

## 2.2 ERBE-like Instantaneous TOA Estimates (ES-8)

The ERBE-like Instantaneous TOA Estimates (ES-8) product contains 24 hours of instantaneous Clouds and the Earth's Radiant Energy System (CERES) data for a single scanner instrument. The ES-8 contains filtered radiances recorded every 0.01-second for the total (TOT), shortwave (SW), and window (WN) channels and the unfiltered SW, longwave (LW), and WN radiances. The SW and LW radiances at spacecraft altitude are converted to Top-of-the-Atmosphere (TOA) fluxes with a scene identification algorithm and Angular Distribution Models (ADMs) which are "like" those used for the Earth Radiation Budget Experiment (ERBE). The TOA fluxes, scene identification, and angular geometry are included on the ES-8. Complete listings of metadata and science parameters are listed in [Tables 2.2-1](#) through [2.2-4](#).

A detailed listing of the data parameters for this product can be found in the ES-8 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:** 2

**Frequency:** 1/Day

**Portion of Atmosphere Covered:** Satellite Altitude and TOA

**Time Interval Covered:**

**File:** 24 Hours

**Record:** 6.6-Seconds

**Portion of Globe Covered:**

**File:** Satellite Swath

**Record:** N/A

**Product Version:**

**TRMM:** Transient-Ops2, Edition2 ++ see NOTE

**Terra:** Edition1 ++ see NOTE, Edition2

**Aqua:** Edition1, Edition2

**NOTE:** The Spectral Response Functions Vdata is only available on ES-8 products with a configuration code greater than 021018.

## ES-8 Metadata

Table 2.2-1 gives an overview of the ES-8 product. The metadata structures contain information which need only be recorded once per daily product. The CERES Baseline Header Metadata and the CERES\_metadata Vdata are listed in Appendix B. As explained in Appendix B, the CERES Baseline Header Metadata includes either the bounding rectangle or GRing attributes. The spatial boundaries of the ES-8 are defined with the bounding rectangle. The ES-8 also contains Product Specific Metadata, which are shown in Table 2.2-2.

Table 2.2-1. ES-8 Product Summary

HDF Name	Description	Number of Parameters	Nominal Size (MB)
CERES Baseline Header Metadata	See <a href="#">Table B-1</a>	36	
CERES_metadata Vdata	See <a href="#">Table B-1</a>	14	
ES-8 Product Specific Metadata	See <a href="#">Table 2.2-2</a>	1	
ES-8 Vdata Summary	See <a href="#">Table 2.2-3</a>	21	1.117
ES-8 SDS Summary	See <a href="#">Table 2.2-4</a>	20	467.108
ES-8 Data Size (MB/Day)			468.225
ES-8 Meta Data Size (MB/Day)			0.880
<b>ES-8 Total Product Size (MB/Day)</b>			<b>469.105</b>
<b>ES-8 Total Product Size with HDF Data Compression</b>			<b>293.5<sup>a</sup></b>

a. GZIP Compression, Level 1

Table 2.2-2. ES-8 Product Specific Metadata

Item	Parameter Name	Records	Units	Range	Data Type
1	ES8_ProductionDate	1	N/A	N/A	ASCII string
2	NumOfCrosstrackRecords	1	N/A	0 .. 13092	Integer
3	NumOfRAPSRecords	1	N/A	0 .. 13092	Integer
4	NumOfAlongtrackRecords	1	N/A	0 .. 13092	Integer
5	NumOfTransitionalRecords	1	N/A	0 .. 13092	Integer
6	Software_SCCR_Number	1	N/A	N/A	ASCII string
7	Data_SCCR_Number	1	N/A	N/A	ASCII string

## ES-8 Vdata Structures

The ES-8 contains 20 record-level parameters and one product-level parameter written by HDF-EOS as HDF Vdata structures. The record-level structures may be thought of as one-dimensional arrays dimensioned according to the number of 6.6-second records contained in the data-day; the maximum number of these records is 13,092 (since the time length of a record may vary, the maximum number of records on the ES-8 can be 13,092). The product-level parameter, Spectral Response Functions, structure contains six arrays, two arrays each for the shortwave, total, and window channels.

The parameters detailed in [Table 2.2-3](#) are:

- a) Time of Observation (Julian date and time)
- b) Earth-Sun distance
- c) Satellite position and velocity
- d) Satellite nadir position
- e) Sun position
- f) Spectral Response Functions

Table 2.2-3. ES-8 Vdata Summary

Parameter Name (Vdata Name)	Units	Range	Maximum Number of Vdata Elements	Data Type	Maximum Vdata Size (KB)
Time of Observation	day	2440000 .. 2480000	13092	64 bit real	102.27
Earth-Sun distance at record start	AU	0.98 .. 1.02	13092	64 bit real	102.27
X component of satellite position at record start	m	-8x10 <sup>6</sup> .. 8x10 <sup>6</sup>	13092	32 bit real	51.14
X component of satellite position at record end	m	-8x10 <sup>6</sup> .. 8x10 <sup>6</sup>	13092	32 bit real	51.14
Y component of satellite position at record start	m	-8x10 <sup>6</sup> .. 8x10 <sup>6</sup>	13092	32 bit real	51.14
Y component of satellite position at record end	m	-8x10 <sup>6</sup> .. 8x10 <sup>6</sup>	13092	32 bit real	51.14
Z component of satellite position at record start	m	-8x10 <sup>6</sup> .. 8x10 <sup>6</sup>	13092	32 bit real	51.14
Z component of satellite position at record end	m	-8x10 <sup>6</sup> .. 8x10 <sup>6</sup>	13092	32 bit real	51.14
X component of satellite velocity at record start	m sec <sup>-1</sup>	-1x10 <sup>4</sup> .. 1x10 <sup>4</sup>	13092	32 bit real	51.14
X component of satellite velocity at record end	m sec <sup>-1</sup>	-1x10 <sup>4</sup> .. 1x10 <sup>4</sup>	13092	32 bit real	51.14
Y component of satellite velocity at record start	m sec <sup>-1</sup>	-1x10 <sup>4</sup> .. 1x10 <sup>4</sup>	13092	32 bit real	51.14
Y component of satellite velocity at record end	m sec <sup>-1</sup>	-1x10 <sup>4</sup> .. 1x10 <sup>4</sup>	13092	32 bit real	51.14
Z component of satellite velocity at record start	m sec <sup>-1</sup>	-1x10 <sup>4</sup> .. 1x10 <sup>4</sup>	13092	32 bit real	51.14
Z component of satellite velocity at record end	m sec <sup>-1</sup>	-1x10 <sup>4</sup> .. 1x10 <sup>4</sup>	13092	32 bit real	51.14
Colatitude of satellite nadir at record start	deg	0 .. 180	13092	32 bit real	51.14
Colatitude of satellite nadir at record end	deg	0 .. 180	13092	32 bit real	51.14
Longitude of satellite nadir at record start	deg	0 .. 360	13092	32 bit real	51.14
Longitude of satellite nadir at record end	deg	0 .. 360	13092	32 bit real	51.14
Colatitude of Sun at observation	deg	0 .. 180	13092	32 bit real	51.14
Longitude of Sun at observation	deg	0 .. 360	13092	32 bit real	51.14
Spectral Response Functions: <sup>a</sup>					
SW channel wavelengths	μm	0 .. 200	632	32 bit real	0.002
SW spectral response values	N/A	-1 .. 1	632	32 bit real	0.002
TOT channel wavelengths	μm	0 .. 200	1051	32 bit real	0.004
TOT spectral response values	N/A	-1 .. 1	1051	32 bit real	0.004
WN channel wavelengths	μm	0 .. 200	871	32 bit real	0.003
WN spectral response values	N/A	-1 .. 1	871	32 bit real	0.003

Table 2.2-3. ES-8 Vdata Summary

Parameter Name (Vdata Name)	Units	Range	Maximum Number of Vdata Elements	Data Type	Maximum Vdata Size (KB)
Total Vdata Size (KB)					1125.08
<b>Total Vdata Size (MB)</b>					<b>1.117</b>

- a. NOTE: The Spectral Response Functions Vdata is only available on ES-8 products with a configuration code greater than 021018.

### ES-8 Scientific Data Sets

The ES-8 contains 20 SDSs which are 2-dimensional arrays of time ordered records where the first dimension corresponds to the number of 6.6-second data records contained in the data-day; the maximum is 13,092 (since the time length of a record may vary, the maximum number of records on the ES-8 can be 13,092). For the measurement-level data, other than flag words, the second dimension corresponds to the number of measurements or footprints contained on a 6.6-second data record (660). There are 22 measurement-level, 32-bit flag words that contain a flag value in each of the right-most 30 bits (22 words x 30 bits/word = 660 bits). For these measurement-level flag words, the second dimension is 22. [Table 2.2-4](#) summarizes the content and size of each SDS contained within the ES-8 file.

The SDSs detailed in [Table 2.2-4](#) are:

- a) Instrument Field-of-View (colatitude and longitude)
- b) Radiometric data (total, shortwave, and window channels)
- c) Satellite and Sun geometry (viewing zenith, solar zenith, and relative azimuth)
- d) Unfiltered radiances (shortwave, longwave, and window)
- e) TOA fluxes (shortwave and longwave)
- f) ERBE scene identification
  - ( 1) clear ocean      ( 5) clear coastal      ( 9) mostly cloudy ocean
  - ( 2) clear land      ( 6) partly cloudy ocean      (10) mostly cloudy land-desert
  - ( 3) clear snow      ( 7) partly cloudy land-desert      (11) mostly cloudy coastal
  - ( 4) clear desert      ( 8) partly cloudy coastal      (12) overcast
- g) Flag words

Table 2.2-4. ES-8 SDS Summary

Parameter Name (SDS Name)	Units	Range	Maximum Number of SDS Elements	Data Type	Maximum SDS Size (KB)
Colatitude of CERES FOV at TOA	deg	0 .. 180	13092x660	32 bit real	33752.81
Longitude of CERES FOV at TOA	deg	0 .. 360	13092x660	32 bit real	33752.81
CERES TOT filtered radiance	W m <sup>-2</sup> sr <sup>-1</sup>	-2 .. 700	13092x660	32 bit real	33752.81
CERES SW filtered radiance	W m <sup>-2</sup> sr <sup>-1</sup>	-4 .. 510	13092x660	32 bit real	33752.81

Table 2.2-4. ES-8 SDS Summary

Parameter Name (SDS Name)	Units	Range	Maximum Number of SDS Elements	Data Type	Maximum SDS Size (KB)
CERES WN filtered radiance	$W m^{-2} sr^{-1} \mu m^{-1}$	-1 .. 15	13092x660	32 bit real	33752.81
CERES viewing zenith at TOA	deg	0 .. 90	13092x660	32 bit real	33752.81
CERES solar zenith at TOA	deg	0 .. 180	13092x660	32 bit real	33752.81
CERES relative azimuth at TOA	deg	0 .. 360	13092x660	32 bit real	33752.81
CERES SW unfiltered radiance	$W m^{-2} sr^{-1}$	-10 .. 510	13092x660	32 bit real	33752.81
CERES LW unfiltered radiance	$W m^{-2} sr^{-1}$	0 .. 200	13092x660	32 bit real	33752.81
CERES WN unfiltered radiance	$W m^{-2} sr^{-1} \mu m^{-1}$	0 .. 15	13092x660	32 bit real	33752.81
CERES SW flux at TOA	$W m^{-2}$	0 .. 1400	13092x660	32 bit real	33752.81
CERES LW flux at TOA	$W m^{-2}$	50 .. 450	13092x660	32 bit real	33752.81
ERBE scene identification at observation	N/A	0 .. 12.4	13092x660	32 bit real	33752.81
TOT channel flag words	N/A	N/A	13092x22	32 bit integer	1125.09
SW channel flag words	N/A	N/A	13092x22	32 bit integer	1125.09
WN channel flag words	N/A	N/A	13092x22	32 bit integer	1125.09
Scanner FOV flag words	N/A	N/A	13092x22	32 bit integer	1125.09
Rapid retrace flag words	N/A	N/A	13092x22	32 bit integer	1125.09
Scanner operations flag word	N/A	N/A	13092x3	32 bit integer	153.42
Total SDS Size (KB)					478318.21
<b>Total SDS Size (MB)</b>					<b>467.108</b>

**Maximum Data Bits\*:** 3927600000  
**Maximum Data Size (MB)\*:** 468.2

\* Note: Maximum sizes are based on 13,092 total 6.6-sec data records.

## ES-8 Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

ES-8 Revision Record

SCCR Approval Date	Release/Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	<ul style="list-style-type: none"> <li>• Updated document to reflect new formats and to comply with standards.</li> </ul>	All
04/26/02	R3V2	341	<ul style="list-style-type: none"> <li>• Updated LW Flux range from [ 0 .. 500] to [ 50 .. 450].</li> <li>• Added the ES-8 Spectral Response Functions Vdata Summary table.</li> <li>• Moved Vdata parameter list from front page to ES-8 Vdata Structures section.</li> <li>• Moved SDS data listing from front page to ES-8 Scientific Data Sets section.</li> <li>• Updated format to comply with standards.</li> </ul>	Table 2.2-4  Table 2.2-3  Vdata  SDS  All
02/23/04	R4V1	503	<ul style="list-style-type: none"> <li>• Updated product versions for Aqua Edition1 to include Edition2.</li> <li>• Supplied footnote for availability of Spectral Response Functions Vdata.</li> <li>• Updated format to comply with standards.</li> <li>• The EOSDIS Product Code line was removed from the document. (6/17/2008)</li> </ul>	Section 2.2  Table 2.2-3  All  Sec. 2.2