,560,240
CERES Relative Azimuth at TOA - Geocentric	13091x660	float32	0.0 .. 360.0	deg	34,560,240
CERES Solar Zenith at Surface	13091x660	float32	0.0 .. 180.0	deg	34,560,240
CERES Solar Zenith at TOA - Geocentric	13091x660	float32	0.0 .. 180.0	deg	34,560,240
CERES SW Filtered Radiance Upwards	13091x660	float32	-10.0 .. 510.0	W m <sup>-2</sup> sr <sup>-1</sup>	34,560,240
CERES TOT Filtered Radiance Upwards	13091x660	float32	0.0 .. 700.0	W m <sup>-2</sup> sr <sup>-1</sup>	34,560,240
CERES Viewing Zenith at Surface	13091x660	float32	0.0 .. 90.0	deg	34,560,240
CERES Viewing Zenith at TOA - Geocentric	13091x660	float32	0.0 .. 90.0	deg	34,560,240
CERES WN Filtered Radiance Upwards	13091x660	float32	0.0 .. 50.0	W m <sup>-2</sup> sr <sup>-1</sup>	34,560,240
Clock Angle Rates	13091x660	float32	-10.0 .. 10.0	deg sec <sup>-1</sup>	34,560,240
Clock Angles	13091x660	float32	0.0 .. 360.0	deg	34,560,240
Colatitude of CERES FOV at Surface	13091x660	float32	0.0 .. 180.0	deg	34,560,240
Colatitude of CERES FOV at TOA	13091x660	float32	0.0 .. 180.0	deg	34,560,240
Cone Angle Rates	13091x660	float32	-100.0 .. 100.0	deg sec <sup>-1</sup>	34,560,240
Cone Angles	13091x660	float32	0.0 .. 90.0	deg	34,560,240
Converted Azimuth Angles	13091x660	float32	0.0 .. 360.0	deg	34,560,240
Converted Elevation Angles	13091x660	float32	0.0 .. 260.0	deg	34,560,240

Table 2.1-3. BDS SDS Summary (2 of 2)

SDS Name	Maximum SDS Elements	Data Type	Range	Units	Maximum Size (Bytes)
Count Conversion SW Sample Offsets	4x660	float32	N/A	count	10,560
Count Conversion TOT Sample Offsets	4x660	float32	N/A	count	10,560
Count Conversion WN Sample Offsets	4x660	float32	N/A	count	10,560
Elevation Position Count	13091x660	uint16	0 .. 4095	count	17,280,120
Julian Date and Time	13091x2	float64	2449353.0 .. 2458500.0	day	209,456
Longitude of CERES FOV at Surface	13091x660	float32	0.0 .. 360.0	deg	34,560,240
Longitude of CERES FOV at TOA	13091x660	float32	0.0 .. 360.0	deg	34,560,240
Radiance and Mode Flags	13091x660	uint32	Table 3.2-1	N/A	34,560,240
Raw Instrument Status Data	13091x185	uint16	Reference 3	N/A	4,843,670
Shortwave Detector Output	13091x660	uint16	0 .. 4095	count	17,280,120
SW Spaceclamp Values	13091x2	float32	N/A	count	104,728
TOT Spaceclamp Values	13091x2	float32	N/A	count	104,728
Total Detector Output	13091x660	uint16	0 .. 4095	count	17,280,120
Window Detector Output	13091x660	uint16	0 .. 4095	count	17,280,120
WN Spaceclamp Values	13091x2	float32	N/A	count	104,728
SDS Total Size (Bytes)					852,124,870
SDS Total Size (MBytes, plus a small HDF overhead percentage)					812.87

### BDS Vdata

The BDS contains eight Vdatas which are collections of records containing one or more fields. Each of the eight Vdatas contains  $n$  (1..10391) records of packet level data, and there is a one-to-one correspondence of the Vdatas record numbers to the BDS SDSs row numbers. [Table 2.1-4](#) summarizes each of the BDS Vdatas. [Reference 3](#) provides detailed descriptions of the parameters.

Table 2.1-4. BDS Vdata Summary

Vdata Name	Number of Fields	Maximum Records	Number Bytes per Record	Maximum Size (Bytes)
Converted Instrument Status Data	25	13091	88	1,152,008
Converted Temperatures	35	13091	708	9,268,428
Converted Voltages and Torques	23	13091	348	4,555,668
Count Conversion Constants	9	1	120	120
Position Counts	12	13091	528	6,912,048
Satellite-Celestial Data	11	13091	128	1,675,648
Temperature Counts	39	13091	450	5,890,950
Voltage and Torque Counts	24	13091	180	2,356,380
Vdata Total Size (Bytes)				31,811,250
Vdata Total Size (MBytes, plus a small HDF overhead percentage)				30.36