

1.0 A-Train Integrated CALIPSO, CloudSat, CERES, and MODIS Merged Product (CCCM or C3M)

The A-train Integrated Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO), CloudSat, Clouds and the Earth's Radiant Energy System (CERES), and Moderate Resolution Imaging Spectroradiometer (MODIS) Merged (CCCM) product contains retrieved cloud and aerosol properties from CALIPSO, CloudSat, and MODIS over the ground track of CALIPSO and CloudSat. These retrieved values from the MODIS instantaneous radiances or from CALIPSO lidar and CloudSat radar signals are collocated with near-nadir footprints from the CERES instrument. For each of these near-nadir footprints, the CCCM product also contains CERES-derived top-of-atmosphere (TOA) irradiances and vertical profiles of shortwave (SW), longwave (LW), and window-channel (WN) modeled irradiances. The horizontal length of the CERES near-nadir footprint is approximately 20 km. The CCCM product is available in daily files.

The CCCM product combines variables from standard CERES data products (the Single Scanner Footprint (SSF) Edition3-Beta2 product and the Clouds and Radiative Swath (CRS) Edition2 product) and introduces new variables unique to this product (CCCM). Because of the integration of multiple instruments, variables derived from multiple algorithms/instruments are included in the product. The algorithm/instruments are roughly divided into three categories:

1. Cloud and aerosol properties derived from MODIS only by the algorithm that is similar to the CERES cloud algorithms (Edition 3-Beta2, Minnis et al. 2010). The data structure of this portion of the product follows exactly the same format of the CERES SSF. Therefore, cloud properties for up to 2 non-overlapping clouds for the entire CERES footprint are included (except for the multilayer cloud variables from SSF-114a through SSF-114k). The irradiances are computed for 5 atmospheric levels including TOA and the surface, such as done in the CERES CRS product.
2. Cloud and aerosol properties derived from the enhanced CERES cloud algorithm. The enhanced algorithm uses cloud mask and height derived from CALIPSO and CloudSat to improve the accuracy of the cloud property retrieval.
3. The vertical profile of cloud and aerosol properties derived from CALIPSO and CloudSat. The retrieval is limited to the area over the ground track of CALIPSO and CloudSat. Therefore, profiles cover only a small part of a CERES footprint. The vertical resolution of the retrieved cloud and aerosol properties closely follows the original CALIPSO and CloudSat data.

The CCCM HDF file begins with the SSF variables followed by the CRS variables. The CCCM variables derived from CALIPSO and CloudSat are included after the SSF and CRS variables.

Detailed product information and variable descriptions are given in [Variable Descriptions of the A-Train Integrated CALIPSO, CloudSat, CERES, and MODIS Merged Product \(CCCM or C3M\)](#).

Level: 2

Frequency: 1/Day

Portion of Atmosphere Covered: Surface to 65 km

Time Interval Covered:

File: 1 Day

Record: 1/100-Second

Portion of Globe Covered:

File: Near-Nadir Satellite Swath

Record: 1 CERES Footprint (Near-nadir only)

Product Version:

Aqua: Version B1

CCCM Metadata

Table 1-1 lists variables in the header. Items CCCM-H1 through CCCM-H31 are the same as those in the CERES SSF file header.

The layer center height (found in CCCM-H36, CCCM-H38, and CCCM-H40) is the midlevel of each layer.

The layer boundaries are given by the level height (CCCM-H37, CCCM-H39, CCCM-H41).

Table 1-1. CCCM_Header

Item	Description	Units	Range	Elements	Bytes/ Elem
CCCM-H1	CCCM_id	N/A	3119	1	4
CCCM-H2	Character name of CERES instrument	N/A	ASCII string	1	4
CCCM-H3	Day and time at hour start	N/A	ASCII string	1	28
CCCM-H4	Character name of satellite	N/A	ASCII string	1	4
CCCM-H5	Character name of high resolution imager instrument	N/A	ASCII string	1	8
CCCM-H6	Number of imager channels	N/A	1 .. 20	1	4
CCCM-H7	Central wavelengths of imager channels	μm	0.4 .. 15.0	20	4
CCCM-H8	Earth-sun distance at hour start	AU	0.98 .. 1.02	1	4
CCCM-H9	Beta angle	deg	-90 .. 90	1	4
CCCM-H10	Co-latitude of subsatellite point at surface at hour start	deg	0 .. 180	1	4
CCCM-H11	Longitude of subsatellite point at surface at hour start	deg	0 .. 360	1	4
CCCM-H12	Co-latitude of subsatellite point at surface at hour end	deg	0 .. 180	1	4
CCCM-H13	Longitude of subsatellite point at surface at hour end	deg	0 .. 360	1	4
CCCM-H14	Along-track angle of satellite at hour end	deg	0 .. 330	1	4
CCCM-H15	Number of footprints in SSF product	N/A	0 .. 360000	1	4
CCCM-H16	Subsystem 4.1 identification string	N/A	ASCII string	1	128
CCCM-H17	Subsystem 4.2 identification string	N/A	ASCII string	1	128
CCCM-H18	Subsystem 4.3 identification string	N/A	ASCII string	1	128
CCCM-H19	Subsystem 4.4 identification string	N/A	ASCII string	1	128
CCCM-H20	Subsystem 4.5 identification string	N/A	ASCII string	1	128
CCCM-H21	Subsystem 4.6 identification string	N/A	ASCII string	1	128
CCCM-H22	IES production date and time	N/A	ASCII string	1	24
CCCM-H23	MOA production date and time	N/A	ASCII string	1	24
CCCM-H24	SSF production date and time	N/A	ASCII string	1	24

Table 1-1. CCCM_Header

Item	Description	Units	Range	Elements	Bytes/ Elem
CCCM-H25	Spare real	N/A	real	1	4
CCCM-H26	Satellite position x vector at hour start	km	-360000 .. 360000	1	8
CCCM-H27	Satellite position y vector at hour start	km	-360000 .. 360000	1	8
CCCM-H28	Satellite position z vector at hour start	km	-360000 .. 360000	1	8
CCCM-H29	Satellite momentum x vector at hour start	km	-360000 .. 360000	1	8
CCCM-H30	Satellite momentum y vector at hour start	km	-360000 .. 360000	1	8
CCCM-H31	Satellite momentum z vector at hour start	km	-360000 .. 360000	1	8
CCCM-H32	InstSARB_ver	N/A	1 .. 32000	1	2
CCCM-H33	CRS production date and time	N/A	ASCII string	1	19
CCCM-H34	Spare character	N/A	ASCII string	1	3
CCCM-H35	CCCM production date and time	N/A	ASCII string	1	24
CCCM-H36	Layer center height profile (clouds and aerosol)	km	-0.5 .. 22.0	113	4
CCCM-H37	Level heights profile (clouds and aerosol)	km	-0.5 .. 22.0	114	4
CCCM-H38	Irradiance layer center height profile	m ^a	-500 .. 65000	137	4
CCCM-H39	Irradiance level height profile	m ^a	-500 .. 65000	138	4
CCCM-H40	CALIPSO cloud layer center height profile	km	-0.5 .. 22.0	345	4
CCCM-H41	CALIPSO cloud level height profile	km	-0.5 .. 22.0	346	4
CCCM-H42	Shortwave spectral wave number bounds	cm ⁻¹	1 .. 32000	15	2
CCCM-H43	Longwave spectral wave number bounds	cm ⁻¹	1 .. 32000	13	2
CCCM-H44	CALIPSO filename and version used 1	N/A	ASCII string	1	128
CCCM-H45	CALIPSO filename and version used 2	N/A	ASCII string	1	128
CCCM-H46	CALIPSO filename and version used 3	N/A	ASCII string	1	128
CCCM-H47	CloudSat filename and version used 1	N/A	ASCII string	1	128
CCCM-H48	CloudSat filename and version used 2	N/A	ASCII string	1	128
CCCM-H49	CloudSat filename and version used 3	N/A	ASCII string	1	128

a. HDF file incorrectly states that the units of this variable are km.

CCCM Data Product

The CCCM product contains Scientific Data Sets (SDS) which combine SDSs from the SSF and CRS products as well as SDSs unique to the CCCM product. Data is provided for the CERES footprints that fall along the CALIPSO and CloudSat ground track only.

[Table 1-2](#) lists the Vgroups within the CCCM HDF file in the same order as they are in the file. SSF SDSs are followed by the CRS SDSs and then the CCCM SDSs. [Table 1-2](#) also provides links to the tables where each group's variables are listed.

Table 1-2. List of the Vgroups

Vgroup Number	SDS Type	Vgroup Name	Table of SDS Names
0	SSF	Time and Position	See Table 1-3
1	SSF	Viewing Angles	See Table 1-4
2	SSF	Surface Map	See Table 1-14
3	SSF	Scene Type	See Table 1-15
4	SSF	Filtered Radiances	See Table 1-16
5	SSF	Unfiltered Radiances	See Table 1-17
6	SSF	TOA and Surface Fluxes	See Table 1-5 and Table 1-18
7	SSF	Full Footprint Area	See Table 1-19
8	SSF	Clear Footprint Area	See Table 1-20
9	SSF	Cloudy Footprint Area	See Table 1-21
10	SSF	Multilayer Cloud Footprint Area	See Table 1-22
11	SSF	Footprint Imager Radiance Statistics	See Table 1-23
12	SSF	Additional Footprint Imager Radiance Statistics	See Table 1-24
13	SSF	MODIS Land Aerosols	See Table 1-25
14	SSF	MODIS Ocean Aerosols	See Table 1-26
15	CRS	Surface Radiative Properties	See Table 1-27
16	CRS	Vertical Profile Description	See Table 1-28
17	CRS	Pristine Vertical Flux Profiles	See Table 1-29
18	CRS	Constrained Clear Sky Profiles	See Table 1-30
19	CRS	Constrained Total Sky Profiles	See Table 1-31
20	CRS	Pristine Constraintment Initial Flux Deltas	See Table 1-32
21	CRS	Clear Sky Constraintment Initial Flux Deltas	See Table 1-33
22	CRS	Total Sky Constraintment Initial Flux Deltas	See Table 1-34
23	CRS	Satellite Emulated Window Channel	See Table 1-35
24	CRS	Unfiltered Total Longwave	See Table 1-36
25	CRS	Constraintment Adjustments	See Table 1-37
26	CRS	Aerosol Constituency Information	See Table 1-38
27	CRS	Constraintment Status	See Table 1-39

Table 1-2. List of the Vgroups

Vgroup Number	SDS Type	Vgroup Name	Table of SDS Names
28	CRS	No Aerosol Fluxes and Deltas	See Table 1-40
29	CCCM	CALIPSO and MODIS Surface Map Along Ground Track	See Table 1-6
30	CCCM	Cloud and Aerosol Mask (CALIPSO and CloudSat)	See Table 1-7
31	CCCM	MODIS Properties over CALIPSO and CloudSat Groups	See Table 1-8
32	CCCM	CALIPSO Aerosol Layer Mean	See Table 1-9
33	CCCM	Cloud Layer Mean	See Table 1-10
34	CCCM	Vertical Model Input Profile	See Table 1-11
35	CCCM	Vertical Irradiance Profile	See Table 1-12
36	CCCM	Vertical Height Profile	See Table 1-13

SSF Scientific Data Sets

[Table 1-3](#) through [Table 1-5](#) immediately below and [Table 1-14](#) through [Table 1-26](#) later in this document contain variables produced by algorithms similar to those used for the CERES SSF product. The variables are numbered the same as their regular SSF counterparts (SSF-1, SSF-2, etc.).

Dimensions

The first dimension in most of the SSF SDSs is n, the number of near-nadir CERES footprints per day, where $n = 24 \text{ hr} \times 3600 \text{ sec/hr} / 3.3 \text{ sec/scan} \sim 26182$.

Table 1-3. Time and Position

Item (SDS Index)	SDS Name (Variable name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-1 (0)	Time of observation	day	2440000 .. 2480000	n	8-byte real	0.2
SSF-2 (1)	Radius of satellite from center of Earth at observation	km	6000 .. 8000	n	8-byte real	0.2
SSF-3 (2)	X component of satellite inertial velocity	km sec ⁻¹	-10 .. 10	n	8-byte real	0.2
SSF-4 (3)	Y component of satellite inertial velocity	km sec ⁻¹	-10 .. 10	n	8-byte real	0.2
SSF-5 (4)	Z component of satellite inertial velocity	km sec ⁻¹	-10 .. 10	n	8-byte real	0.2
SSF-6 (5)	Colatitude of subsatellite point at surface at observation	deg	0 .. 180	n	4-byte real	0.1
SSF-7 (6)	Longitude of subsatellite point at surface at observation	deg	0 .. 360	n	4-byte real	0.1

Table 1-3. Time and Position

Item (SDS Index)	SDS Name (Variable name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-8 (7)	Colatitude of subsolar point at surface at observation	deg	0 .. 180	n	4-byte real	0.1
SSF-9 (8)	Longitude of subsolar point at surface at observation	deg	0 .. 360	n	4-byte real	0.1
SSF-10 (9)	Colatitude of CERES FOV at surface	deg	0 .. 180	n	4-byte real	0.1
SSF-11 (10)	Longitude of CERES FOV at surface	deg	0 .. 360	n	4-byte real	0.1
SSF-12 (11)	Scan sample number	N/A	1 .. 660	n	2-byte int	0.05
SSF-13 (12)	Packet number	N/A	0 .. 13100	n	2-byte int	0.05
SSF-14 (13)	Cone angle of CERES FOV at satellite	deg	0 .. 90	n	4-byte real	0.1
SSF-15 (14)	Clock angle of CERES FOV at satellite wrt inertial velocity	deg	0 .. 360	n	4-byte real	0.1
SSF-16 (15)	Rate of change of cone angle	deg sec ⁻¹	-300 .. 300	n	4-byte real	0.1
SSF-17 (16)	Rate of change of clock angle	deg sec ⁻¹	-20 .. 20	n	4-byte real	0.1
SSF-18 (17)	Along-track angle of CERES FOV at surface	deg	-30 .. 330	n	4-byte real	0.1
SSF-19 (18)	Cross-track angle of CERES FOV at surface	deg	-90 .. 90	n	4-byte real	0.1

Table 1-4. Viewing Angles

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-20 (19)	CERES viewing zenith at surface	deg	0 .. 90	n	4-byte real	0.1
SSF-21 (20)	CERES solar zenith at surface	deg	0 .. 180	n	4-byte real	0.1
SSF-22 (21)	CERES relative azimuth at surface	deg	0 .. 360	n	4-byte real	0.1
SSF-23 (22)	CERES viewing azimuth at surface wrt North	deg	0 .. 360	n	4-byte real	0.1

Variables in [Table 1-5](#) list the CERES-derived TOA irradiances. The corresponding CERES surface fluxes are listed in [Table 1-18](#).

Table 1-5. CERES-derived TOA Irradiances
(Vgroup: TOA and Surface Fluxes)

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-38 (37)	CERES SW TOA flux - upwards	W m ⁻²	0 .. 1400	n	4-byte real	0.2
SSF-38a (38)	CERES SW TOA flux - downwards	W m ⁻²	0 .. 1400	n	4-byte real	0.2
SSF-39 (39)	CERES LW TOA flux - upwards	W m ⁻²	0 .. 1400	n	4-byte real	0.2
SSF-40 (40)	CERES WN TOA flux - upwards	W m ⁻²	0 .. 1400	n	4-byte real	0.2

CCCM Scientific Data Sets

Table 1-6 through Table 1-13 contain the CCCM variables (those unique to the CCCM product).

Dimensions

The first dimension in most of the CCCM SDSs is:

$$n \text{ (number of near-nadir footprints per day)} = 24 \text{ hr} \times 3600 \text{ sec/hr} / 3.3 \text{ sec/scan} \sim 26182$$

Table 1-6. CALIPSO and MODIS Surface Map Along Ground Track

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CCCM-1 (291)	Mean altitude of surface above sea level	m	-1000... 10000	n	4-byte real	0.1
CCCM-2 (292)	Stdev of altitude of surface above sea level	m	-1000... 10000	n	4-byte real	0.1
CCCM-3 (293)	Surface spectral albedo	N/A	0...100	n x 7	4-byte real	0.7
CCCM-4 (294)	Mean CloudSat surface reflectivity	N/A		n	4-byte real	0.1
CCCM-5 (295)	Stdev CloudSat surface reflectivity	N/A		n	4-byte real	0.1

Variables in Table 1-7 are extracted from the CALIPSO Level 2 vertical feature mask data product and the CloudSat 2B-CLDCLASS product and are either rearranged or averaged over a CERES footprint.

CCCM-18, -19: If an aerosol layer overlaps with clouds, the thickest aerosol layer overlapping each cloud group is kept.

CCCM-23, -24: Up to sixteen ($m = 16$) aerosol layers over clear sky (i.e. the cloudless portion in a CERES footprint according to CALIPSO and CloudSat) are kept.

Note: Thick smoke (aerosols) sometimes completely attenuates the CALIPSO signal. The mean attenuation level for this complete attenuation case by smoke (CCCM-25) is kept separately from the complete attenuation level by clouds (CCCM-20). When attenuation by aerosol occurs, it is assumed that this CALIPSO profile is clear (cloud-free) unless CloudSat detects clouds below the complete attenuation level. Profiles with complete attenuation by smoke and no CloudSat clouds below the attenuation level are therefore included in clear (cloud-free) area percent coverage (CCCM-21).

Additional dimensions in [Table 1-7](#) are:

m (maximum number of cloud layer groups) = 16 or

m (maximum number of aerosol layers over clear sky) = 16

p (maximum number of overlapping cloud layers in a cloud group) = 6

Table 1-7. Cloud and Aerosol Mask (CALIPSO and CloudSat)

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CCCM-6 (296)	Total number of CloudSat profiles	N/A	0.. 70	n	2-byte int	0.05
CCCM-7 (297)	Total number of CloudSat clear profiles	N/A	0 .. 70	n	2-byte int	0.05
CCCM-8 (298)	Total number of good CloudSat profiles	N/A	0 .. 70	n	2-byte int	0.05
CCCM-9 (299)	Total number of CALIPSO profiles	N/A	0 .. 210	n	2-byte int	0.05
CCCM-10 (300)	Total number of CALIPSO clear profiles	N/A	0 .. 210	n	2-byte int	0.05
CCCM-11 (301)	Total number of good CALIPSO profiles	N/A	0 .. 210	n	2-byte int	0.05
CCCM-12 (302)	Cloud group area percent coverage	%	0 ...100	n x m	4-byte real	1.6
CCCM-13 (303)	Cloud layer top level height	km	-0.5 .. 30	n x m x p	4-byte real	9.6
CCCM-14 (304)	Cloud top source flag	N/A	11 .. 24	n x m x p	1-byte int	2.4
CCCM-15 (305)	Cloud layer base level height	km	-0.5 .. 30	n x m x p	4-byte real	9.6
CCCM-16 (306)	Cloud base source flag	N/A	11 .. 24	n x m x p	1-byte int	2.4
CCCM-17 (307)	Precipitation flag CloudSat	N/A	0 ...10	n x m	1-byte int	0.4
CCCM-18 (308)	CALIPSO aerosol layer (overlap with cloud) top level height	km	-0.5 .. 20.2	n x m	4-byte real	1.6

Table 1-7. Cloud and Aerosol Mask (CALIPSO and CloudSat)

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CCCM-19 (309)	CALIPSO aerosol layer (overlap with cloud) base level height	km	-0.5 .. 20.2	n x m	4-byte real	1.6
CCCM-20 (310)	Mean CALIPSO signal attenuation top level height (cloudy)	km	-0.5 .. 20.2	n x m	4-byte real	1.6
CCCM-21 (311)	Cloud-free area percent coverage (CALIPSO-CloudSat)	%	0 ...100	n	4-byte real	0.1
CCCM-22 (312)	CALIPSO aerosol area percent coverage without clouds	%	0 ...100	n	4-byte real	0.1
CCCM-23 (313)	CALIPSO aerosol layer (over clear area) top level height	km	-0.5 .. 20.2	n x m	4-byte real	1.6
CCCM-24 (314)	CALIPSO aerosol layer (over clear area) base layer height	km	-0.5 .. 20.2	n x m	4-byte real	1.6
CCCM-25 (315)	Mean CALIPSO signal attenuation level height (aerosol area)	km	-0.5 .. 20.2	n	4-byte real	0.1
CCCM-26 (316)	CALIPSO signal attenuation area percent coverage	%	0 ..100	n	4-byte real	0.1

Variables in [Table 1-8](#) are cloud properties derived from MODIS radiances by the CERES cloud algorithms (Ed3 Beta2), either standard or enhanced, over the CALIPSO/CloudSat cloud groups.

Second dimension of 2 indicates MODIS-derived cloud property set:

- 1 = track (standard cloud algorithm)
- 2 = enhanced track (enhanced cloud algorithm)

Third dimension is m (maximum number of cloud layer groups) = 16.

Table 1-8. MODIS Properties over CALIPSO and CloudSat Groups

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CCCM-27 (317)	Clear area percent coverage MODIS	%	0 ...100	n x 2	4-byte real	0.2
CCCM-28 (318)	Cloud percent coverage over group from MODIS	%	0 ...100	n x 2 x m	4-byte real	3.2
CCCM-29 (319)	Mean group visible optical depth from MODIS radiance	N/A	0 .. 400	n x 2 x m	4-byte real	3.2
CCCM-30 (320)	Mean group logarithm of visible optical depth from MODIS rad	N/A	-6 .. 6	n x 2 x m	4-byte real	3.2
CCCM-31 (321)	Mean group cloud top height from MODIS radiance	km	0 .. 20	n x 2 x m	4-byte real	3.2
CCCM-32 (322)	Mean group water particle radius from MODIS rad (3.7)	μm	0 .. 40	n x 2 x m	4-byte real	3.2

Table 1-8. MODIS Properties over CALIPSO and CloudSat Groups

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CCCM-33 (323)	Mean group ice particle effective diameter from MODIS rad (3.7)	μm	0 .. 300	n x 2 x m	4-byte real	3.2
CCCM-34 (324)	Mean group cloud particle phase from MODIS radiance (3.7)	N/A	1 .. 2	n x 2 x m	4-byte real	3.2
CCCM-35 (325)	Mean group water particle radius from MODIS radiance (2.1)	μm	0 .. 40	n x 2 x m	4-byte real	3.2
CCCM-36 (326)	Mean group ice particle effective diameter from MODIS rad (2.1)	μm	0 .. 300	n x 2 x m	4-byte real	3.2

Variables in [Table 1-9](#) are from the CALIPSO Lidar Level 2 5 km aerosol layer product.

Second dimension of 16 indicates the maximum number of aerosol layers.

Table 1-9. CALIPSO Aerosol Layer Mean

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CCCM-37 (327)	CALIPSO aerosol layer percent coverage	N/A	0 ... 100	n x 16	2-byte int	0.8
CCCM-38 (328)	CALIPSO aerosol layer top level height	km	-0.5 ... 30.1	n x 16	4-byte real	1.6
CCCM-39 (329)	CALIPSO aerosol layer base level height	km	-0.5 ... 30.1	n x 16	4-byte real	1.6
CCCM-40 (330)	CALIPSO aerosol layer opacity flag	N/A	0 ... 1	n x 16	1-byte int	0.4
CCCM-41 (331)	CALIPSO layer aerosol horizontal averaging distance	km	5 ... 80	n x 16	1-byte int	0.4
CCCM-42 (332)	CALIPSO aerosol feature classification flags	N/A	0 ... 127 (98298)	n x 16	1-byte int	0.4
CCCM-43 (333)	Mean CALIPSO aerosol feature optical depth at 532 nm	N/A	0 ... 5.0	n x 16	4-byte real	1.6
CCCM-44 (334)	Mean CALIPSO aerosol feature optical depth uncertain at 532 nm	N/A	0 ... TBD	n x 16	4-byte real	1.6
CCCM-45 (335)	Mean CALIPSO aerosol feature optical depth at 1064 nm	N/A	0 ... 5.0	n x 16	4-byte real	1.6
CCCM-46 (336)	Mean CALIPSO aerosol feature optical depth uncertain at 1064 nm	N/A	0 ... TBD	n x 16	4-byte real	1.6
CCCM-47 (337)	Mean CALIPSO relative humidity in aerosol layer	%	0 ... 100	n x 16	4-byte real	1.6
CCCM-48 (338)	Mean CALIPSO aerosol layer CAD score	N/A	-100 ... 100	n x 16	2-byte int	0.8

Table 1-9. CALIPSO Aerosol Layer Mean

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CCCM-49 (339)	Mean CALIPSO aerosol optical thickness at 532 nm	N/A	-0.1 ... 5.0	n	4-byte real	0.1
CCCM-50 (340)	Stdev of CALIPSO aerosol optical thickness at 532 nm	N/A	0 ... 5.0	n	4-byte real	0.1
CCCM-50a (341)	Mean CALIPSO aerosol optical thickness uncertainty at 532 nm	N/A	-0.1 ... 5.0	n	4-byte real	0.1
CCCM-50b (342)	Stdev of CALIPSO aerosol optical thickness uncertain at 532 nm	N/A	0 ... 5.0	n	4-byte real	0.1
CCCM-50c (343)	Mean CALIPSO aerosol optical thickness at 1064 nm	N/A	-0.1 ... 5.0	n	4-byte real	0.1
CCCM-50d (344)	Stdev of CALIPSO aerosol optical thickness at 1064 nm	N/A	0 ... 5.0	n	4-byte real	0.1
CCCM-50e (345)	Mean CALIPSO aerosol optical thickness uncertainty at 1064 nm	N/A	-0.1 ... 5.0	n	4-byte real	0.1
CCCM-50f (346)	Stdev of CALIPSO aerosol optical thickness uncertain at 1064 nm	N/A	0 ... 5.0	n	4-byte real	0.1

Variables in [Table 1-10](#) are from the CALIPSO Lidar Level 2 5 km cloud layer product, the CALIPSO lidar Level 2 5 km cloud profile data product, and the CloudSat 2B-CLDCLASS and 2B-CWC-RO products.

Second dimension indicates the vertical layer.

CALIPSO data are stored with 345 vertical layers. The height information is given by CCCM-125 and 126.

CloudSat variables are stored with 113 vertical layers. The height information is given by CCCM-121 and 122.

The second dimension of CCCM-73 is from 2B-CLDCLASS and indicates cloud type:

1: High clouds, 2: As, 3: Ac, 4: St, 5: Sc, 6: Cu, 7: Ns, 8: Deep convective clouds.

Table 1-10. Cloud Layer Mean

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CCCM-51 (347)	CALIPSO layer cloud type profile	N/A	0...7	n x 113	2-byte int	5.7
CCCM-52 (348)	Cloud fraction profile	N/A	0...100	n x 113	4-byte real	11.3
CCCM-53 (349)	Mean CALIPSO cloud layer CAD score	N/A	-100 ... 102	n x 345	2-byte int	17.3
CCCM-54 (350)	Mean CALIPSO cloud layer extinction coefficient at 532 nm	km ⁻¹	0...100	n x 345	4-byte real	34.5

Table 1-10. Cloud Layer Mean

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CCCM-55 (351)	Mean CALIPSO constrained cloud layer extinction coeff at 532 nm	km ⁻¹	0...100	n x 345	4-byte real	34.5
CCCM-56 (352)	Mean logarithm of CALIPSO extinction coefficient at 532 nm	N/A	-6.0 ... 6.0	n x 345	4-byte real	34.5
CCCM-57 (353)	CALIPSO extinction coefficient uncertainty at 532 nm	km ⁻¹	TBD	n x 345	4-byte real	34.5
CCCM-58 (354)	Mean CALIPSO ice water content	g m ⁻³	TBD	n x 345	4-byte real	34.5
CCCM-59 (355)	Stdev of CALIPSO ice water content	g m ⁻³	TBD	n x 345	4-byte real	34.5
CCCM-60 (356)	CALIPSO ice water content uncertainty	g m ^{-3 a}	TBD	n x 345	4-byte real	34.5
CCCM-60a (357)	Mean CALIPSO cloud optical depth at 532 nm	N/A	0 ... 5.0	n	4-byte real	0.1
CCCM-60b (358)	Stdev of CALIPSO cloud optical depth at 532 nm	N/A	0 ... 5.0	n	4-byte real	0.1
CCCM-60c (359)	Mean CALIPSO cloud optical depth uncertainty at 532 nm	N/A	0 ... 5.0	n	4-byte real	0.1
CCCM-60d (360)	Stdev of CALIPSO cloud optical depth uncertainty at 532 nm	N/A	0 ... 5.0	n	4-byte real	0.1
CCCM-61 (361)	Mean CloudSat radar only liquid effective radius	μm	0 ... 1000	n x 113	4-byte real	11.3
CCCM-62 (362)	Stdev of CloudSat radar only liquid effective radius	μm	0 ... 1000	n x 113	4-byte real	11.3
CCCM-63 (363)	CloudSat radar only liquid effective radius uncertainty	N/A	0 ... 250	n x 113	4-byte real	11.3
CCCM-64 (364)	Mean CloudSat radar only ice effective radius	μm	0 ... 3000	n x 113	4-byte real	11.3
CCCM-65 (365)	Stdev of CloudSat radar only ice effective radius	μm	0 ... 3000	n x 113	4-byte real	11.3
CCCM-66 (366)	CloudSat radar only ice effective radius uncertainty	N/A	0 ... 250	n x 113	4-byte real	11.3
CCCM-67 (367)	Mean CloudSat radar only liquid water content	g m ⁻³	0 ... 15.0	n x 113	4-byte real	11.3
CCCM-68 (368)	Stdev of CloudSat radar only liquid water content	g m ⁻³	0 ... 15.0	n x 113	4-byte real	11.3
CCCM-69 (369)	CloudSat radar only liquid water content uncertainty	N/A	0 ... 250	n x 113	4-byte real	11.3
CCCM-70 (370)	Mean CloudSat radar only ice water content	g m ⁻³	0 ... 10.0	n x 113	4-byte real	11.3
CCCM-71 (371)	Stdev of CloudSat radar only ice water content	g m ⁻³	0 ... 10.0	n x 113	4-byte real	11.3

Table 1-10. Cloud Layer Mean

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CCCM-72 (372)	CloudSat radar only ice water content uncertainty	N/A	0 ... 250	n x 113	4-byte real	11.3
CCCM-73 (373)	CloudSat cloud type histogram	100 × %	0 ... 10000	n x 8	2-byte int	0.4

a. HDF file incorrectly states that the units of this variable are microns.

The variables in [Table 1-11](#) provide the atmospheric input profiles for the irradiance computations.

Table 1-11. Vertical Model Input Profile

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CCCM-74 (374)	Modeled aerosol type	N/A	0 ... 100	n x 7	2-byte int	0.35
CCCM-75 (375)	Aerosol source flag	N/A	0 ... 10	n	2-byte int	0.05
CCCM-75a (376)	Surface albedo source	N/A	0 ... 10	n	2-byte int	0.05
CCCM-76 (377)	Pressure profile	hPa	0 ... 1100	n x 138	4-byte real	13.8
CCCM-77 (378)	Temperature profile	K	100 ... 400	n x 138	4-byte real	13.8
CCCM-78 (379)	Water vapor mixing ratio profile	g/g	0.00001 ... 0.03	n x 138	4-byte real	13.8
CCCM-79 (380)	Ozone mixing ratio profile	g/g	0.0 ... 0.00005	n x 138	4-byte real	6.6
CCCM-80 (381)	Surface geopotential height	m	-400 ... 10000	n	2-byte int	0.05
CCCM-81 (382)	Lifting condensation level	hPa	0...1100	n	2-byte int	0.05
CCCM-81a (383)	Cloud area untuned	N/A	0 ... 100.0	n	4-byte real	0.1
CCCM-81b (384)	Cloud area enhanced	N/A	0 ... 100.0	n	4-byte real	0.1
CCCM-81c (385)	Cloud optical depth weight untuned	N/A	0 ... 128.0	n	4-byte real	0.1
CCCM-81d (386)	Cloud optical depth weight enhanced	N/A	0 ... 128.0	n	4-byte real	0.1
CCCM-82 (387)	Aerosol extinction coefficient profile used	km ⁻¹	0 ... 10.0	n x 137	4-byte real	13.7

Table 1-11. Vertical Model Input Profile

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CCCM-83 (388)	Aerosol single scattering albedo profile used	N/A	0 ... 1.0	n x 137	4-byte real	13.7
CCCM-84 (389)	Cloud extinction coefficient profile used	km ⁻¹	0...128	n x 137	4-byte real	13.7
CCCM-85 (390)	Liquid water content profile used	g m ⁻³	0 ... 15.0	n x 137	4-byte real	13.7
CCCM-86 (391)	Ice water content profile used	g m ⁻³	0 ... 10.0	n x 137	4-byte real	13.7

The variables in [Table 1-12](#) provide the irradiance computations.

All fluxes are given at the edge of each layer (138 levels, 1 = TOA, 138 = sea level -480 m, CCCM-124). In addition to top-of-atmosphere (65 km) and surface, the upward and downward irradiances are computed at the edge of layers (levels) by the CERES radiative transfer code FLCKKR (Flux model for CERES with K-distribution and correlated-K for Radiation). Depths of the layers are: 120 m below the altitude of 3 km, 240 m from 3 km to 21 km, 480 m from 21 km to 33 km, 3000 m from 33 km to 45 km, and 5000m from 45 km to 65 km. The vertical resolution of the irradiance profile is given by CCCM-122 and 123.

Second dimension of 4 in the irradiance profiles or in the TOA or surface irradiances indicates sky conditions for which the fluxes are computed:

- 1 = cloud+aerosol (all-sky)
- 2 = cloud only (all-sky with no aerosols)
- 3 = clear-sky (with aerosol)
- 4 = clear-sky (without aerosol, pristine).

The third dimensional index is the vertical level or layer.

Second dimension of 12 or 14 in the spectral irradiances indicates wavelength. Wavelength information of TOA and surface spectral irradiances is given by CCCM-127 (shortwave) and CCCM-128 (longwave).

Table 1-12. Vertical Irradiance Profile

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CCCM-87 (392)	SW downward flux profile enhanced MODIS (CALIPSO CloudSat)	W m ⁻²	0 ... 1500	n x 4 x 138	4-byte real	55.2
CCCM-88 (393)	SW upward flux profile enhanced MODIS (CALIPSO CloudSat)	W m ⁻²	0 ... 1500	n x 4 x 138	4-byte real	55.2
CCCM-89 (394)	LW downward flux profile enhanced MODIS (CALIPSO CloudSat)	W m ⁻²	0 ... 1500	n x 4 x 138	4-byte real	55.2

Table 1-12. Vertical Irradiance Profile

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CCCM-90 (395)	LW upward flux profile enhanced MODIS (CALIPSO CloudSat)	$W m^{-2}$	0 ... 1500	n x 4 x 138	4-byte real	55.2
CCCM-91 (396)	WN downward flux profile enhanced MODIS CALIPSO CloudSat)	$W m^{-2}$	0 ... 1500	n x 4 x 138	4-byte real	55.2
CCCM-92 (397)	WN upward flux profile enhanced MODIS (CALIPSO CloudSat)	$W m^{-2}$	0 ... 1500	n x 4 x 138	4-byte real	55.2
CCCM-93 (398)	SW downward flux TOA standard MODIS (CALIPSO CloudSat)	$W m^{-2}$	0 ... 1500	n x 4	4-byte real	0.4
CCCM-94 (399)	SW upward flux TOA standard MODIS (CALIPSO CloudSat)	$W m^{-2}$	0 ... 1500	n x 4	4-byte real	0.4
CCCM-95 (400)	SW downward flux surface standard MODIS (CALIPSO CloudSat)	$W m^{-2}$	0 ... 1500	n x 4	4-byte real	0.4
CCCM-96 (401)	SW upward flux surface standard MODIS (CALIPSO CloudSat)	$W m^{-2}$	0 ... 1500	n x 4	4-byte real	0.4
CCCM-97 (402)	LW downward flux surface standard MODIS (CALIPSO CloudSat)	$W m^{-2}$	0 ... 1500	n x 4	4-byte real	0.4
CCCM-98 (403)	LW upward flux TOA standard MODIS (CALIPSO CloudSat)	$W m^{-2}$	0 ... 1500	n x 4	4-byte real	0.4
CCCM-99 (404)	LW upward flux surface standard MODIS (CALIPSO CloudSat)	$W m^{-2}$	0 ... 1500	n x 4	4-byte real	0.4
CCCM-100 (405)	WN downward flux surface standard MODIS (CALIPSO CloudSat)	$W m^{-2}$	0 ... 1500	n x 4	4-byte real	0.4
CCCM-101 (406)	WN upward flux TOA standard MODIS (CALIPSO CloudSat)	$W m^{-2}$	0 ... 1500	n x 4	4-byte real	0.4
CCCM-102 (407)	WN upward flux surface standard MODIS (CALIPSO CloudSat)	$W m^{-2}$	0 ... 1500	n x 4	4-byte real	0.4
CCCM-103 (408)	SW all-sky up TOA spectral flux enh MODIS (CALIPSO CloudSat)	$W m^{-2}$	0 ... 1500	n x 14	4-byte real	1.4
CCCM-104 (409)	SW all-sky down TOA spectral flux enh MODIS (CALIPSO CloudSat)	$W m^{-2}$	0 ... 1500	n x 14	4-byte real	1.4
CCCM-105 (410)	SW all-sky up surface spectral flux enh MODIS (CALIPSO CloudSat)	$W m^{-2}$	0 ... 1500	n x 14	4-byte real	1.4
CCCM-106 (411)	SW all-sky down surface spectral flux enh MODIS (CALIPSO CldSat)	$W m^{-2}$	0 ... 1500	n x 14	4-byte real	1.4
CCCM-107 (412)	LW all-sky up TOA spectral flux enh MODIS (CALIPSO CloudSat)	$W m^{-2} sr^{-1}$	0 ... 1500	n x 12	4-byte real	1.2
CCCM-108 (413)	LW all-sky up surface spectral flux enh MODIS (CALIPSO CldSat)	$W m^{-2}$	0 ... 1500	n x 12	4-byte real	1.2
CCCM-109 (414)	LW all-sky down surface spectral flux enh MODIS (CALIPSO CldSat)	K	0 ... 1500	n x 12	4-byte real	1.2
CCCM-110 (415)	LW TOA modeled unfiltered radiance enhanced (CALIPSO CloudSat)	$W m^{-2} sr^{-1}$	0 ... 200	n	4-byte real	0.1

Table 1-12. Vertical Irradiance Profile

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CCCM-111 (416)	WN TOA modeled unfiltered radiance enhanced (CALIPSO CloudSat)	$W m^{-2} sr^{-1}$	0 ... 60	n	4-byte real	0.1
CCCM-112 (417)	WN TOA modeled filtered radiance enhanced (CALIPSO CloudSa)	$W m^{-2} sr^{-1}$	0 ... 50	n	4-byte real	0.1
CCCM-113 (418)	WN TOA upward flux enhanced (CALIPSO CloudSat)	$W m^{-2}$	0 ... 1500	n	4-byte real	0.1
CCCM-114 (419)	LW TOA modeled unfiltered radiance standard (CALIPSO CloudSat)	$W m^{-2} sr^{-1}$	0 ... 200	n	4-byte real	0.1
CCCM-115 (420)	WN TOA modeled unfiltered radiance standard (CALIPSO CloudSat)	$W m^{-2} sr^{-1}$	0 ... 60	n	4-byte real	0.1
CCCM-116 (421)	WN TOA modeled filtered radiance standard (CALIPSO CloudSat)	$W m^{-2} sr^{-1}$	0 ... 50	n	4-byte real	0.1
CCCM-117 (422)	WN TOA upward flux standard (CALIPSO CloudSat)	$W m^{-2}$	0 ... 1500	n	4-byte real	0.1
CCCM-118 (423)	Irradiance modeling source flag	N/A	0 ... 6000	n	2-byte int	0.05
CCCM-119 (424)	Flux confidence flag	N/A	0 ... 32767	n x 2	2-byte int	0.1
CCCM-120 (425)	Irradiance surface level	N/A	1 ... 138	n	2-byte int	0.05

The variables in [Table 1-13](#) provide information on the vertical coordinates used in the irradiance computations.

Table 1-13. Vertical Height Profile

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CCCM-121 (426)	Layer center height profile (clouds and aerosol)	km	-0.5 .. 65	113	4-byte real	< 0.01
CCCM-122 (427)	Level height profile (clouds and aerosol)	km	-0.5 .. 65	114	4-byte real	< 0.01
CCCM-123 (428)	Irradiance layer center height profile	m	500 .. 65000	137	4-byte real	< 0.01
CCCM-124 (429)	Irradiance level height profile	m	500 .. 65000	138	4-byte real	< 0.01
CCCM-125 (430)	CALIPSO cloud layer center height profile	km	-0.5 .. 65	345	4-byte real	< 0.01
CCCM-126 (431)	CALIPSO cloud level height profile	km	-0.5 .. 65	346	4-byte real	< 0.01
CCCM-127 (432)	Shortwave spectral wave number bounds	cm^{-1} ^a	2500 .. 60000	15	2-byte int	< 0.01

Table 1-13. Vertical Height Profile

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CCCM-128 (433)	Longwave spectral wave number bounds	cm ⁻¹ ^a	0 .. 2850	13	2-byte int	< 0.01

a. HDF file incorrectly states that the units of this variable are microns.

SSF Scientific Data Sets (continued)

Second dimension of 2 in [Table 1-14](#) indicates:

- 1 = Properties averaged over the entire CERES footprint (full)
- 2 = Properties averaged only along the ground track (track)

Third dimension of 8 indicates that the 8 most prevalent surface types are kept for each footprint.

Note: The definition of surface type used in [Table 1-14](#) is the same as that used in the CERES SSF product.

Table 1-14. CERES Surface Map
(Vgroup: Surface Map)

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-24 (23)	Altitude of surface above sea level	m	-1000 .. 10000	n x 2	4-byte real	0.2
SSF-25 (24)	Surface type index	N/A	1 .. 20	n x 2 x 8	2-byte int	0.8
SSF-26 (25)	Surface type percent coverage	N/A	0 .. 100	n x 2 x 8	2-byte int	0.8

Table 1-15. Scene Type

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-27 (26)	CERES SW ADM type for inversion process	N/A	0 .. 5000	n	2-byte int	0.05
SSF-28 (27)	CERES LW ADM type for inversion process	N/A	0 .. 5000	n	2-byte int	0.05
SSF-29 (28)	Cloud Classification	N/A	0 .. 32766	n	2-byte int	0.05
SSF-30 (29)	Snow/Ice percent coverage clear-sky overhead-sun vis albedo	N/A	0 .. 9999	n	2-byte int	0.05

Table 1-16. Filtered Radiances

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-31 (30)	CERES TOT filtered radiance - upwards	$W m^{-2} sr^{-1}$	0 .. 700	n	4-byte real	0.1
SSF-32 (31)	CERES SW filtered radiance - upwards	$W m^{-2} sr^{-1}$	-10 .. 510	n	4-byte real	0.1
SSF-33 (32)	CERES WN filtered radiance - upwards	$W m^{-2} sr^{-1} \mu m^{-1}$	0 .. 15	n	4-byte real	0.1
SSF-34 (33)	Radiance and Mode flags	N/A	0 .. ($2^{31}-1$)	n	4-byte int	0.1

Table 1-17. Unfiltered Radiances

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-35 (34)	CERES SW radiance - upwards	$W m^{-2} sr^{-1}$	-10 .. 510	n	4-byte real	0.1
SSF-36 (35)	CERES LW radiance - upwards	$W m^{-2} sr^{-1}$	0 .. 200	n	4-byte real	0.1
SSF-37 (36)	CERES WN radiance - upwards	$W m^{-2} sr^{-1}$	0 .. 60	n	4-byte real	0.1

Table 1-18. Additional CERES-derived TOA and Surface Irradiances
(Vgroup: TOA and Surface Fluxes)

First four variables in this Vgroup are listed in [Table 1-5](#).

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-41 (41)	CERES downward SW surface flux - Model A	$W m^{-2}$	0 .. 1400	n	4-byte real	0.1
SSF-42 (42)	CERES downward LW surface flux - Model A	$W m^{-2}$	0 .. 700	n	4-byte real	0.1
SSF-43 (43)	CERES downward WN surface flux - Model A	$W m^{-2}$	0 .. 250	n	4-byte real	0.1
SSF-44 (44)	CERES net SW surface flux - Model A	$W m^{-2}$	0 .. 1400	n	4-byte real	0.1
SSF-45 (45)	CERES net LW surface flux - Model A	$W m^{-2}$	-250 .. 50	n	4-byte real	0.1
SSF-46 (46)	CERES downward SW surface flux - Model B	$W m^{-2}$	0 .. 1400	n	4-byte real	0.1
SSF-46a (47)	CERES downward SW surface flux - Model B, clearsky	$W m^{-2}$	0 .. 1400	n	4-byte real	0.1

Table 1-18. Additional CERES-derived TOA and Surface Irradiances
(Vgroup: TOA and Surface Fluxes)

First four variables in this Vgroup are listed in [Table 1-5](#).

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-47 (48)	CERES downward LW surface flux - Model B	W m ⁻²	0 .. 700	n	4-byte real	0.1
SSF-47a (49)	CERES downward LW surface flux - Model B, clearsky	W m ⁻²	0 .. 700	n	4-byte real	0.1
SSF-48 (50)	CERES net SW surface flux - Model B	W m ⁻²	0 .. 1400	n	4-byte real	0.1
SSF-49 (51)	CERES net LW surface flux - Model B	W m ⁻²	-250 .. 50	n	4-byte real	0.1
SSF-49a (52)	CERES downward LW surface flux - Model C	W m ⁻²	0 .. 700	n	4-byte real	0.1
SSF-49b (53)	CERES downward LW surface flux - Model C, clearsky	W m ⁻²	0 .. 700	n	4-byte real	0.1
SSF-49c (54)	CERES net LW surface flux - Model C	W m ⁻²	-250 .. 50	n	4-byte real	0.1
SSF-50 (55)	CERES broadband surface albedo	N/A	0 .. 1	n	4-byte real	0.1
SSF-51 (56)	CERES LW surface emissivity	N/A	0 .. 1	n	4-byte real	0.1
SSF-52 (57)	CERES WN surface emissivity	N/A	0 .. 1	n	4-byte real	0.1

Second dimension of 2 in [Table 1-19](#) indicates:

- 1 = Properties averaged over the entire CERES footprint (full)
- 2 = Properties averaged only along the ground track (track)

Table 1-19. Full Footprint Area

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-53 (58)	Number of imager pixels in CERES FOV	N/A	0 .. 32766	n x 2	2-byte int	0.05
SSF-54 (59)	Imager percent coverage	N/A	0 .. 100	n x 2	2-byte int	0.05
SSF-55 (60)	Imager viewing zenith over CERES FOV	deg	0 .. 90	n	4-byte real	0.1
SSF-56 (61)	Imager relative azimuth over CERES FOV	deg	0 .. 360	n	4-byte real	0.1
SSF-57 (62)	Surface wind - U-vector	m sec ⁻¹	-100 .. 100	n	4-byte real	0.1

Table 1-19. Full Footprint Area

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-58 (63)	Surface wind - V-vector	m sec ⁻¹	-100 .. 100	n	4-byte real	0.1
SSF-59 (64)	Surface skin temperature	K	175 .. 375	n	4-byte real	0.1
SSF-59a (65)	Surface pressure	hPa	0 .. 1100	n	4-byte real	0.1
SSF-60 (66)	Column averaged relative humidity	N/A	0 .. 100	n	4-byte real	0.1
SSF-60a (67)	Surface minus 750 mb air temperature difference	K	-200 .. 200	n	4-byte real	0.1
SSF-60b (68)	Estimated Inversion Stability	K	-200 .. 200	n	4-byte real	0.1
SSF-61 (69)	Precipitable water	cm	0.001 .. 10	n	4-byte real	0.1
SSF-62 (70)	Flag - Source of precipitable water	N/A	0 .. 120	n	2-byte int	0.05
SSF-63 (71)	Cloud property extrapolation over cloudy area	N/A	0 .. 100	n	2-byte int	0.05
SSF-64 (72)	Notes on general procedure	N/A	0 .. 32766	n	2-byte int	0.05
SSF-65 (73)	Notes on cloud algorithms	N/A	0 .. 32766	n	2-byte int	0.05
SSF-65a (74)	Additional notes on cloud algorithms	N/A	0 .. 32766	n	2-byte int	0.05
SSF-65b (75)	Notes on cloud multilayer	N/A	0 .. 32766	n	2-byte int	0.05

Second dimension of 4 in [Table 1-20](#), [Table 1-21](#), and [Table 1-22](#) indicates the MODIS-derived cloud property set:

1. Cloud and aerosol properties derived from MODIS radiances by the standard CERES cloud algorithms and averaged over the entire CERES footprint
2. Cloud and aerosol properties derived from MODIS radiances by the standard CERES cloud algorithms and averaged only along the ground track
3. Cloud and aerosol properties derived from MODIS radiances by the enhanced CERES cloud algorithms and averaged only along the ground track
4. Cloud and aerosol properties derived from MODIS radiances by the enhanced CERES cloud algorithms and averaged over the entire CERES footprint (currently filled with default values)

Table 1-20. Properties derived from MODIS from clear-sky area
(Vgroup: Clear Footprint Area)

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimen- sions	Data Type	Maximum Daily Size (MB)
SSF-66 (76)	Clear area percent coverage at subpixel resolution	N/A	0 .. 100	n x 4	4-byte real	0.4
SSF-67 (77)	Cloud-mask clear-strong percent coverage	N/A	0 .. 100	n x 4	2-byte int	0.2
SSF-68 (78)	Cloud-mask clear-weak percent coverage	N/A	0 .. 100	n x 4	2-byte int	0.2
SSF-69 (79)	Cloud-mask snow/ice percent coverage	N/A	0 .. 100	n x 4	2-byte int	0.2
SSF-70 (80)	Cloud-mask aerosol B percent coverage	N/A	0 .. 100	n x 4	2-byte int	0.2
SSF-71 (81)	Flag - Type of aerosol B	N/A	0 .. 9999	n x 4	2-byte int	0.2
SSF-72 (82)	Cloud-mask percent coverage supplement	N/A	0 .. 32766	n x 4	2-byte int	0.2
SSF-73 (83)	Total aerosol A optical depth - visible	N/A	-1 .. 5	n x 4	4-byte real	0.4
SSF-74 (84)	Total aerosol A optical depth - near IR	N/A	-1 .. 5	n x 4	4-byte real	0.4
SSF-75 (85)	Aerosol A supplement 1	N/A	-1000 .. 1000	n x 4	4-byte real	0.4
SSF-76 (86)	Aerosol A supplement 2	N/A	-1000 .. 1000	n x 4	4-byte real	0.4
SSF-77 (87)	Aerosol A supplement 3	N/A	-1000 .. 1000	n x 4	4-byte real	0.4
SSF-78 (88)	Aerosol A supplement 4	N/A	-1000 .. 1000	n x 4	4-byte real	0.4
SSF-79 (89)	Imager-based surface skin temperature	K	175 .. 375	n x 4	4-byte real	0.4
SSF-79a (90)	Imager-based precipitable water	cm	0.001 .. 10	n x 4	4-byte real	0.4
SSF-80 (91)	Vertical temperature change	K	-30 .. 90	n x 4	4-byte real	0.4

The cloudy portion of the CERES footprint may contain up to two distinct cloud layers. The third dimensional index of 2 in [Table 1-21](#) refers to the lower (1) and upper (2) cloud layers.

Table 1-21. Properties derived from MODIS from cloudy-sky area
(Vgroup: Cloudy Footprint Area)

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimen- sions	Data Type	Maximum Daily Size (MB)
SSF-81 (92)	Clear/layer/overlap percent coverages	N/A	0 .. 100	n x 4 x 4	4-byte real	1.6
SSF-82 (93)	Note for cloud layer	N/A	0 .. (2 ³¹⁻¹)	n x 4 x 2	4-byte int	0.8
SSF-83 (94)	Mean visible optical depth for cloud layer	N/A	0 .. 400	n x 4 x 2	4-byte real	0.8
SSF-84 (95)	Stddev of visible optical depth for cloud layer	N/A	0 .. 300	n x 4 x 2	4-byte real	0.8
SSF-85 (96)	Mean logarithm of visible optical depth for cloud layer	N/A	-6 .. 6	n x 4 x 2	4-byte real	0.8
SSF-86 (97)	Stddev of logarithm of visible optical depth for cloud layer	N/A	0 .. 6	n x 4 x 2	4-byte real	0.8
SSF-87 (98)	Mean cloud infrared emissivity for cloud layer	N/A	0 .. 2	n x 4 x 2	4-byte real	0.8
SSF-88 (99)	Stddev of cloud infrared emissivity for cloud layer	N/A	0 .. 2	n x 4 x 2	4-byte real	0.8
SSF-89 (100)	Mean liquid water path for cloud layer (3.7)	g m ⁻²	0 .. 10000	n x 4 x 2	4-byte real	0.8
SSF-90 (101)	Stddev of liquid water path for cloud layer (3.7)	g m ⁻²	0 .. 8000	n x 4 x 2	4-byte real	0.8
SSF-91 (102)	Mean ice water path for cloud layer (3.7)	g m ⁻²	0 .. 10000	n x 4 x 2	4-byte real	0.8
SSF-92 (103)	Stddev of ice water path for cloud layer (3.7)	g m ⁻²	0 .. 8000	n x 4 x 2	4-byte real	0.8
SSF-93 (104)	Mean cloud top pressure for cloud layer	hPa	0 .. 1100	n x 4 x 2	4-byte real	0.8
SSF-94 (105)	Stddev of cloud top pressure for cloud layer	hPa	0 .. 600	n x 4 x 2	4-byte real	0.8
SSF-94a (106)	Mean cloud top temperature for cloud layer	K	100 .. 350	n x 4 x 2	4-byte real	0.8
SSF-94b (107)	Mean cloud top height for cloud layer	km	0 .. 20	n x 4 x 2	4-byte real	0.8
SSF-95 (108)	Mean cloud effective pressure for cloud layer	hPa	0 .. 1100	n x 4 x 2	4-byte real	0.8
SSF-96 (109)	Stddev of cloud effective pressure for cloud layer	hPa	0 .. 500	n x 4 x 2	4-byte real	0.8
SSF-97 (110)	Mean cloud effective temperature for cloud layer	K	100 .. 350	n x 4 x 2	4-byte real	0.8
SSF-98 (111)	Stddev of cloud effective temperature for cloud layer	K	0 .. 150	n x 4 x 2	4-byte real	0.8

Table 1-21. Properties derived from MODIS from cloudy-sky area
(Vgroup: Cloudy Footprint Area)

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimen- sions	Data Type	Maximum Daily Size (MB)
SSF-99 (112)	Mean cloud effective height for cloud layer	km	0 .. 20	n x 4 x 2	4-byte real	0.8
SSF-100 (113)	Stddev of cloud effective height for cloud layer	km	0 .. 12	n x 4 x 2	4-byte real	0.8
SSF-101 (114)	Mean cloud base pressure for cloud layer	hPa	0 .. 1100	n x 4 x 2	4-byte real	0.8
SSF-102 (115)	Stddev of cloud base pressure for cloud layer	hPa	0 .. 600	n x 4 x 2	4-byte real	0.8
SSF-102a (116)	Mean cloud base temperature for cloud layer	K	100 .. 350	n x 4 x 2	4-byte real	0.8
SSF-103 (117)	Mean water particle radius for cloud layer (3.7)	μm	0 .. 40	n x 4 x 2	4-byte real	0.8
SSF-104 (118)	Stddev of water particle radius for cloud layer (3.7)	μm	0 .. 20	n x 4 x 2	4-byte real	0.8
SSF-105 (119)	Mean ice particle effective diameter for cloud layer (3.7)	μm	0 .. 300	n x 4 x 2	4-byte real	0.8
SSF-106 (120)	Stddev of ice particle effective diameter for cloud layer (3.7)	μm	0 .. 200	n x 4 x 2	4-byte real	0.8
SSF-107 (121)	Mean cloud particle phase for cloud layer (3.7)	N/A	1 .. 2	n x 4 x 2	4-byte real	0.8
SSF-108 (122)	Mean water particle radius for cloud layer (1.6)	μm	0 .. 40	n x 4 x 2	4-byte real	0.8
SSF-109 (123)	Mean ice particle effective diameter for cloud layer (1.6)	μm	0 .. 300	n x 4 x 2	4-byte real	0.8
SSF-110 (124)	Mean logarithm of visible optical depth for cloud layer (1.6)	N/A	-6 .. 6	n x 4 x 2	4-byte real	0.8
SSF-110a (125)	Mean water particle radius for cloud layer (2.1)	μm	0 .. 40	n x 4 x 2	4-byte real	0.8
SSF-110b (126)	Mean ice particle effective diameter for cloud layer (2.1)	μm	0 .. 300	n x 4 x 2	4-byte real	0.8
SSF-110c (127)	Mean logarithm of visible optical depth for cloud layer (2.1)	N/A	-6 .. 6	n x 4 x 2	4-byte real	0.8
SSF-111 (128)	CO2 slicing percent coverages for cloud layer	N/A	0 .. 100	n x 4 x 2	4-byte real	0.8
SSF-111a (129)	Mean infrared emissivity for cloud layer - CO2 slicing	N/A	0 .. 2	n x 4 x 2	4-byte real	0.8
SSF-111b (130)	Mean effective pressure for cloud layer - CO2 slicing	hPa	0 .. 1100	n x 4 x 2	4-byte real	0.8
SSF-111c (131)	Mean effective temperature for cloud layer - CO2 slicing	K	100 .. 350	n x 4 x 2	4-byte real	0.8

Table 1-21. Properties derived from MODIS from cloudy-sky area
(Vgroup: Cloudy Footprint Area)

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-112 (132)	Mean effective height for cloud layer - CO2 slicing	km	0 .. 20	n x 4 x 2	4-byte real	0.8
SSF-113 (133)	Percentiles of visible optical depth for cloud layer	N/A	0 .. 400	n x 4 x 13 x 2	4-byte real	10.4

The second dimensional index of variables in [Table 1-22](#) is the same as the second index of variables in [Table 1-20](#) and [Table 1-21](#).

The third dimensional index of variables in [Table 1-22](#) indicates cloud layer classification:

1. single lower cloud layer from Edition 2 (Ed2) cloud algorithm that is not multilayer including optically thick clouds,
2. single upper cloud layer from Ed2 cloud algorithm that is not multilayer including optically thick clouds,
3. multilayer cloud that is assigned to lower cloud layer when the Ed2 cloud algorithm is used,
4. multilayer cloud that is assigned to upper cloud layer when the Ed2 cloud algorithm is used.

Descriptions of how these four cloud classifications are made and other cloud properties associated with these cloud classes are included in the [CCCM Variable Descriptions](#) document because these are significantly different from Ed2.

Table 1-22. Multilayer Cloud Footprint Area

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-114a (134)	Single layer/multilayer percent coverages	N/A	0 .. 100	n x 4 x 4	4-byte real	1.6
SSF-114b (135)	Mean visible optical depth for multilayer	N/A	0 .. 400	n x 4 x 4	4-byte real	1.6
SSF-114c (136)	Mean logarithm of visible optical depth for multilayer	N/A	-6 .. 6	n x 4 x 4	4-byte real	1.6
SSF-114d (137)	Mean cloud infrared emissivity for multilayer	N/A	0 .. 2	n x 4 x 4	4-byte real	1.6
SSF-114e (138)	Mean cloud top pressure for multilayer	hPa	0 .. 1100	n x 4 x 4	4-byte real	1.6
SSF-114f (139)	Mean cloud top temperature for multilayer	K	100 .. 350	n x 4 x 4	4-byte real	1.6

Table 1-22. Multilayer Cloud Footprint Area

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-114g (140)	Mean cloud top height for multilayer	km	0 .. 20	n x 4 x 4	4-byte real	1.6
SSF-114h (141)	Mean cloud effective pressure for multilayer	hPa	0 .. 1100	n x 4 x 4	4-byte real	1.6
SSF-114i (142)	Mean cloud effective temperature for multilayer	K	100 .. 350	n x 4 x 4	4-byte real	1.6
SSF-114j (143)	Mean cloud effective height for multilayer	km	0 .. 20	n x 4 x 4	4-byte real	1.6
SSF-114k (144)	Mean cloud base pressure for multilayer	hPa	0 .. 1100	n x 4 x 4	4-byte real	1.6

In [Table 1-23](#), the second or third dimension of 5 is for wavelength indicated by SSF-115.

The second dimension of 2 indicates:

- 1 = Imager radiances averaged over the entire CERES footprint (full)
- 2 = Imager radiances averaged only along the ground track (track)

Table 1-23. Imager radiance along the ground track
(Vgroup: Footprint Imager Radiance Statistics)

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-115 (145)	Imager channel central wavelength	μm	0.4 .. 15.0	n x 5	4-byte real	0.5
SSF-116 (146)	All subpixel clear area percent coverage	N/A	0 .. 100	n x 2	4-byte real	0.2
SSF-117 (147)	All subpixel overcast cloud area percent coverage	N/A	0 .. 100	n x 2	4-byte real	0.2
SSF-118 (148)	Mean imager radiances over clear area	$\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$	-1000 .. 1000	n x 2 x 5	4-byte real	1.0
SSF-119 (149)	Stddev of imager radiances over clear area	$\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$	0 .. 1000	n x 2 x 5	4-byte real	1.0
SSF-120 (150)	Mean imager radiances over overcast cloud area	$\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$	-1000 .. 1000	n x 2 x 5	4-byte real	1.0
SSF-121 (151)	Stddev of imager radiances over overcast cloud area	$\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$	0 .. 1000	n x 2 x 5	4-byte real	1.0
SSF-122 (152)	Mean imager radiances over full CERES FOV	$\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$	-1000 .. 1000	n x 2 x 5	4-byte real	1.0
SSF-123 (153)	Stddev of imager radiances over full CERES FOV	$\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$	0 .. 1000	n x 2 x 5	4-byte real	1.0

Table 1-23. Imager radiance along the ground track
(Vgroup: Footprint Imager Radiance Statistics)

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-126 (154)	Mean imager radiances over cloud layer 1 (no overlap)	$W m^{-2} sr^{-1} \mu m^{-1}$	-1000 .. 1000	n x 2 x 5	4-byte real	1.0
SSF-127 (155)	Stddev of imager radiances over cloud layer 1 (no overlap)	$W m^{-2} sr^{-1} \mu m^{-1}$	0 .. 1000	n x 2 x 5	4-byte real	1.0
SSF-128 (156)	Mean imager radiances over cloud layer 2 (no overlap)	$W m^{-2} sr^{-1} \mu m^{-1}$	-1000 .. 1000	n x 2 x 5	4-byte real	1.0
SSF-129 (157)	Stddev of imager radiances over cloud layer 2 (no overlap)	$W m^{-2} sr^{-1} \mu m^{-1}$	0 .. 1000	n x 2 x 5	4-byte real	1.0
SSF-130 (158)	Mean imager radiances over cloud layer 1 and 2 overlap	$W m^{-2} sr^{-1} \mu m^{-1}$	-1000 .. 1000	n x 2 x 5	4-byte real	1.0
SSF-131 (159)	Stddev of imager radiances over cloud layer 1 and 2 overlap	$W m^{-2} sr^{-1} \mu m^{-1}$	0 .. 1000	n x 2 x 5	4-byte real	1.0

In [Table 1-24](#), the second or third dimension of 7 is for wavelength indicated by SSF-131a.

The second dimension of 2 indicates:

- 1 = Imager radiances averaged over the entire CERES footprint (full)
- 2 = Imager radiances averaged only along the ground track (track)

Table 1-24. Additional imager radiance along the ground track
(Vgroup: Additional Footprint Imager Radiance Statistics)

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-131a (160)	Additional imager channel central wavelength	μm	0.4 .. 15.0	n x 7	4-byte real	1.4
SSF-131b (161)	Additional mean imager radiances over clear area	$W m^{-2} sr^{-1} \mu m^{-1}$	-1000 .. 1000	n x 2 x 7	4-byte real	1.4
SSF-131c (162)	Additional stddev imager radiances over clear area	$W m^{-2} sr^{-1} \mu m^{-1}$	0 .. 1000	n x 2 x 7	4-byte real	1.4
SSF-131d (163)	Additional mean imager radiances over full CERES FOV	$W m^{-2} sr^{-1} \mu m^{-1}$	-1000 .. 1000	n x 2 x 7	4-byte real	1.4
SSF-131e (164)	Additional stddev imager radiances over full CERES FOV	$W m^{-2} sr^{-1} \mu m^{-1}$	0 .. 1000	n x 2 x 7	4-byte real	1.4

Second dimension of 2 in [Table 1-25](#) and [Table 1-26](#) indicates:

- 1 = Properties averaged over the entire CERES footprint (full)
- 2 = Properties averaged only along the ground track (track)

Table 1-25. MODIS Land Aerosols

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-132 (165)	Percentage of CERES FOV with MODIS land aerosol	N/A	0 .. 100	n x 2	2-byte int	0.1
SSF-133 (166)	PSF-wtd MOD04 cloud fraction land	N/A	0 .. 100	n x 2	2-byte int	0.1
SSF-134 (167)	PSF-wtd MOD04 aerosol types land	N/A	0 .. 9999	n x 2	4-byte int	0.2
SSF-135 (168)	PSF-wtd MOD04 dust weighting factor land	N/A	0.0 .. 1.0	n x 2	4-byte real	0.2
SSF-136 (169)	PSF-wtd MOD04 corrected optical depth land (0.470)	N/A	0.0 .. 5.0	n x 2	4-byte real	0.2
SSF-137 (170)	PSF-wtd MOD04 corrected optical depth land (0.550)	N/A	0.0 .. 5.0	n x 2	4-byte real	0.2
SSF-138 (171)	PSF-wtd MOD04 corrected optical depth land (0.659)	N/A	0.0 .. 5.0	n x 2	4-byte real	0.2
SSF-139 (172)	MOD04 number pixels percentile land (0.659) in CERES FOV	N/A	0 .. (2 ³¹ -1)	n x 2	4-byte int	0.2
SSF-140 (173)	PSF-wtd MOD04 mean reflectance land (0.470)	N/A	0.0 .. 1.0	n x 2	4-byte real	0.2
SSF-141 (174)	PSF-wtd MOD04 mean reflectance land (0.659)	N/A	0.0 .. 1.0	n x 2	4-byte real	0.2
SSF-142 (175)	PSF-wtd MOD04 mean reflectance land (0.865)	N/A	0.0 .. 1.0	n x 2	4-byte real	0.2
SSF-143 (176)	PSF-wtd MOD04 mean reflectance land (2.130)	N/A	0.0 .. 1.0	n x 2	4-byte real	0.2
SSF-144 (177)	PSF-wtd MOD04 mean reflectance land (3.750)	N/A	0.0 .. 1.0	n x 2	4-byte real	0.2
SSF-145 (178)	PSF-wtd MOD04 std reflectance land (0.470)	N/A	0.0 .. 2.0	n x 2	4-byte real	0.2

Table 1-26. MODIS Ocean Aerosols

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-146 (179)	Percentage of CERES FOV with MODIS ocean aerosol	N/A	0 .. 100	n x 2	2-byte int	0.1
SSF-147 (180)	PSF-wtd MOD04 cloud fraction ocean	N/A	0 .. 100	n x 2	2-byte int	0.1
SSF-148 (181)	PSF-wtd MOD04 solution indices ocean small, average	N/A	0 .. 99999	n x 2	4-byte int	0.2
SSF-149 (182)	PSF-wtd MOD04 solution indices ocean large, average	N/A	0 .. 99999	n x 2	4-byte int	0.2

Table 1-26. MODIS Ocean Aerosols

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
SSF-150 (183)	PSF-wtd MOD04 effective optical depth average ocean (0.470)	N/A	0.0 .. 5.0	n x 2	4-byte real	0.2
SSF-151 (184)	PSF-wtd MOD04 effective optical depth average ocean (0.550)	N/A	0.0 .. 5.0	n x 2	4-byte real	0.2
SSF-152 (185)	PSF-wtd MOD04 effective optical depth average ocean (0.659)	N/A	0.0 .. 5.0	n x 2	4-byte real	0.2
SSF-153 (186)	PSF-wtd MOD04 effective optical depth average ocean (0.865)	N/A	0.0 .. 5.0	n x 2	4-byte real	0.2
SSF-154 (187)	PSF-wtd MOD04 effective optical depth average ocean (1.240)	N/A	0.0 .. 5.0	n x 2	4-byte real	0.2
SSF-155 (188)	PSF-wtd MOD04 effective optical depth average ocean (1.640)	N/A	0.0 .. 5.0	n x 2	4-byte real	0.2
SSF-156 (189)	PSF-wtd MOD04 effective optical depth average ocean (2.130)	N/A	0.0 .. 5.0	n x 2	4-byte real	0.2
SSF-157 (190)	PSF-wtd MOD04 optical depth small average ocean (0.550)	N/A	0.0 .. 5.0	n x 2	4-byte real	0.2
SSF-158 (191)	PSF-wtd MOD04 optical depth small average ocean (0.865)	N/A	0.0 .. 5.0	n x 2	4-byte real	0.2
SSF-159 (192)	PSF-wtd MOD04 optical depth small average ocean (2.130)	N/A	0.0 .. 5.0	n x 2	4-byte real	0.2
SSF-160 (193)	PSF-wtd MOD04 cloud condensation nuclei ocean, average	CCN cm ⁻²	0.0 .. 1*10 ¹¹	n x 2	4-byte real	0.2
SSF-161 (194)	PSF-wtd MOD04 mean reflectance ocean (0.470)	N/A	0.0 .. 1.0	n x 2	4-byte real	0.2
SSF-162 (195)	PSF-wtd MOD04 mean reflectance ocean (0.555)	N/A	0.0 .. 1.0	n x 2	4-byte real	0.2
SSF-163 (196)	PSF-wtd MOD04 mean reflectance ocean (0.659)	N/A	0.0 .. 1.0	n x 2	4-byte real	0.2
SSF-164 (197)	PSF-wtd MOD04 mean reflectance ocean (0.865)	N/A	0.0 .. 1.0	n x 2	4-byte real	0.2
SSF-165 (198)	PSF-wtd MOD04 mean reflectance ocean (1.240)	N/A	0.0 .. 1.0	n x 2	4-byte real	0.2
SSF-166 (199)	PSF-wtd MOD04 mean reflectance ocean (1.640)	N/A	0.0 .. 1.0	n x 2	4-byte real	0.2
SSF-167 (200)	PSF-wtd MOD04 mean reflectance ocean (2.130)	N/A	0.0 .. 1.0	n x 2	4-byte real	0.2

CRS Scientific Data Sets

Table 1-27 through Table 1-40 contain variables produced by algorithms similar to those used for the CERES CRS product. The variables are numbered the same as their regular CRS counterparts (CRS-161, CRS-162, etc.).

Note: The first 160 Aqua CRS SDSs are listed in the corresponding SSF Data Products Catalog.

Dimensions

The first dimension in all of the CRS SDSs is n, the number of near-nadir CERES footprints per day, where $n = 24 \text{ hr} \times 3600 \text{ sec/hr} / 3.3 \text{ sec/scan} \sim 26182$.

Table 1-27. Surface Radiative Properties

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CRS-161 (201)	Photosynthetically active radiation over surface	W m^{-2}	0 .. 780	n	4-byte real	0.1
CRS-162 (202)	Direct/diffuse surface ratio	N/A	0 .. 30	n	4-byte real	0.1
CRS-163 (203)	Corrected initial broadband surface albedo	N/A	0 .. 1	n	4-byte real	0.1

Table 1-28. Vertical Profile Description

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CRS-164 (204)	Number of atmospheric levels	N/A	0 .. 5	n	4-byte int	0.1
CRS-165 (205)	Pressure levels	hPa	0 .. 1100	n x 5	4-byte real	0.1

Second dimensional index in [Table 1-29](#) indicates:

- 1 = TOA
- 2 = surface

Table 1-29. Pristine Vertical Flux Profiles

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CRS-166 (206)	Shortwave flux - upward - pristine	W m^{-2}	0 .. 1400	n x 2	4-byte real	0.2
CRS-167 (207)	Shortwave flux - downward - pristine	W m^{-2}	0 .. 1400	n x 2	4-byte real	0.2
CRS-168 (208)	Longwave flux - upward - pristine	W m^{-2}	0 .. 850	n x 2	4-byte real	0.2
CRS-169 (209)	Longwave flux - downward - pristine	W m^{-2}	0 .. 700	n x 2	4-byte real	0.2
CRS-170 (210)	Window channel flux - upward - pristine	W m^{-2}	0 .. 370	n x 2	4-byte real	0.2

Table 1-29. Pristine Vertical Flux Profiles

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CRS-171 (211)	Window channel flux - downward - pristine	W m ⁻²	0 .. 370	n x 2	4-byte real	0.2

The second dimensional index of variables in [Table 1-30](#) and [Table 1-31](#) indicates pressure level:

- 1 = TOA
- 2 = 70 hPa
- 3 = 200 hPa
- 4 = 500 hPa
- 5 = Surface

Table 1-30. Constrained Clear Sky Profiles

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CRS-172 (212)	Shortwave flux - upward - clear	W m ⁻²	0 .. 1400	n x 5	4-byte real	0.5
CRS-173 (213)	Shortwave flux - downward - clear	W m ⁻²	0 .. 1400	n x 5	4-byte real	0.5
CRS-174 (214)	Longwave flux - upward - clear	W m ⁻²	0 .. 850	n x 5	4-byte real	0.5
CRS-175 (215)	Longwave flux - downward - clear	W m ⁻²	0 .. 700	n x 5	4-byte real	0.5
CRS-176 (216)	Window channel flux - upward - clear	W m ⁻²	0 .. 370	n x 5	4-byte real	0.5
CRS-177 (217)	Window channel flux - downward - clear	W m ⁻²	0 .. 370	n x 5	4-byte real	0.5

Table 1-31. Constrained Total Sky Profiles

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CRS-178 (218)	Shortwave flux - upward - total	W m ⁻²	0 .. 1400	n x 5	4-byte real	0.5
CRS-179 (219)	Shortwave flux - downward - total	W m ⁻²	0 .. 1400	n x 5	4-byte real	0.5
CRS-180 (220)	Longwave flux - upward - total	W m ⁻²	0 .. 850	n x 5	4-byte real	0.5
CRS-181 (221)	Longwave flux - downward - total	W m ⁻²	0 .. 700	n x 5	4-byte real	0.5
CRS-182 (222)	Window channel flux - upward - total	W m ⁻²	0 .. 370	n x 5	4-byte real	0.5

Table 1-31. Constrained Total Sky Profiles

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CRS-183 (223)	Window channel flux - downward - total	W m ⁻²	0 .. 370	n x 5	4-byte real	0.5

The adjustments in [Table 1-32](#), [Table 1-33](#), and [Table 1-34](#) are defined as:
Adjustment = Tuned irradiance – Untuned irradiance.

Therefore, the adjusted value needs to be subtracted to compute the untuned irradiances.

Table 1-32. Pristine Constraint Initial Flux Deltas

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CRS-184 (224)	Shortwave flux adjustment at surface - upward - pristine	W m ⁻²	-1400 .. 1400	n	4-byte real	0.1
CRS-185 (225)	Shortwave flux adjustment at TOA - upward - pristine	W m ⁻²	-1400 .. 1400	n	4-byte real	0.1
CRS-186 (226)	Shortwave flux adjustment at surface - downward - pristine	W m ⁻²	-1400 .. 1400	n	4-byte real	0.1
CRS-187 (227)	Longwave flux adjustment at surface - upward - pristine	W m ⁻²	-600 .. 600	n	4-byte real	0.1
CRS-188 (228)	Longwave flux adjustment at surface - downward - pristine	W m ⁻²	-700 .. 700	n	4-byte real	0.1
CRS-189 (229)	Longwave flux adjustment at TOA - upward - pristine	W m ⁻²	-700 .. 700	n	4-byte real	0.1
CRS-190 (230)	Window channel flux adjustment at surface - upward - pristine	W m ⁻²	-50 .. 50	n	4-byte real	0.1
CRS-191 (231)	Window channel flux adjustment at surface - downward - pristine	W m ⁻²	-50 .. 50	n	4-byte real	0.1
CRS-192 (232)	Window channel flux adjustment at TOA - upward - pristine	W m ⁻²	-50 .. 50	n	4-byte real	0.1

Table 1-33. Clear Sky Constraint Initial Flux Deltas

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CRS-193 (233)	Shortwave flux adjustment at surface - upward - clear	W m ⁻²	-1400 .. 1400	n	4-byte real	0.1
CRS-194 (234)	Shortwave flux adjustment at TOA - upward - clear	W m ⁻²	-1400 .. 1400	n	4-byte real	0.1
CRS-195 (235)	Shortwave flux adjustment at surface - downward - clear	W m ⁻²	-1400 .. 1400	n	4-byte real	0.1

Table 1-33. Clear Sky Constraint Initial Flux Deltas

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CRS-196 (236)	Longwave flux adjustment at surface - upward - clear	W m ⁻²	-600 .. 600	n	4-byte real	0.1
CRS-197 (237)	Longwave flux adjustment at surface - downward - clear	W m ⁻²	-700 .. 700	n	4-byte real	0.1
CRS-198 (238)	Longwave flux adjustment at TOA - upward - clear	W m ⁻²	-700 .. 700	n	4-byte real	0.1
CRS-199 (239)	Window channel flux adjustment at surface - upward - clear	W m ⁻²	-50 .. 50	n	4-byte real	0.1
CRS-200 (240)	Window channel flux adjustment at surface - downward - clear	W m ⁻²	-50 .. 50	n	4-byte real	0.1
CRS-201 (241)	Window channel flux adjustment at TOA - upward - clear	W m ⁻²	-50 .. 50	n	4-byte real	0.1

Table 1-34. Total Sky Constraint Initial Flux Deltas

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CRS-202 (242)	Shortwave flux adjustment at surface - upward - total	W m ⁻²	-1400 .. 1400	n	4-byte real	0.1
CRS-203 (243)	Shortwave flux adjustment at TOA - upward - total	W m ⁻²	-1400 .. 1400	n	4-byte real	0.1
CRS-204 (244)	Shortwave flux adjustment at surface - downward - total	W m ⁻²	-1400 .. 1400	n	4-byte real	0.1
CRS-205 (245)	Longwave flux adjustment at surface - upward - total	W m ⁻²	-600 .. 600	n	4-byte real	0.1
CRS-206 (246)	Longwave flux adjustment at surface - downward - total	W m ⁻²	-700 .. 700	n	4-byte real	0.1
CRS-207 (247)	Longwave flux adjustment at TOA - upward - total	W m ⁻²	-700 .. 700	n	4-byte real	0.1
CRS-208 (248)	Window channel flux adjustment at surface - upward - total	W m ⁻²	-50 .. 50	n	4-byte real	0.1
CRS-209 (249)	Window channel flux adjustment at surface - downward - total	W m ⁻²	-50 .. 50	n	4-byte real	0.1
CRS-210 (250)	Window channel flux adjustment at TOA - upward - total	W m ⁻²	-50 .. 50	n	4-byte real	0.1

Table 1-35. Satellite Emulated Window Channel

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CRS-211 (251)	Window channel filtered radiance - satellite emulated	$W m^{-2} sr^{-1}$	0 .. 50	n	4-byte real	0.1
CRS-212 (252)	Window channel filtered radiance adjustment - satellite emulate	$W m^{-2} sr^{-1}$	0 .. 50	n	4-byte real	0.1
CRS-213 (253)	Window channel flux - satellite adjustment - TOA	$W m^{-2}$	2 .. 50	n	4-byte real	0.1
CRS-214 (254)	Window channel flux adjustment - satellite adjustment - TOA	$W m^{-2}$	2 .. 50	n	4-byte real	0.1

Table 1-36. Unfiltered Total Longwave

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CRS-215 (255)	Total longwave unfiltered radiance - satellite emulated	$W m^{-2} sr^{-1}$	0 .. 200	n	4-byte real	0.1
CRS-216 (256)	Total longwave unfiltered radiance adjust - satellite emulated	$W m^{-2} sr^{-1}$	0 .. 200	n	4-byte real	0.1

The cloudy portion of the CERES footprint may contain up to two distinct cloud layers. The second dimensional index of 2 in [Table 1-37](#) refers to the lower (1) and upper (2) cloud layers.

Table 1-37. Constraint Adjustments

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CRS-217 (257)	Total column precipitable water - initial	cm	0 .. 10	n	4-byte real	0.1
CRS-218 (258)	Total column precipitable water - adjustment	cm	-10 .. 10	n	4-byte real	0.1
CRS-219 (259)	Upper tropospheric precipitable water - initial	cm	0 .. 10	n	4-byte real	0.1
CRS-220 (260)	Upper tropospheric precipitable water - adjustment	cm	-10 .. 10	n	4-byte real	0.1
CRS-221 (261)	Upper tropospheric humidity - initial	N/A	0.0 .. 100.0	n	4-byte real	0.1
CRS-222 (262)	Upper tropospheric humidity - adjustment	N/A	0.0 .. 100.0	n	4-byte real	0.1
CRS-223 (263)	Surface albedo - adjustment	N/A	-1 .. 1	n	4-byte real	0.1
CRS-224 (264)	Aerosol optical depth - initial	N/A	0 .. 2	n	4-byte real	0.1

Table 1-37. Constraint Adjustments

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CRS-225 (265)	Aerosol optical depth - adjustment	N/A	-2 .. 2	n	4-byte real	0.1
CRS-226 (266)	Skin temperature - initial	K	200 .. 350	n	4-byte real	0.1
CRS-227 (267)	Skin temperature - adjustment	K	200 .. 350	n	4-byte real	0.1
CRS-228 (268)	Mean visible optical depth - adjustment	N/A	-400 .. 400	n x 2	4-byte real	0.2
CRS-229 (269)	Mean cloud fractional area - adjustment	N/A	-1 .. 1	n x 2	4-byte real	0.2
CRS-230 (270)	Mean cloud effective temperature - adjustment	K	TBD	n x 2	4-byte real	0.2

Table 1-38. Aerosol Constituency Information

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CRS-231 (271)	Aerosol constituency flags	N/A	01000000 .. 18999999	n x 7	4-byte int	0.7
CRS-232 (272)	Surface albedo and aerosol sources flag	N/A	100 - 303	n	4-byte int	0.1

Table 1-39. Constraint Status

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimensions	Data Type	Maximum Daily Size (MB)
CRS-233 (273)	Number of tuning iterations	N/A	0 .. 1	n	4-byte int	0.1
CRS-234 (274)	Constraint status flag	N/A	0 .. 600	n	4-byte int	0.1
CRS-235 (275)	FuLiou model error code	N/A	1 .. 3000	n	4-byte int	0.1

Second dimensional index of 2 in [Table 1-40](#) indicates:

- 1 = TOA
- 2 = surface

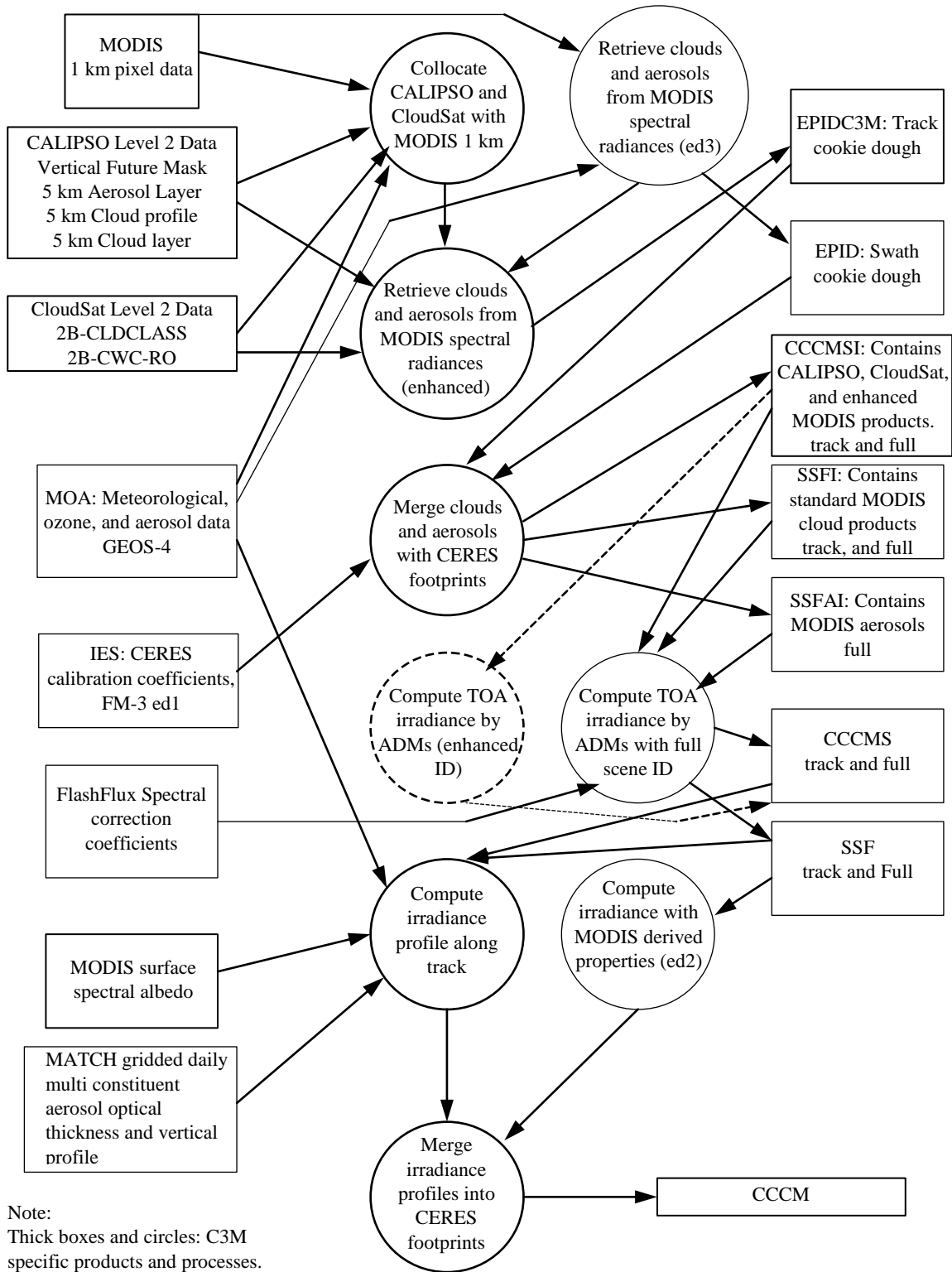
Table 1-40. Information for Cloudy Skies with No Aerosols Included in Computations
(No Aerosol Fluxes and Deltas Vgroup)

Item (SDS Index)	SDS Name (Variable Name)	Units	Range	Dimen- sions	Data Type	Maximum Daily Size (MB)
CRS-236 (276)	Shortwave flux - upward - cloudy sky : no aerosol	W m ⁻²	0 .. 1400	n x 2	4-byte real	0.1
CRS-237 (277)	Shortwave flux - downward - cloudy sky : no aerosol	W m ⁻²	0 .. 1400	n x 2	4-byte real	0.1
CRS-238 (278)	Longwave flux - upward - cloudy sky : no aerosol	W m ⁻²	0 .. 850	n x 2	4-byte real	0.1
CRS-239 (279)	Longwave flux - downward - cloudy sky : no aerosol	W m ⁻²	0 .. 700	n x 2	4-byte real	0.1
CRS-240 (280)	Window flux - upward - cloudy sky : no aerosol	W m ⁻²	0 .. 370	n x 2	4-byte real	0.1
CRS-241 (281)	Window flux - downward - cloudy sky : no aerosol	W m ⁻²	0 .. 370	n x 2	4-byte real	0.1
CRS-242 (282)	Shortwave flux adjustment at surface - upward - cloudy : no aer	W m ⁻²	-1400 .. 1400	n	4-byte real	0.1
CRS-243 (283)	Shortwave flux adjustment at TOA - upward - cloudy : no aerosol	W m ⁻²	-1400 .. 1400	n	4-byte real	0.1
CRS-244 (284)	Shortwave flux adjustment at surface - downward - cloudy : no a	W m ⁻²	-1400 .. 1400	n	4-byte real	0.1
CRS-245 (285)	Longwave flux adjustment at surface - upward - cloudy : no aero	W m ⁻²	-600 .. 600	n	4-byte real	0.1
CRS-246 (286)	Longwave flux adjustment at surface - downward - cloudy : no ae	W m ⁻²	-700 .. 700	n	4-byte real	0.1
CRS-247 (287)	Longwave flux adjustment at TOA - upward - cloudy : no aerosol	W m ⁻²	-700 .. 700	n	4-byte real	0.1
CRS-248 (288)	Window flux adjustment at surface - upward - cloudy : no aeroso	W m ⁻²	-50 .. 50	n	4-byte real	0.1
CRS-249 (289)	Window flux adjustment at surface - downward - cloudy : no aero	W m ⁻²	-50 .. 50	n	4-byte real	0.1
CRS-250 (290)	Window flux adjustment at TOA - upward - cloudy : no aerosol	W m ⁻²	-50 .. 50	n	4-byte real	0.1

Megabytes / Day:

Average daily file size is 182 MB.

CCCM Top Level Data Flow Diagram



Note:
 Thick boxes and circles: C3M specific products and processes.
 Thin boxes and circles: CERES standard products and processes.
 Dashed lines: Future processes.