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

EOSDIS Product Code: CER02

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, 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 Table 2.2-4.

Specifically, the ES-8 contains the following kinds of information:

1. Scan-level Data (Vdata Structures)

    a) Time of Observation (Julian date and time)
    b) Earth-Sun distance
    c) Satellite position and velocity and Sun position

2. Measurement-level Data (Scientific Data Sets (SDSs))

    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

A more detailed listing of the data parameters for this product can be found in the the ES-8 Collection Guide: http://asd-www.larc.nasa.gov/ceres/collect_guide/list.html (Reference 3).

Level: 2
Frequency: 1/Day
Configuration Code: 007000 or greater

Portion of Globe Covered
File: Satellite Swath
Record: N/A

Time Interval Covered
File: 24 Hours
Record: 6.6-Seconds

Portion of Atmosphere Covered
File: Satellite Altitude and TOA

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 (MBytes)
CERES Baseline Header Metadata	See Table B-1	35	
CERES_metadata Vdata	See Table B-2	14	
ES-8 Product Specific Metadata	See Table 2.2-2	1	
ES-8 Vdata Summary	See Table 2.2-3	20	1.1
ES-8 SDS Summary	See Table 2.2-4	20	467.1
ES-8 Data Size (MB/Day)			468.2
ES-8 MetadataSize (MB/Day)			11.8
ES-8 Total Product Size (MB/Day)			**480.0**

Table 2.2-2. ES-8 Product Specific Metadata

Item	Parameter Name	Records	Units	Range	Data Type
1	NumOfCrosstrackRecords	1	N/A	0 .. 13091	Integer
2	NumOfRAPSRecords	1	N/A	0 .. 13091	Integer
3	NumOfAlongtrackRecords	1	N/A	0 .. 13091	Integer
4	NumOfTransitionalRecords	1	N/A	0 .. 13091	Integer

ES-8 Vdata Structures

The ES-8 contains 22 record-level parameters written by HDF-EOS as HDF Vdata structures. These structures may be thought of as one-dimensional arrays with a maximum dimension that corresponds to the maximum number of 6.6-second data records contained in one day or 13,091. Each of these arrays contains one of the parameters listed in Table 2.2-3.

Table 2.2-3. ES-8 Vdata Summary

Parameter Name (Vdata Name)	Units	Range	Maximum Number of Vdata Elements	Bits per Element	Maximum Vdata Size (KB)
Time of Observation	day	2440000.. .2480000	13091	64	102.27
Earth-Sun distance at record start	AU	0.98 .. 1.02	13091	64	102.27
X component of satellite position at record start	m	-8x106 .. 8x106	13091	32	51.14
X component of satellite position at record end	m	-8x106 .. 8x106	13091	32	51.14
Y component of satellite position at record start	m	-8x106 .. 8x106	13091	32	51.14
Y component of satellite position at record end	m	-8x106 .. 8x106	13091	32	51.14
Z component of satellite position at record start	m	-8x106 .. 8x106	13091	32	51.14
Z component of satellite position at record end	m	-8x106 .. 8x106	13091	32	51.14
X component of satellite velocity at record start	$m\ sec^{-1}$	-1x104 .. 1x104	13091	32	51.14
X component of satellite velocity at record end	$m\ sec^{-1}$	-1x104 .. 1x104	13091	32	51.14
Y component of satellite velocity at record start	$m\ sec^{-1}$	-1x104 .. 1x104	13091	32	51.14
Y component of satellite velocity at record end	$m\ sec^{-1}$	-1x104 .. 1x104	13091	32	51.14
Z component of satellite velocity at record start	$m\ sec^{-1}$	-1x104 .. 1x104	13091	32	51.14
Z component of satellite velocity at record end	$m\ sec^{-1}$	-1x104 .. 1x104	13091	32	51.14
Colatitude of satellite nadir at record start	deg	0 .. 180	13091	32	51.14
Colatitude of satellite nadir at record end	deg	0 .. 180	13091	32	51.14
Longitude of satellite nadir at record start	deg	0 .. 360	13091	32	51.14
Longitude of satellite nadir at record end	deg	0 .. 360	13091	32	51.14
Colatitude of Sun at observation	deg	0 .. 180	13091	32	51.14
Longitude of Sun at observation	deg	0 .. 360	13091	32	51.14
Total Vdata Size (KB)					1125.06
Total Vdata Size (MB)					1.10

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 maximum number of 6.6-second data contained in one day or 13,091. For measurement level data, other than flag words, the second dimension corresponds to the maximum number of measurements or footprints contained on a 6.6-second data record or 660. There are 22 measurement-level, 32 bit flag words that contain a flag value in each of the right-most 30 bits (22words x 30bits/word = 660 bits). For these measurement-level flag words, the second dimension is 22. For the scanner operations flag word, the second dimension is 3.

Table 2.2-4 summarizes the contents and sizes of each SDS contained within the ES-8 file.

Table 2.2-4. ES-8 SDS Summary

Parameter Name (SDS Name)	Units	Range	Maximum Number of SDS Elements	Bits per Element	Maximum SDS Size (KB)
Colatitude of CERES FOV at TOA	deg	0 .. 180	13091 x 660	32	33750.23
Longitude of CERES FOV at TOA	deg	0 .. 360	13091 x 660	32	33750.23
CERES TOT filtered radiance	$W\ m^{-2}\ sr^{-1}$	0 .. 700	13091 x 660	32	33750.23
CERES SW filtered radiance	$W\ m^{-2}\ sr^{-1}$	-10 .. 510	13091 x 660	32	33750.23
CERES WN filtered radiance	$W\ m^{-2}\ sr^{-1}mm^{-1}$	0 .. 15	13091 x 660	32	33750.23
CERES viewing zenith at TOA	deg	0 .. 90	13091 x 660	32	33750.23
CERES solar zenith at TOA	deg	0 .. 180	13091 x 660	32	33750.23
CERES relative azimuth at TOA	deg	0 .. 360	13091 x 660	32	33750.23
CERES SW unfiltered radiance	$W\ m^{-2}\ sr^{-1}$	-10 .. 510	13091 x 660	32	33750.23
CERES LW unfiltered radiance	$W\ m^{-2}\ sr^{-1}$	0 .. 200	13091 x 660	32	33750.23
CERES WN unfiltered radiance	$W\ m^{-2}\ sr^{-1}mm^{-1}$	0 .. 15	13091 x 660	32	33750.23
CERES SW flux at TOA	$W\ m^{-2}$	0 .. 1400	13091 x 660	32	33750.23
CERES LW flux at TOA	$W\ m^{-2}$	0 .. 500	13091 x 660	32	33750.23
ERBE scene identification at observation	N/A	0 .. 12.4	13091 x 660	32	33750.23
TOT channel flag words	N/A	N/A	13091 x 22	32	1125.01
SW channel flag words	N/A	N/A	13091 x 22	32	1125.01
WN channel flag words	N/A	N/A	13091 x 22	32	1125.01
Scanner FOV flag words	N/A	N/A	13091 x 22	32	1125.01
Rapid retrace flag words	N/A	N/A	13091 x 22	32	1125.01
Scanner operations flag word	N/A	N/A	13091 x 3	32	153.41
Total SDS Size (KB)					478281.7
Total SDS Size (MB)					**467.07**

Maximum Data Bits*: **3927300000**
Maximum Data Size (MB)*: **468.2**

* Note: Maximum sizes are based on 13,091 total 6.6-sec data records.