

# NWP SAF

## *Satellite Application Facility for Numerical Weather Prediction*

Document NWPSAF-MF-UD-003

Version 7.5 14 May 2015

### AAPP DOCUMENTATION

### DATA FORMATS

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This documentation was developed within the context of the EUMETSAT Satellite Application Facility on Numerical Weather Prediction (NWP SAF), under the Cooperation Agreement dated 01 December 2006, between EUMETSAT and the Met Office, UK, by one or more partners within the NWP SAF. The partners in the NWP SAF are the Met Office, ECMWF, KNMI and Météo France.

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Change record			
Version	Date	Author / changed by	Remarks
4.0	April 03	T.Labrot	Creation for AAPP V4.0
5.0	April 05	T.Labrot N.Atkinson	Update for AAPP V5
5.1	May 05	N.Atkinson	Incorporate updates following beta release 5.0
6.0	June 06	T.Labrot	Update for AAPP V6
6.1	Oct 07	N.Atkinson	Corrections to 1c/1d satellite IDs
7.0	Oct 11	T.Labrot N.Atkinson	Update for AAPP V7
7.1	Jan 12	N.Atkinson	Corrections to MAIA3 variables
7.2	Apr 13	N.Atkinson, P. Roquet	Add format of MAIA4 output datasets
7.3	Feb 14	P. Roquet	Update MAIA4 cloud mask definition
7.4	July 14	N.Atkinson	Add MWTS2, MWHS2, IRAS 1c definitions
7.5	May 15	P. Roquet	Update MAIA4 Cloud Mask Confidence

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## 1. INTRODUCTION

This document describes the formats of the files that the AAPP user needs to do an AAPP run (e.g. an orbital prediction file, raw data level 0 file and a forecast file), and the formats of the files that an entire AAPP run produces. A general description of all the files is also available in the *AAPP software description document*, in the section named “Interfaces”. The level 1b format definitions in AAPP closely follow the definitions in section 8 of the NOAA KLM User’s Guide (<http://www2.ncdc.noaa.gov:80/docs/klm/>). Many fields are not initialised in AAPP.

## 2. FORMAT OF TBUS\_YYYYMMDD.TXT FILE

The TBUS bulletins contain the relevant parameters for the navigation of the NOAA satellites. They are issued daily by NOAA. A TBUS bulletin is named `tbus_YYYYMMDD.txt` for a TBUS bulletin received on the date `YYYY/MM/DD`.

The TBUS bulletin file format is a WMO format. Section 5.1 and Appendix A of the NOAA KLM User’s Guide are assigned to TBUS bulletins ( <http://www2.ncdc.noaa.gov:80/docs/klm/> )

(See also information in *tbus.5* (directory *AAPP/man/man5*) and in the paragraph “interfaces” of the *AAPP software description document*).

## 3. FORMAT OF TWO-LINE ELEMENT (TLE) FILE (TLE\_YYYYMMDD\_HHMN.TXT)

The TLE files contain the NORAD Two-Line Element sets. They are fully consistent with the SGP4 or SDP4 orbital extrapolation models. They are named `tle_YYYYMMDD_hhmn.txt`, where `YY/MM/DD` at time `hh:mn` is the reception date of the file.

The TLE files are available at <http://www.celestrak.com> or at <http://www.space-track-org> .

The TLE files are multi-satellite and contain 2 lines per satellite with several fields. The TLE format is fully described at <http://www.celestrak.com> in the section “Frequently Asked Questions: Two-line Element Set Format”.

The format is summarized here:

Line 1:

format

(i1,1x,i5,a1,1x,a8,1x,i2,f12.8,1x,f10.8,2(1x,f6.5,i2),1x,i1,1x,i4,i1)

line1\_id - line number of element data

tle\_satnumber - satellite number (TLE)

tle\_satclas - satellite classification

tle\_intdes - International designator (3 parts)

year - Epoch last 2 digits of year

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day\_of\_year - Epoch day of year and fractional portion of day  
 tle\_ftdmm - first time derivative of the mean motion  
 tle\_stdmm - second time derivative of the mean motion  
 stdmm\_exp - ..... exponent  
 tle\_bstar - BSTAR drag term  
 bstar\_exp - ..... exponent  
 tle\_ephtype - ephemeris type  
 tle\_elemnum - element number  
 tle\_chksum1 - check sum line 1

Line 2

format

(i1,1x,i5,2(1X,F8.4),1X,F7.7,2(1X,F8.4),1X,F11.8,i5,i1)

line2\_id - line number of element data  
 tle\_satnumber - satellite number (TLE)  
 tle\_inclin - inclination  
 tle\_rigasc - right ascension of the ascending node  
 tle\_eccent - eccentricity  
 tle\_argper - argument of perigee  
 tle\_meanano - mean anomaly  
 tle\_meanmotion - mean motion  
 tle\_orbnum - orbit number at epoch  
 tle\_chksum2 - check sum line 2

(See also information in *tle.5* (directory *AAPP/man/man5*) and in the paragraph named “interfaces” of the *AAPP software description document*).

#### **4. FORMAT OF SPOT-5 ELEMENT (SPM) FILE (SPM YYYYMMDD HHMN.TXT)**

**Important note:** The use of SPM bulletins for METOP is being phased out. They will not be included for METOP-B, and will be withdrawn from the METOP-A Admin messages once METOP-B is operational. Users should instead migrate to the new Multi-Mission Administrative Messages (MMAM), which contains TLEs for both METOP and NOAA satellites. See the EUMETSAT web site for further information ([Home > Data Access > Direct Dissemination > Multi-Mission Administrative Message](#)).

The SPM files contain the EUMETSAT SPOT-5 Element sets. They are fully consistent with the SPOT orbital extrapolation models. They are named *spm\_yyyymmdd\_hhmn.txt*, where *yyy/mm/dd* at time *hh:mn* is the reception date of the file.

The SPM information is contained in the METOP ADMIN CCSDS packets. They are only valid for METOP satellites. The text file considered here is a human readable version of the binary Admin file.

The format is summarized here:

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All lines preceding the target header line are ignored in the decoding routines:

Target header line:

! Spot parameters epoch time MJD-2000

Line 1, free format:

day - epoch day MJD2000  
sec - seconds of day  
ms - micro-seconds

Line 2, free format:

order - order number [1, 2, 3] of bulletin in file

Line 3, free format:

elem - 13 SPOT elements (degrees, days, km)

## **5. FORMAT OF RAW NOAA DATA LEVEL 0 FILE**

The raw NOAA data level 0 format is closely connected to the hardware of each acquisition centre. It encloses unpacked HRPT minor frames. An HRPT minor frame is an array of 11090 words, made of the 10 bits HRPT words right justified in 16 bit words. The HRPT minor frame format is detailed in the NOAA KLM User's Guide – Section 4.1 for NOAA KLM satellites (<http://www2.ncdc.noaa.gov:80/docs/klm/>) and in the NOAA Polar Orbiter Data User's Guide – section 3.2 for pre-NOAA KLM satellites (<http://www2.ncdc.noaa.gov/docs/podug/>).

## **6. FORMAT OF RAW METOP DATA LEVEL 0 FILE**

For METOP direct readout, the interface to AAPP is at “EPS Level 0”. The user reception system is assumed to have the capability of receiving the METOP AHRPT data stream and converting to EPS Level 0 format as defined by EUMETSAT, with one file for one instrument. The level 0 contains the raw instrument data. It is described in the EUMETSAT documentation:

<http://www.eumetsat.int> Home → Data & Products → Resources: Document EPS:GGS.SPE.96167.

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## 7. FORMAT OF HRPT.L1B FILE

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

HRPT.11a format = HRPT.11b format (in HRPT.11a, calibration and location fields are empty).

### Header and record length

Header length = record length

22016 bytes (does not respect 1B NOAA size)

### Type

C = character

I2 = integer\*2

I4 = integer\*4

### Header Record

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>GENERAL INFORMATION</b>				
avh_h_siteid	C	3	1	Data set creation site ID
avh_h_blank	C	1	1	ASCII blank
avh_h_11bversnb	I2	2	1	level 1b format version number
avh_h_11bversyr	I2	2	1	level 1b format version year
avh_h_11bversdy	I2	2	1	level 1b format version day of year
avh_h_reclg	I2	2	1	record length
avh_h_blksz	I2	2	1	reserved for block size
avh_h_hdrent	I2	2	1	count of header records in data set
avh_h_filler0	I2	2	3	Unassigned (no value)
avh_h_dataname	C	42	1	data set name
avh_h_prblkid	C	8	1	processing block identification
avh_h_satid	I2	2	1	Spacecraft identification code 4=NOAA-15 (NOAA-K) 2=NOAA-16 (NOAA-L) 6=NOAA-17 (NOAA-M) 7=NOAA-18 (NOAA-N) 8=NOAA-19 (NOAA-N') 11=Metop-B (Metop-1) 12=Metop-A (Metop-2) 13=Metop-C (Metop-3) 14=Metop simulator
avh_h_instid	I2	2	1	instrument identification
avh_h_datatyp	I2	2	1	data type code



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				(1 = LAC; 2 = GAC; 3 = HRPT)
avh_h_tipsrc	I2	2	1	TIP source code (0 = not applicable; 1 = GAC embedded; 2 = stored; 3 = third CDA; 4 = HRPT embedded)
avh_h_startdatajd	I4	4	1	start of data set day count from 00h,1 Jan 1950
avh_h_startdatayr	I2	2	1	start of data set year
avh_h_startdatady	I2	2	1	start of data set day of year
avh_h_startdatatime	I4	4	1	start of data set UTC time of day in milliseconds
avh_h_enddatajd	I4	4	1	end of data set day count from 00h,1 Jan 1950
avh_h_enddatayr	I2	2	1	end of data set year
avh_h_enddatady	I2	2	1	end of data set day of year
avh_h_enddatatime	I4	4	1	end of data set UTC time of day in milliseconds
avh_h_cpidsyr	I2	2	1	year of Last CPIDS Update
avh_h_cpidsdy	I2	2	1	Day of Year of Last CPIDS Update
avh_h_filler1	I2	2	4	Unassigned (no value)
<b>DATA SET QUALITY INDICATORS</b>				
avh_h_inststat1	I4	4	1	first instrument status bit 15 : motor/telemetry (0 = off; 1 = on) bit 14 : electronics/telemetry (0 = off; 1 = on) bit 13 : channel 1 status (0 = disable; 1 = enable) bit 12 : channel 2 status (0 = disable; 1 = enable) bit 11 : channel 3A status (0 = disable; 1 = enable) bit 10 : channel 3B status (0 = disable; 1 = enable) bit 9 : channel 4 status (0 = disable; 1 = enable) bit 8 : channel 5 status (0 = disable; 1 = enable)
avh_h_filler2	I2	2	1	Unassigned (no value)
avh_h_statchrecnb	I2	2	1	record number of status change ( if 0, none occurred)
avh_h_inststat2	I4	4	1	second instrument status ( if previous word is 0, no change)
avh_h_scnlin	I2	2	1	count of scan lines in this data set
avh_h_calloccnlin	I2	2	1	count of calibrated, Earth located scan lines in this data set
avh_h_misscnlin	I2	2	1	count of missing scan lines
avh_h_datagaps	I2	2	1	count of data gaps in this data set

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avh_h_okdatafr	I2	2	1	count of data frames without frame sync word errors
avh_h_pacsparityerr	I2	2	1	count of PACS detected TIP parity errors
avh_h_auxsyncerrsum	I2	2	1	sum of all auxiliary sync errors detected in the input data
avh_h_timeseqerr	I2	2	1	time sequence error (0 = none; otherwise the record number of the first occurrence)
avh_h_timeseqerrcode	I2	2	1	time sequence error code
avh_h_socclockupind	I2	2	1	socc clock update indicator (0 = none during this orbit; otherwise the record number of the first occurrence)
avh_h_locerrind	I2	2	1	Earth location error indicator (0 = none during this orbit; otherwise the record number of the first occurrence)
avh_h_locerrcode	I2	2	1	Earth location error code
avh_h_pacsstatfield	I2	2	1	PACS status bit field bit 15-3 : spare bit 2 : pseudo noise (0 = normal data; 1 = P/N data) bit 1 : tape direction (0 = time decrementing) bit 0 : data mode (0 = test data; 1 = flight data)
avh_h_pacsdatasrc	I2	2	1	PACS data source (0 = unused; 1 = Gilmore; 2 = Wallops; 3 = SOCC)
avh_h_filler3	I4	4	1	Unassigned (no value)
avh_h_spare1	C	8	1	spare (reserved for ingester)
avh_h_spare2	C	8	1	spare (reserved of the decommutation)
avh_h_filler4	I2	2	5	Unassigned (no value)
<b>CALIBRATION</b>				
avh_h_racalind	I2	2	1	ramp/auto calibration indicators bit field bit 5: ramp non-linearity for GAC, LAC, and HRPT channel 5 bit 4: ramp non-linearity for GAC, LAC, and HRPT channel 4 bit 3: ramp non-linearity for GAC, LAC, and HRPT channel 3B bit 2: ramp non-linearity for GAC, LAC, and HRPT channel 3A bit 1: ramp non-linearity for GAC, LAC, and HRPT channel 2 bit 0: ramp non-linearity for GAC, LAC, and HRPT channel 1
avh_h_solarcalyr	I2	2	1	year of most recent solar channel

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				calibration
avh_h_solarcaldy	I2	2	1	day of year of most recent solar channel calibration
avh_h_pcalalgind	I2	2	1	primary calibration algorithm identification
avh_h_pcalalgopt	I2	2	1	primary calibration algorithm option selected
avh_h_scalalgind	I2	2	1	secondary calibration algorithm identification
avh_h_scalalgopt	I2	2	1	secondary calibration algorithm option selected
avh_h_irrtcoef	I2	2	6*4	IR Target Temperature Conversion Coefficients scaling factor of $avh\_h\_irrtcoef(1,*) = 10^2$ $avh\_h\_irrtcoef(2,*) = 10^5$ $avh\_h\_irrtcoef(3,*) = 10^8$ $avh\_h\_irrtcoef(4,*) = 10^{11}$ $avh\_h\_irrtcoef(5,*) = 10^{14}$ $avh\_h\_irrtcoef(6,*) = 10^{17}$
avh_h_filler5	I4	4	2	Unassigned (no value)
<b>RADIANCE TO TEMPERATURE CONVERSION</b>				
avh_h_albcnv	I4	4	2*3	albedo conversion order of channels : 1, 2, 3A. for nochannel = 1 to 3A : $10^1 \times$ (albedo-radiance nochannel solar filtered irradiance in wavelength) $10^3 \times$ (albedo-radiance nochannel equivalent filter width in wavelength)
avh_h_radtempcnv	I4	4	3*3	radiance to temperature conversion order of channels : 3B, 4, 5. for nochannel = 3B to 5: $10^2 \times$ (temperature-radiance nochannel central wavenumber Ch3b) or $10^3 \times$ (temperature-radiance nochannel central wavenumber Ch4,5) $10^5 \times$ (temperature-radiance nochannel constant 1) $10^6 \times$ (temperature-radiance nochannel constant 2) <i>Note: prior to v5, constant 1 and constant 2 contained the temp-&gt;radiance constants not radiance-&gt;temp</i>
avh_h_filler6	I4	4	3	Unassigned (no value)
<b>NAVIGATION</b>				
avh_h_modelid	C	8	1	Reference Ellipsoid Model ID ="GRS 80" in the actual version of AAPP
avh_h_nadlctol	I2	2	1	10 x (nadir Earth location tolerance in kilometers)

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avh_h_locbit	I2	2	1	Earth location bit field bit 0 : attitude error correction (0 = not corrected)
avh_h_filler7	I2	2	1	Unassigned (no value)
avh_h_rollerr	I2	2	1	10 <sup>3</sup> x (constant roll attitude error in degrees)
avh_h_pitcherr	I2	2	1	10 <sup>3</sup> x (constant pitch attitude error in degrees)
avh_h_yawerr	I2	2	1	10 <sup>3</sup> x (constant yaw attitude error in degrees)
avh_h_epoyr	I2	2	1	epoch year for orbit vector
avh_h_epody	I2	2	1	day of epoch year for orbit vector
avh_h_epotime	I4	4	1	Epoch UTC Time of day in milliseconds for Orbit Vector
avh_h_smaxis	I4	4	1	10 <sup>5</sup> x (semi-major axis in kilometers)
avh_h_eccen	I4	4	1	10 <sup>8</sup> x (eccentricity)
avh_h_incli	I4	4	1	10 <sup>5</sup> x (inclination in degrees)
avh_h_argper	I4	4	1	10 <sup>5</sup> x (argument of perigee in degrees)
avh_h_rascnod	I4	4	1	10 <sup>5</sup> x (right ascension of the ascending node in degrees)
avh_h_manom	I4	4	1	10 <sup>5</sup> x (mean anomaly in degrees)
avh_h_xpos	I4	4	1	10 <sup>5</sup> x (position vector x component in kilometers)
avh_h_ypos	I4	4	1	10 <sup>5</sup> x (position vector y component in kilometers)
avh_h_zpos	I4	4	1	10 <sup>5</sup> x (position vector z component in kilometers)
avh_h_xvel	I4	4	1	10 <sup>8</sup> x (velocity vector x-dot component in kilometers/second)
avh_h_yvel	I4	4	1	10 <sup>8</sup> x (velocity vector y-dot component in kilometers/second)
avh_h_zvel	I4	4	1	10 <sup>8</sup> x (velocity vector z-dot component in kilometers/second)
avh_h_earthsun	I4	4	1	10 <sup>6</sup> x (Earth/sun distance ratio)
avh_h_filler8	I4	4	4	Unassigned (no value)
<b>ANALOG TELEMETRY CONVERSION</b>				
avh_h_pchtemp	I2	2	5	patch temperature coef
avh_h_reserved1	I2	2	1	(reserved) Unassigned (no value)
avh_h_pchtempext	I2	2	5	patch temperature extended coef.
avh_h_reserved2	I2	2	1	(reserved) Unassigned (no value)
avh_h_pchpow	I2	2	5	patch power coef
avh_h_reserved3	I2	2	1	(reserved) Unassigned (no value)
avh_h_rdttemp	I2	2	5	radiator temperature coef.
avh_h_reserved4	I2	2	1	(reserved) Unassigned (no value)
avh_h_bbtemp1	I2	2	5	black body temperature 1 coef.
avh_h_reserved5	I2	2	1	(reserved) Unassigned (no value)
avh_h_bbtemp2	I2	2	5	black body temperature 2 coef.

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avh_h_reserved6	I2	2	1	(reserved) Unassigned (no value)
avh_h_bbtemp3	I2	2	5	black body temperature 3 coef.
avh_h_reserved7	I2	2	1	(reserved) Unassigned (no value)
avh_h_bbtemp4	I2	2	5	black body temperature 4 coef.
avh_h_reserved8	I2	2	1	(reserved) Unassigned (no value)
avh_h_eleccur	I2	2	5	electronics current coef.
avh_h_reserved9	I2	2	1	(reserved) Unassigned (no value)
avh_h_motorcur	I2	2	5	motor current coef.
avh_h_reserved10	I2	2	1	(reserved) Unassigned (no value)
avh_h_earthpos	I2	2	5	earth shield position coef.
avh_h_reserved11	I2	2	1	(reserved) Unassigned (no value)
avh_h_electemp	I2	2	5	electronics temperature coef.
avh_h_reserved12	I2	2	1	(reserved) Unassigned (no value)
avh_h_ctypep	I2	2	5	cooler housing temperature coef.
avh_h_reserved13	I2	2	1	(reserved) Unassigned (no value)
avh_h_bptemp	I2	2	5	baseplate temperature coef.
avh_h_reserved14	I2	2	1	(reserved) Unassigned (no value)
avh_h_mhtemp	I2	2	5	motor housing temperature coef.
avh_h_reserved15	I2	2	1	(reserved) Unassigned (no value)
avh_h_adcontemp	I2	2	5	A/D converter temperature coef.
avh_h_reserved16	I2	2	1	(reserved) Unassigned (no value)
avh_h_d4bvolt	I2	2	5	detector #4 bias voltage coef.
avh_h_reserved17	I2	2	1	(reserved) Unassigned (no value)
avh_h_d5bvolt	I2	2	5	detector #5 bias voltage coef.
avh_h_reserved18	I2	2	1	(reserved) Unassigned (no value)
avh_h_bbtempchn3B	I2	2	5	black body temperature channel 3B coef.
avh_h_reserved19	I2	2	1	(reserved) Unassigned (no value)
avh_h_bbtempchn4	I2	2	5	black body temperature channel 4 coef.
avh_h_reserved20	I2	2	1	(reserved) Unassigned (no value)
avh_h_bbtempchn5	I2	2	5	black body temperature channel 5 coef.
avh_h_reserved21	I2	2	1	(reserved) Unassigned (no value)
avh_h_refvolt	I2	2	5	reference voltage coef.
avh_h_reserved22	I2	2	1	(reserved) Unassigned (no value)
<b>FILLER</b>				
avh_h_filler9	I2	2	10664	filler bytes to equal data record length Unassigned (no value)

**One Data Record for one AVHRR scan line**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>SCAN LINE INFORMATION</b>				
avh_scnlin	I2	2	1	Scan line number

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avh_scnlinyr	I2	2	1	Scan line year
avh_scnlindy	I2	2	1	Scan line day of year
avh_clockdrift	I2	2	1	satellite clock drift delta in milliseconds
avh_scnlintime	I4	4	1	Scan line UTC time of day in milliseconds
avh_scnlinbit	I2	2	1	scan line bit field bit 15 : (0 = ascending data; 1 = descending data) bit 14 : (1 = scan time corrected for clock drift) bit 13 : (1 = Earth location corrected for TIP attitude) bit 0 : channel 3 select (0 = 3A; 1 = 3B)
avh_filler0	I2	2	5	Unassigned (no value)
<b>QUALITY INDICATORS</b>				
integer avh_qualind	I4	4	1	quality indicator bit field bit 31 : (1 = do not use data for product generation) bit 30 : (1 = time sequence error detected in this frame) bit 29 : (1 = data gap precedes this frame) bit 28 : (1 = insufficient data for calibration) bit 27 : (1 = Earth location data not available) bit 26 : (1 = sync lock dropped during this frame) bit 25 : (1 = frame sync word error greater than zero) bit 24 : (1 = frame sync previously dropped lock) bit 23 : (1 = flywheeling detected during this frame) bit 22 : (1 = bit slippage detected during this frame) bit 9 : tip parity in first minor frame bit 8 : tip parity in second minor frame bit 7 : tip parity in third minor frame bit 6 : tip parity in fourth minor frame bit 5 : tip parity in fifth minor frame bit 4 : (1 = reflected sunlight detected channel 3B) bit 3 : (1 = reflected sunlight detected channel 4) bit 2 : (1 = reflected sunlight detected channel 5) bit 1 : (1 = resync occurred on this frame) bit 0 : (1 = pseudo noise occurred on this frame)
avh_scnlinqual	I4	4	1	Scan line quality flags <b>Time Problem Code</b>

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				<p>bit 31-24 : spare          bit 23 : time field is bad but can probably be inferred from the previous good time          bit 22 : time field is bad and can't be inferred from the previous good time          bit 21 : this record starts a sequence that is inconsistent with previous time (i.e., there is a time discontinuity).this may or may not associated with a spacecraft clock update.(see bit 26 above)          bit 20 : start of a sequence that apparently repeats scan times that have been previously accepted.          bit 19-16 : spare</p> <p><b>Calibration Problem Code</b>          (all bits set to 0 indicates normal calibration)          bit 15 : scan line was not calibrated because of bad time          bit 14 : scan line was calibrated using fewer than the preferred number of scan lines because of proximity to start or end of data set or to a data gap          bit 13 : scan line was not calibrated because of bad or insufficient PRT data          bit 12 : scan line was calibrated but with marginal PRT data          bit 11 : some uncalibrated channels on this scan (see channel indicators)          bit 10 : spare          bit 09 : spare          bit 08 : spare</p> <p><b>Earth location Problem Code</b>          (all bits set to 0 implies the earth location was normal)          bit 07 : not Earth located because of bad time          bit 06 : Earth location questionable because of questionable time code          (see time problem flags above)          bit 05 : Earth location questionable -- only marginal agreement with reasonableness check          bit 04 : Earth location questionable -- fails reasonableness check          bit 03-00 : spare</p>
avh_calqual	I2	2	3	calibration quality flags order of channels : 3B, 4, 5. (all bits off implies a good calibration)

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				bit 7 : this channel is not calibrated bit 6 : this channel is calibrated but questionable bit 5 : not good blackbody count for scan line bit 4 : not good space view counts for scan line bit 3 : insufficient PRT data bit 2 : some bad blackbody view counts for this line bit 1 : some bad space view counts for this line bit 0 : some bad PRT data
avh_cbiterr	I2	2	1	count of bit errors in frame sync
avh_filler1	I4	4	2	Unassigned (no value)
<b>CALIBRATION COEFFICIENTS</b>				
avh_calvis	I4	4	5*3*3	Calibration coeff for the visible channel 1 3 samples of coefficients: First index (i=1) : operational set Second index (i=2) : test set Third index (i=3) : prelaunch set  index number i: 1: $10^{10} x$ ( slope 1) 2 $10^7 x$ (intercept 1) 3 $10^{10} x$ (slope 2) 4 $10^7 x$ (intercept 2) 5 intersection  Calibration coeff for the visible channel 2 The same 3 samples of coefficients  Calibration coeff for the visible channel 3A The same 3 samples of coefficients  <i>Note: Because the "slope 2" for channel 3A can exceed the size of a signed 4-byte integer, from AAPP v7 onwards the software treats this as an unsigned integer, i.e. if it is negative the user should apply the <math>10^{-10}</math> scaling and add 0.4294967296 to the resulting slope value.</i>
avh_calir	I4	4	3*2*3	Calibration coefficients for the IR channels Order of the channels: 3B, 4, 5 2 samples of coefficients: operational set, test set  <b>Case 1:</b> Only for the CMS and for data before the 27 January 1999 12 UTC (for archive data) $10^6 x$ (IR calibration nochannel coefficient 1,



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				<p>operational)  <math>10^6</math> x (IR calibration nochannel coefficient 2, operational)  <math>10^6</math> x (IR calibration nochannel coefficient 3, operational)  <math>10^6</math> x (IR calibration nochannel coefficient 1, test)  <math>10^6</math> x (IR calibration nochannel coefficient 2, test)  <math>10^6</math> x (IR calibration nochannel coefficient 3, test)</p> <p><b>If not case 1:</b>  <math>10^9</math> x (IR calibration nochannel coefficient 1, operational)  <math>10^6</math> x (IR calibration nochannel coefficient 2, operational)  <math>10^6</math> x (IR calibration nochannel coefficient 3, operational)  <math>10^9</math> x (IR calibration nochannel coefficient 1, test)  <math>10^6</math> x (IR calibration nochannel coefficient 2, test)  <math>10^6</math> x (IR calibration nochannel coefficient 3, test)</p>
avh_filler2	I4	4	3	<p>the exponents of the IR calibration coefficients.</p> <p>In AAPP, in the case 1 defined in the previous element, avh_filler2(1)=6          avh_filler2(1)=6          avh_filler2(1)=6          in the case 1 defined in the previous element, avh_filler2(1)=9          avh_filler2(1)=6          avh_filler2(1)=6</p>
<b>NAVIGATION</b>				
avh_navstat	I4	4	1	<p>Navigation Status Bit Field          bits 31-17: zero fill          bit 16: Earth location corrected for TIP Euler Angles          bits 15 - 12: Earth location indicator          (0 = Earth location available;          1 = user ephemeris files greater than 24 hours old;          2 = no Earth location available)          bits 11 - 8: spacecraft attitude control          (0 = operating in YGC or NOMINAL mode;          1 = operating in another mode</p>

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				2 = attitude exceeds nominal tolerance; 3 = both 1 and 2) bits 7 - 4: attitude SMODE (0 = NOMINAL mode; 1 = rate nulling mode; 2 = YGC mode; 3 = search mode; 4 = coast mode) bits 3 - 0: attitude PWT1P\$AC (0 = NOMINAL mode/no test; 1 = yaw axis test in progress; 2 = roll axis test in progress; 3 = pitch axis test in progress)
avh_attangtime	I4	4	1	Time associated with TIP Euler angles(seconds)
avh_rollang	I2	2	1	10 <sup>3</sup> xRoll Angle in Degrees
avh_pitchang	I2	2	1	10 <sup>3</sup> xPitch Angle in Degrees
avh_yawang	I2	2	1	10 <sup>3</sup> xYaw Angle in Degrees
avh_scalti	I2	2	1	10 x Spacecraft Altitude (MSL) in km in this scan line.
avh_ang	I2	2	3*51	set of 3 angles in degrees for point 25 to point 2025 every 40 points first angle : 10 <sup>2</sup> x (solar zenith angle ) second angle : 10 <sup>2</sup> x (satellite zenith angle ) third angle : 10 <sup>2</sup> x (relative azimuth angle )
avh_filler3	I2	2	3	Unassigned (no value)
avh_pos	I4	4	2*51	lat/lon pair in degrees for point 25 to point 2025 every 40 points first : 10 <sup>4</sup> x (latitude ) second : 10 <sup>4</sup> x (longitude ) (North latitude and East longitude are positive)
avh_filler4	I4	4	2	Unassigned (no value)
<b>HRPT MINOR FRAME TELEMETRY</b>				
avh_telem	I2	2	103	telemetry data (HRPT minor frame format) it corresponds to the 103 first 10 bit words from HRPT. They are packed three (10 bit) words in four bytes, right justified.
avh_filler5	I2	2	1	Unassigned (no value)
<b>AVHRR SENSOR DATA</b>				
avh_hrpt or avh_video	I2	2	5*2048	Sensor Data, Band Interleaved by Pixel (BIP) set of 5 channels every point
avh_filler6	I4	4	2	Unassigned (no value)
<b><i>THIS PART DOES NOT RESPECT THE NOAA 1B FORMAT SPECIFICATION BUT IT KEEPS THE POSSIBILITY TO DERIVE THE ANALOG AND DIGITAL TELEMETRY STRUCTURE</i></b>				
<b>TIP MINOR FRAME HEADER</b>				
avh_tipmfhd	I2	2	7*5	the following sequence is repeated 5 times : words 1 to 3 : bit 47-28 : TIP minor frame sync

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				bit 27-24 : satellite address bit 23 : command verification status bit 22-21 : TIP status bit 20-18 : TIP major frame counter bit 17-09 : dwell mode address bit 08-00 : TIP minor frame counter word 4 : command verification words 5 to 7 : bit 47-40 : 3.2 second digital B subcom1 bit 39-32 : 32 second analog subcom bit 31-24 : 16 second analog subcom bit 23-16 : 1 second analog subcom bit 15-08 : 3.2 second digital B subcom 2 bit 07-00 : 16 second analog subcom 2
<b>CPU TELEMETRY</b>				
avh_cputel equivalent to avh_icputel	C  I2	6  2	2*5  6*5	the following sequence is repeated 5 times : first : CPU-A telemetry (words TIP 46-51) second : CPU-B telemetry (words TIP 96-101)
avh_filler7	I2	2	67	Unassigned (no value)

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## **8. DIFFERENCES BETWEEN THE HRPT.L1B FORMAT OF NOAA AND THE HRPT.L1B FORMAT OF AAPP**

The comparison was done with:

- HRPT.11b format of NOAA version: NOAA KLM user's guide after amendments of September 24, 2001
- HRPT.11b format of NOAA version: AAPP version .3.3
- No change of HRPT.11b format between the AAPP version 3.3 and the AAPP version 4.

The first difference between AAPP HRPT 11b and NOAA HRPT 11b is :

AAPP has no missing record. It fills records even if scan lines are missing.

NOAA HRPT 11b can have missing records (do not use the module `chk1btime` – after the end of the decommutation task - with NOAA HRPT.11b)

Note: The names of parameters are those defined in the include `avh1b.h`

Despite the differences that are detailed below it is possible to convert the NOAA '16-bit unpacked' format – HRPT or LAC – to a format that is broadly compatible with AAPP as follows:

1. Strip off the trailing 512 bytes from each NOAA record (tool `hrpt1b_noaa.exe` in AAPP v5)
2. Re-calibrate using `avhrcl`, but without the Earth location option, i.e. `avhrcl -c -s noaa...`

### **Record Length**

	HRPT.11b of AAPP	HRPT.11b of NOAA
Total number of header record ( <code>avh_h_hdrcnt</code> )	1	1
Length of the header record	22016 bytes	15872 for packed datasets 22528 for unpacked datasets
Length of a data record	22016 bytes	15872 for packed datasets 22528 for unpacked datasets

### **Header Record**

The differences are for the following variables:

**avh\_h\_reclg:**                    22016 for AAPP  
   22528 for NOAA

**avh\_h\_datatyp:**                always equal to 3 in AAPP (data type code always HRPT)

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- avh\_h\_tipsrc:** always equal to 4 in AAPP (TIP source code always stored AIP)
- avh\_h\_inststat1:** 2 possible values for AAPP for bits15-0  
1111 1011 0000 0000 → channel 3a is enabled  
or 1111 0111 0000 0000 → channel 3b is enabled
- avh\_h\_inststat2:** 2 possible values for AAPP for bits15-0  
1111 1011 0000 0000 → channel 3a is enabled  
or 1111 0111 0000 0000 → channel 3b is enabled
- avh\_h\_calloccsnlin:** always equal to avh\_h\_scnlin in AAPP
- avh\_h\_pcalalgind:** always equal to 0 in AAPP
- avh\_h\_pcalalgot:** always equal to 0 in AAPP
- avh\_h\_scalalgind:** always equal to 0 in AAPP
- avh\_h\_scalalgot:** always equal to 0 in AAPP
- avh\_h\_modelid:** equal to GRS80 in AAPP
- avh\_h\_nadloctol:** always equal to 0 in AAPP
- avh\_h\_locbit:** bits15-1 always equal to 0 in AAPP  
bit 0 equal 1 for attitude error correction  
equal 0 if option of navigation is off in AAPP
- avh\_h\_radtempcnv:** prior to AAPP v5, this contained the temperature to radiance band corrections coefs, whereas NESDIS 1b contains radiance to temperature. AAPP and NESDIS are the same in AAPP v5 and later.

List of not initialised parameters in AAPP :

- avh\_h\_instid**
- avh\_h\_pacsparityerr**
- avh\_h\_auxsyncerrsum**
- avh\_h\_timeseqerrcode**
- avh\_h\_socclockupind**
- avh\_h\_locerrind**
- avh\_h\_locerrcode**
- avh\_h\_pacsstatfield**
- avh\_h\_pacsdatasrc**
- avh\_h\_racalind**

**avh\_h\_pchtemp(5)**  
**avh\_h\_pchtempext(5)**  
**avh\_h\_chpow(5)**  
**avh\_h\_rdtemp(5)**  
**avh\_h\_bbtemp1(5)**  
**avh\_h\_bbtemp2(5)**  
**avh\_h\_bbtemp3(5)**  
**avh\_h\_bbtemp4(5)**  
**avh\_h\_eleccur(5)**  
**avh\_h\_motorcur(5)**  
**avh\_h\_earthpos(5)**  
**avh\_h\_electemp(5)**  
**avh\_h\_chttemp(5)**  
**avh\_h\_bptemp(5)**  
**avh\_h\_mhtemp(5)**  
**avh\_h\_adcontemp(5)**  
**avh\_h\_d4bvolt(5)**  
**avh\_h\_d5bvolt(5)**  
**avh\_h\_bbtempchn3b(5)**  
**avh\_h\_bbtempchn4(5)**  
**avh\_h\_bbtempchn5(5)**  
**avh\_h\_refvolt(5)**

All “blank”, filler or reserved parameters:

**avh\_h\_blkksz**  
**avh\_h\_filler0(3)**  
**avh\_h\_filler1(4)**  
**avh\_h\_filler2**  
**avh\_h\_filler3**  
**avh\_h\_spare1**  
**avh\_h\_spare2**  
**avh\_h\_filler4(5)**  
**avh\_h\_filler5(2)**

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**avh\_h\_filler6(3)**  
**avh\_h\_filler7**  
**avh\_h\_filler8(4)**  
**avh\_h\_reserved1,...,22**

**Data Record**

The differences are for the following variables:

- avh\_scnlinbit :** In AAPP, bits 1 and 0 are different from those of NOAA  
AAPP : bits 1-0 : channel 3 select with 0=3a , 1=3b , 2=transition  
NOAA :bits 1-0 : channel 3 select with 0=3b , 1=3a , 2=transition
- avh\_qualind :** bits 28,26,24,23,22,21,20,4,3,2,0 are not initialised in AAPP  
bit 25 : AAPP : = 1 if frame sync. errors  
NOAA : =1 if instrument status changed with this scan  
bits 9-5 : AAPP : = 1 if TIP parity errors  
NOAA : bit 9 zero fill  
bit 8 : TIP parity error detected  
bit 7-2 : reflected sunlight detected ch3b , ch4 , ch5
- avh\_scnlinqual :** All the bits are set to zero in AAPP
- avh\_calvis(5,3,3) :** AAPP :Visible operational and visible test calibration coefficients  
are always set to zero → avh\_calvis(\*,1 or 2,\*) = 0  
Scaling factor are 10<sup>10</sup> and 10<sup>7</sup>  
NOAA : Scaling factor are 10<sup>7</sup> and 10<sup>6</sup>
- avh\_calir(3,2,3) :** AAPP :The second set of coefficients are the mean coefficients of the sub-block  
NOAA : The second set of coefficients are test coefficients  
AAPP : Scaling factor are 10<sup>9</sup> , 10<sup>6</sup> , 10<sup>6</sup>  
Note they are equal to 10<sup>6</sup> , 10<sup>6</sup> , 10<sup>6</sup>  
if (avh\_h\_siteid.eq.'CMS' .and. avh\_h\_startdatajd.lt.17923.5)

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NOAA : Scaling factor are  $10^6$  ,  $10^6$  ,  $10^6$

**avh\_filler2(3)** : AAPP : It stores the 3 exponents of the scaling factor of avh\_calir. Contains 9,6,6  
NOAA : zero fill

**avh\_navstat** : AAPP : bits 31-14 and bits 12-0 are set to zero  
bit 13 = 1 if the scan line is not located

**avh\_hrpt(5,2048) and avh\_video(5\*2048)** :

For the NOAA 16-bit format the AAPP and NOAA sensor data are the same. For NOAA 10-bit format they are different:

AAPP : avh\_hrpt and avh\_video are integer\*2 words and there is 5\*2048 words

NOAA 10-bit : AVHRR sensor data words are integer\*4 words and there is 3414 words

No digital B telemetry in AAPP format

No analog housekeeping data in AAPP format

But avh\_tipmfhd(7,5) keeps the possibility to derive the analog and digital telemetry structure.

No clouds data from AVHRR in AAPP format

List of not initialised parameters in AAPP :

**avh\_calqual(3)**

**avh\_cputel(2,5)**

Filler parameters

**avh\_filler0(5)**

**avh\_filler1(2)**

**avh\_filler3(3)**

**avh\_filler4(2)**

**avh\_filler5**

**avh\_filler6(2)**

**avh\_filler7(191)**



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**9. FORMAT OF HIRS.L1B FILE, OUTPUT OF THE FIRST HIRS CALIBRATION ALGORITHM**

(See also general information in the paragraph named “Interfaces” of the *AAPP software description document*)

HIRS.11a format = HIRS.11b format (in HIRS.11a, calibration and location fields are empty).

Header and record length

Header length = record length  
4608 bytes

Type

- C = character
- I1 = integer\*1 or byte
- I2 = integer\*2
- I4 = integer\*4

**Header Record**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>GENERAL INFORMATION</b>				
hrs_h_siteid	C	3	1	Data set creation site ID
hrs_h_blank	C	1	1	ASCII blank
hrs_h_11bversnb	I2	2	1	level 1b format version number
hrs_h_11bversyr	I2	2	1	level 1b format version year
hrs_h_11bversdy	I2	2	1	level 1b format version day of year
hrs_h_reclg	I2	2	1	record length
hrs_h_blksz	I2	2	1	(reserved for block size)
hrs_h_hdrcnt	I2	2	1	count of header records in this data set
hrs_h_filler0	I2	2	3	Unassigned (no value)
hrs_h_dataname	C	42	1	data set name
hrs_h_prblkid	C	8	1	processing block identification
hrs_h_satid	I2	2	1	Spacecraft identification code 4=NOAA-15 (NOAA-K) 2=NOAA-16 (NOAA-L) 6=NOAA-17 (NOAA-M) 7=NOAA-18 (NOAA-N) 8=NOAA-19 (NOAA-N') 11=Metop-B (Metop-1) 12=Metop-A (Metop-2) 13=Metop-C (Metop-3) 14=Metop simulator

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hrs_h_instid	I2	2	1	instrument ID
hrs_h_datatyp	I2	2	1	data type code 5=HIRS
hrs_h_tipsrc	I2	2	1	TIP source code 0=not applicable; 1=GAC embedded ; 2=stored ; 3=third CDA; 4=HRPT embedded
hrs_h_startdatajd	I4	4	1	start of data set Julian Day(00h,1jan50)
hrs_h_startdatayr	I2	2	1	start of data set year
hrs_h_startdatady	I2	2	1	start of data set day of the year
hrs_h_startdatatime	I4	4	1	start of data set UTC time of day in milliseconds
hrs_h_enddatajd	I4	4	1	end of data set Julian Day(00h,1jan50)
hrs_h_enddatayr	I2	2	1	end of data set year
hrs_h_enddatady	I2	2	1	end of data set day of the year
hrs_h_enddatatime	I4	4	1	end of data set UTC time of day in milliseconds
hrs_h_cpidsyr	I2	2	1	year of last CPIDS Update
hrs_h_cpidsdy	I2	2	1	day of year of last CPIDS Update
hrs_h_filler1	I2	2	4	Unassigned (no value)
<b>DATA SET QUALITY INDICATORS</b>				
hrs_h_inststat1	I4	4	1	instrument status
hrs_h_filler2	I2	2	1	Unassigned (no value)
hrs_h_statchrecnb	I2	2	1	record number of status change (if 0, none occurred)
hrs_h_inststat2	I4	4	1	second instrument status (if previous word is 0, no change)
hrs_h_scnlin	I2	2	1	count of scan lines in this data set
hrs_h_callocsclin	I2	2	1	count of calibrated, earth located scan lines in this data set
hrs_h_missclin	I2	2	1	count of missing scan lines
hrs_h_datagaps	I2	2	1	count of data gaps in this data set
hrs_h_okdatafr	I2	2	1	count of data frames without frame sync word errors
hrs_h_pacsparityerr	I2	2	1	count of PACS detected TIP parity errors
hrs_h_auxsyncerrsum	I2	2	1	sum of all auxiliary sync errors detected in the input data
hrs_h_timeseqerr	I2	2	1	time sequence error 0=none otherwise the record number of the first occurrence
hrs_h_timeseqerrcode	I2	2	1	time sequence error code
hrs_h_socclockupind	I2	2	1	socc clock update indicator 0=none during this orbit otherwise the record number of the first occurrence
hrs_h_locerrind	I2	2	1	Earth location error indicator

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				0=none during this orbit otherwise the record number of the first occurrence
hrs_h_locerrcode	I2	2	1	Earth location error code
hrs_h_pacsstatfield	I2	2	1	PACS status bit field bit 15-3 : spare (zero fill) bit 2 : pseudo noise 0=normal data 1=P/N data bit 1 : tape direction 0=time decrementing bit 0 : data mode 0=test data 1=flight data
hrs_h_pacsdatasrc	I2	2	1	Pacs data source 0=unused 1=Gilmore 2=Wallops 3=SOCC
hrs_h_filler3	I4	4	1	Unassigned (no value)
hrs_h_spare1	C	8	1	spare <reserved for the ingester>
hrs_h_spare2	C	8	1	spare <reserved of the decommutation>
hrs_h_filler4	I2	2	5	Unassigned (no value)
<b>CALIBRATION</b>				
hrs_h_autocalind	I2	2	1	ramp/auto calibration indicators bit 0 : auto calibration override switch for HIRS/3
hrs_h_solarcalyr	I2	2	1	year of most recent solar ch. calib.
hrs_h_solarcaldy	I2	2	1	day of year of most recent solar channel calibration
hrs_h_calinf	I4	4	4*20	calibration information order of the channels : 1, 17, 2, 3, 13, 4, 18, 11, 19, 7, 8,20, 10, 14, 6, 5, 15, 12, 16, 9. 10^6*(mean calibration slope of channel nochannel) 10^6*(standard deviation of calibration slope) 10^6*(b-sub-1 for channel nochannel) 10^6*(standard deviation of linear regression for b-sub-1 for channel nochannel)
hrs_h_filler5	I4	4	2	Unassigned (no value)
<b>TEMPERATURE TO RADIANCE CONVERSION</b>				
hrs_h_tempradcnv	I4	4	3*19	temperature-radiance conversion order of channels = 1,2,3,4,...,18,19 for nochannel = 1 to 19 : 10^6 x (nochannel central wavenumber for ch1 to ch 12) 10^5 x (nochannel central wavenumber for ch13 to ch 19)

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				10 <sup>6</sup> x (nochannel constant 1) 10 <sup>6</sup> x (nochannel constant 2)
hrs_h_20solfiltirrad	I2	2	1	10 <sup>6</sup> x (albedo-radiance ch20 solar filtered irradiance)
hrs_h_20equifiltwidth	I2	2	1	10 <sup>6</sup> x (albedo-radiance ch 20 equivalent filter width)
hrs_h_filler6	I4	4	1	Unassigned (no value)
<b>NAVIGATION</b>				
hrs_h_modelid	C	8	1	Reference Ellipsoid Model ID ="GRS 80" in the actual version of AAPP
hrs_h_nadlctol	I2	2	1	10*(nadir Earth location tolerance in kilometers)
hrs_h_locbit	I2	2	1	Earth location bit field bit 0: attitude error correction (0=not corrected)
hrs_h_filler7	I2	2	1	Unassigned (no value)
hrs_h_rollerr	I2	2	1	10 <sup>3</sup> x (constant roll attitude error (dg))
hrs_h_pitcherr	I2	2	1	10 <sup>3</sup> x (constant pitch attitude error (dg))
hrs_h_yawerr	I2	2	1	10 <sup>3</sup> x (constant yaw attitude error (dg))
hrs_h_epoyr	I2	2	1	epoch year for orbit vector
hrs_h_epody	I2	2	1	day of epoch year for orbit vector
hrs_h_epotime	I4	4	1	epoch UTC time of day in milliseconds for orbit vector
hrs_h_smaxis	I4	4	1	10 <sup>5</sup> x (semi-major axis in kilometers)
hrs_h_eccen	I4	4	1	10 <sup>8</sup> x (eccentricity)
hrs_h_incli	I4	4	1	10 <sup>5</sup> x (inclination in degrees)
hrs_h_argper	I4	4	1	10 <sup>5</sup> x (argument of perigee in degrees)
hrs_h_rascnod	I4	4	1	10 <sup>5</sup> x (right ascension of the ascending node in degrees)
hrs_h_manom	I4	4	1	10 <sup>5</sup> x (mean anomaly in degrees)
hrs_h_xpos	I4	4	1	10 <sup>5</sup> x (position vector X component in km)
hrs_h_ypos	I4	4	1	10 <sup>5</sup> x (position vector Y component in km)
hrs_h_zpos	I4	4	1	10 <sup>5</sup> x (position vector Z component in km)
hrs_h_xvel	I4	4	1	10 <sup>8</sup> x (velocity vector X-dot component in kilometers/seconds)
hrs_h_yvel	I4	4	1	10 <sup>8</sup> x (velocity vector Y-dot component in kilometers/seconds)
hrs_h_zvel	I4	4	1	10 <sup>8</sup> x (velocity vector Z-dot component in kilometers/seconds)
hrs_h_earthsun	I4	4	1	10 <sup>6</sup> x (earth/sun distance ratio)
hrs_h_filler8	I4	4	4	Unassigned (no value)
<b>ANALOG TELEMETRY CONVERSION</b>				
hrs_h_rdttemp	I2	2	6	radiator temp.conversion coefficients
hrs_h_bptemp	I2	2	6	base plate temp. conv. coef.
hrs_h_elttemp	I2	2	6	electronics temp. conv. coef.

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hrs_h_pchtemp	I2	2	6	patch temp. conv. coef.
hrs_h_fhcc	I2	2	6	filter housing controller current conv. coef.
hrs_h_scnmtemp	I2	2	6	scan motor temperature conv. coef.
hrs_h_fwtemp	I2	2	6	filter wheel motor temp. conv. coef.
hrs_h_p5v	I2	2	6	+5 VDC monitor conv. coef.
hrs_h_p10v	I2	2	6	+10 VDC TLM/DC/DC conv. conv.coef.
hrs_h_p75v	I2	2	6	+7.5 VDC TLM/DC/DC conv. conv. coef.
hrs_h_m75v	I2	2	6	-7.5 VDC TLM/DC/DC conv. conv. coef.
hrs_h_p15v	I2	2	6	+15 VDC monitor conv. coef.
hrs_h_m15v	I2	2	6	-15 VDC monitor conv. coef.
hrs_h_fwmcure	I2	2	6	filter wheel motor current conv. coef.
hrs_h_scmcur	I2	2	6	scan motor current conv. coef.
hrs_h_pchcpow	I2	2	6	patch controller power conv. coef.
hrs_h_filler9	I4	4	890	Unassigned (no value)

**One Data Record for one HIRS scan line**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>SCAN LINE INFORMATION</b>				
hrs_scnlin	I2	2	1	scan line number
hrs_scnlinyr	I2	2	1	scan line year
hrs_scnlindy	I2	2	1	scan line day of year
hrs_clockdrift	I2	2	1	satellite clock drift delta in milliseconds
hrs_scnlintime	I4	4	1	scan line UTC time of day in milliseconds
hrs_scnlinf	I2	2	1	scan line bit field bit 15 : =0 ascending dat =1 descending data bit 14 : =1 scan time corrected for clock drift bit 13-0 : <zero fill>
hrs_mjfrcnt	I2	2	1	major frame count
hrs_scnpos	I2	2	1	scan position number in 32 seconds cycle
hrs_scntyp	I2	2	1	scan type code 0 : Earth view 1 : space view 2 : cold black body view 3 : main black body view
hrs_filler1	I4	4	2	Unassigned (no value)
<b>QUALITY INDICATORS</b>				
hrs_qualind	I4	4	1	quality indicator bit field if a bit is on(=1) then the statement is true. bit 31: do not use scan for product generation bit 30: time sequence error detected with this scan

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				bit 29: data gap precedes this scan bit 28: no calibration bit 27: no earth location bit 26: first good time following a clock update bit 25: instrument status changed with this scan bit 24-0: <zero fill>
hrs_linqualflgs	I4	4	1	scan line quality flags if a bit is on(=1) then the statement is true  <b>time problem code :</b> (all bits off implies the scan time is as expected) bit31-24: <zero fill> bit 23: time field is bad but can probably be inferred from the previous good time bit 22: time field is bad and can't be inferred from the previous good time bit 21: this record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity). This may or may not be associated with a spacecraft clock update. (see bit 26 above) bit 20: start of a sequence that apparently repeats scan times that have been previously accepted. bits 19-16: <zero fill>  <b>calibration problem code :</b> (Note these bits complement the channel indicators; all bits set to 0 indicates normal calibration) bit 15: scan line was not calibrated because of bad time bit 14: scan line was calibrated using fewer than the preferred number of scan lines because of proximity to start or end of data set or to a data gap. bit 13: scan line was not calibrated because of bad or insufficient PRT data bit 12: scan line was calibrated but with marginal PRT data bit 11: some uncalibrated channels of this scan. See channel indicators. bit 10: uncalibrated due to instrument mode bits 9-8: <zero fill>

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				<p><b>Earth location problem code</b> (all bits set to 0 implies the Earth location was normal)</p> <ul style="list-style-type: none"> <li>bit 7: not Earth located because of bad time</li> <li>bit 6: Earth location questionable because of questionable time code (see time problem flags above)</li> <li>bit 5: Earth location questionable. Only marginal agreement with reasonableness check.</li> <li>bit 4: Earth location questionable. Fails reasonableness check</li> <li>bit 3-0: &lt;zero fill&gt;</li> </ul>
hrs_chqualflg	I2	2	20	<p>quality flag for each channel order of the channels: 1, 17, 2, 3, 13, 4, 18, 11, 19, 7, 8, 20, 10, 14, 6, 5, 15, 12, 16, 9.</p> <p>(all bits off implies a good calibration)</p> <ul style="list-style-type: none"> <li>bit 15-6: &lt;zero fill&gt;</li> <li>bit 5: all bad blackbody counts for scan line</li> <li>bit 4: all bad space view counts for scan line</li> <li>bit 3: all bad PRTs counts for scan line</li> <li>bit 2: marginal blackbody view counts for this line</li> <li>bit 1: marginal space view counts for this line</li> <li>bit 0: marginal PRTs counts for scan line</li> </ul>
hrs_mnfrqual	I1	1	64	<p>minor frame quality indicators for nel 0 to 63 (for bits 7 through 1,if bit is on(=1) then statement is true)</p> <ul style="list-style-type: none"> <li>bit 7 : 1 = this frame suspect due to a time error</li> <li>bit 6 : 1 = this frame contains data gap data fill</li> <li>bit 5 : 1 = this frame contains TIP dwell data fill</li> <li>bit 4 : 1 = data suspect due to PACS QC error</li> <li>bit 3 : 1 = mirror locked during this frame</li> <li>bit 2 : 1 = mirror position error during this frame</li> <li>bit 1 : 1 = mirror was moving during this frame</li> <li>bit 0 : minor word odd parity bit</li> </ul>
hrs_filler2	I4	4	4	Unassigned (no value)
<b>CALIBRATION COEFFICIENTS</b>				
hrs_calcof	I4	4	3*20	calibration coefficients order of the channels:

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				1, 17, 2, 3, 13, 4, 18, 11, 19, 7, 8, 20, 10, 14, 6, 5, 15, 12, 16, 9. - 10 <sup>12</sup> *the second one - 10 <sup>9</sup> *the first one - 10 <sup>6</sup> *the zeroth one
hrs_scalcof	I4	4	3*20	second calibration coefficients order of the channels: 1, 17, 2, 3, 13, 4, 18, 11, 19, 7, 8, 20, 10, 14, 6, 5, 15, 12, 16, 9. - 10 <sup>12</sup> *the second one - 10 <sup>9</sup> *the first one - 10 <sup>6</sup> *the zeroth one
hrs_filler3	I4	4	3	Unassigned (no value)
<b>NAVIGATION</b>				
hrs_navstat	I4	4	1	navigation status bit field bits15-12: earth location indicator 0=earth location available 1=user ephemerics files greater than 24hours old 2=no earth location available bits11-08: spacecraft attitude control 0=operating in YGC or nominal mode 1=operating in another mode 2=attitude exceeds nominal tolerance 3=both 1 and 2 bits07-04: attitude SMODE 0=nominal mode 1=rate nulling mode 2=YGC mode 3=search mode 4=coast mode bits03-00: attitude PWT1\$AC 0=nominal mode/no test 1=yaw axis test in progress 2=roll axis test in progress 3=pitch axis test in progress
hrs_attangtime	I4	4	1	time associated angles (seconds)
hrs_rollang	I2	2	1	10 <sup>3</sup> xRoll angle in degrees
hrs_pitchang	I2	2	1	10 <sup>3</sup> xPitch angle in degrees
hrs_yawang	I2	2	1	10 <sup>3</sup> xYaw angle in degrees
hrs_scalti	I2	2	1	10*spacecraft altitude (MSL) in km
hrs_ang	I2	2	168	scan angles in degrees word1: 100*solar zenith angle, point 1 word2: 100*satellite zenith angle, point 1 word3: 100*local azimuth angle, point 1 word4: 100*solar zenith angle, point 2 word5: 100*satellite zenith angle, point 2 word6: 100*local azimuth angle, point 2



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				..... word168: 100*solar zenith angle, point 56 word168: 100*satellite zenith angle, point 56 word168: 100*local azimuth angle, point 56
hrs_pos	I4	4	112	Earth location (north latitude and east longitude are positive) word1: 10^4*latitude in degrees, point 1 word2: 10^4*longitude in degrees, point 1 word3: 10^4*latitude in degrees, point 2 word4: 10^4*longitude in degrees, point 2 ..... word112: 10^4*longitude in degrees, point 56
hrs_filler4	I4	4	2	Unassigned (no value)
<b>HIRS DATA ELEMENTS</b>				
hrs_elem	I2	2	24*64	element data <b>for nel 0 to 63</b> word 1 bits 15-8 : scan encoder position bits 7-3 : electronic cal level indicator bits 2-0 : spare word 2 bits 15-13: spare bits 12-7 : channel 1 period monitor bits 6-1 : element number bit 0 : filter sync designator word 23 bits flag bit 15 : valid data flag bit 14 : odd bit parity bits 13-0 : spare word 24 zero fill  <b>for nel 0 to 55</b> word 3-22: radiometric channel no. 1, 17, 2, 3, 13, 4, 18, 11, 19, 7, 8, 20, 10, 14, 6, 5, 15, 12, 16, 9  <b>for nel 56</b> word 3-22: positive calibration channel no. 1, 17, 2, 3, 13, 4, 18, 11, 19, 7, 8, 20, 10, 14, 6, 5, 15, 12, 16, 9  <b>for nel 57</b> word 3-22: negative calibration channel no. 1, 17, 2, 3, 13, 4, 18, 11, 19, 7, 8, 20, 10, 14, 6, 5, 15, 12, 16, 9  <b>for nel 58</b> word 3-7: internal warm target, temp sensor #1 (5 readings) word 8-12: internal warm target, temp sensor

				<p>#2 word 13-17: internal warm target, temp sensor #3 word 18-22: internal warm target, temp sensor #4</p> <p><b>for nel 59</b> word 3-7: internal cold target, temp sensor #1 (5 readings) word 8-12 HIRS/4: Analog ground 3 word 8-12 HIRS/3: internal cold target, temp sensor #2 word 13-17 HIRS/4: Internal Warm Target, temp Sensor #5 word 13-17 HIRS/3: internal cold target, temp sensor #3 word 18-22 HIRS/4: Tertiary Telescope Temperature Sensor word 18-22 HIRS/3: internal cold target, temp sensor #4</p> <p><b>for nel 60</b> word 3-7: internal filter wheel housing, temp sensor #1 (5 readings) word 8-12: internal filter wheel housing, temp sensor #2 word 13-17: internal filter wheel housing, temp sensor #3 word 18-22: internal filter wheel housing, temp sensor #4</p> <p><b>for nel 61</b> word 3-7: patch temp. (5 readings) word 8-12: 1st stage radiator word 13-17: filter wheel housing heater current word 18-22: elec.cal.digital to analog converter</p> <p><b>for nel 62</b> word 3 scan mirror temperature word 4 primary telescope temperature word 5 secondary telescope temperature word 6 HIRS baseplate temperature word 7 HIRS electronics temperature word 8 patch temperature full range word 9 scan motor temperature word 10 filter wheel motor temperature word 11 cooler housing temperature word 12 patch control power</p>
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				word 13 scan motor current word 14 filter motor current word 15 +15 VDC word 16 -15 VDC word 17 +7.5 VDC word 18 -7.5 VDC word 19 +10 VDC word 20 + 5 VDC word 21 analog ground word 22 analog ground  <b>for nel 63</b> word 3 line counter word 4 first status word bits 15-8 : <zero fill> bit 7 : instrument on/off bit 6 : scan motor on/off bit 5 : filter wheel on/off bit 4 : electronics on/off bit 3 : cooler heat on/off bit 2 : internal warm target pos. bit 1 : internal cold target pos. bit 0 : space position word 5 second status word bits 15-8 : <zero fill> bit 7 : nadir pos. bit 6 : calibration enable/disable bit 5 : cooler door release enable/disable bit 4 : cooler door open bit 3 : cooler door closed bit 2 : filter housing heat on/off bit 1 : patch temp. control on/off bit 0 : filter motor power high word 6 Data verification binary code word 7-22: spare
hrs_filler5	I4	4	3	Unassigned (no value)
<b>DIGITAL B DATA</b>				
hrs_digbinvwbf	I2	2	1	invalid word bit flags
hrs_digbtbwr	I2	2	1	digital "B" data from TIP bit 15: instrument power bit 14: electronics power bit 13: filter motor power bit 12: scan motor power bit 11: cooler heater bit 10: filter housing heater bit 9 : cooler door release bit 8 : cooler window heater bit 7 : go to nadir position

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				bit 6 : calibration sequence bit 5 : cooler door closed bit 4 : cooler door fully open bit 3 : filter motor power level bit 2 : patch temperature controller bit 1-0: <zero fill>
<b>ANALOG TELEMETRY</b>				
hrs_aninvwbf	I4	4	1	invalid word bit flags (if bit=1, associated telemetry word was not updated during most recent minor frame cycle – possibly due to lost frame) bits 31-17 : <zero fill> bit 16 : patch controller power (word 16) ..bits 15-2 : words 15 through 2 (in order) bit 1 : radiator temperature (word 1) bit 0 : <zero fill>
hrs_anwrđ	I1	1	16	Word 1 : Radiator temperature Word 2 : Base Plate Temperature Word 3 : Electronics Temperature Word 4 : Patch Temperature Word 5 : Filter Housing Controller Current Word 6 : Scan Motor Temperature Word 7 : Filter Wheel Motor Temperature Word 8 : +5 VDC Monitor Word 9 : +10 VDC TLM/DC/DC Conv. Word 10 : +7.5 VDC TLM/DC/DC Conv. Word 11 : -7.5 VDC TLM/DC/DC Conv. Word 12 : +15 VDC Monitor Word 13 : -15 VDC Monitor Word 14 : Filter Wheel Motor Current Word 15 : Scan Motor Current Word 16 : Patch Controller Power
<b>FILLER</b>				
hrs_filler6	I4	4	11	Unassigned (no value)

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## **10. FORMAT OF THE HIRS.L1B FILE, OUTPUT OF THE HIRS CALIBRATION ALGORITHM 4**

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

HIRS.11a format = HIRS.11b format (in HIRS.11a, calibration and location fields are empty).

### Header and record length

Header length = record length  
4608 bytes

### Type

C = character  
I2 = integer\*2  
I4 = integer\*4

### **Header Record**

<b>Name in AAPP code</b>	<b>Type</b>	<b>Word Size in byte</b>	<b>Number of words</b>	<b>Meaning</b>
<b>GENERAL INFORMATION</b>				
hrs_h_siteid	C	3	1	Data set creation site ID CMS=Centre de Meteorologie spatiale/France DSS=Dundee Satellite Receiving Station/UK NSS=National Environmental Satellite Data and Information Service/USA UKM=United Kingdom Meteorological Office/UK
hrs_h_blank	C	1	1	ASCII blank
hrs_h_11bversnb	I2	2	1	level 1b format version number
hrs_h_11bversyr	I2	2	1	level 1b format version year
hrs_h_11bversdy	I2	2	1	level 1b format version day of year
hrs_h_reclg	I2	2	1	record length
hrs_h_blksz	I2	2	1	(reserved for block size)
hrs_h_hdrcnt	I2	2	1	count of header records in this data set
hrs_h_filler0	I2	2	3	Unassigned (no value)
hrs_h_dataname	C	42	1	data set name
hrs_h_prblkid	C	8	1	processing block identification
hrs_h_satid	I2	2	1	Spacecraft identification code 4=NOAA-15 (NOAA-K) 2=NOAA-16 (NOAA-L)

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				6=NOAA-17 (NOAA-M) 7=NOAA-18 (NOAA-N) 8=NOAA-19 (NOAA-N') 11=Metop-B (Metop-1) 12=Metop-A (Metop-2) 13=Metop-C (Metop-3) 14=Metop simulator
hrs_h_instid	I2	2	1	instrument ID 301=s/n H301 (NOAA-L) 302=s/n H302 (NOAA-K) 303=s/n H303 (NOAA-M) 304=s/n H304 (NOAA-N') 305=s/n H305 (NOAA-N) 306=s/n H306 (Metop-2) 307=s/n H307 (Metop-1)
hrs_h_datatyp	I2	2	1	data type code 5=HIRS
hrs_h_tipsrc	I2	2	1	TIP source code (NOAA: values defined below Metop: zero fill) 0=unused, i.e., GAC/HRPT/LAC data; 1=GAC embedded AMSU and TIP ; 2=stored TIP (STIP) ; 3=HRPT/LAC- embedded AMSU and TIP; 4=stored AIP (SAIP)
hrs_h_startdatajd	I4	4	1	start of data set Julian Day(00h,1jan50)
hrs_h_startdatayr	I2	2	1	start of data set year
hrs_h_startdatady	I2	2	1	start of data set day of the year
hrs_h_startdatatime	I4	4	1	start of data set UTC time of day in milliseconds
hrs_h_enddatajd	I4	4	1	end of data set Julian Day(00h,1jan50)
hrs_h_enddatayr	I2	2	1	end of data set year
hrs_h_enddatady	I2	2	1	end of data set day of the year
hrs_h_enddatatime	I4	4	1	end of data set UTC time of day in milliseconds
hrs_h_cpidsyr	I2	2	1	year of last CPIDS Update
hrs_h_cpidsdy	I2	2	1	day of year of last CPIDS Update
hrs_h_fov1offset	I2	2	4	time offset for FOV 1 (ms)
hrs_h_instrtype	C	6	1	instrument type: 'HIRS/3' or 'HIRS/4'
<b>DATA SET QUALITY INDICATORS</b>				
hrs_h_inststat1	I4	4	1	instrument status bits 31-16: zero fill bit 15: instrument power (0=off;1=on) bit 14: Electronics power (0=off;1=on) bit 13: Filter motor power (0=off;1=on) bit 12: Scan motor power (0=off;1=on) bit 11: Cooler heater (0=off;1=on) bit 10: Filter housing heater (0=off;1=on)

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				bit 9: Cooler door release (0=disabled;1=enabled) bit 8: Cooler window heater (0=on;1=off) bit 7: Go to nadir position (0=no;1=yes/initiated) bit 6: Calibration sequence (0=disabled;1=enabled) bit 5: Cooler door closed (0=yes;1=no) bit 4: Cooler door fully open (0=yes;1=no) bit 3: Filter motor power level (0=normal;1=high) bit 2: Patch temperature controller (0=off;1=on) bit 1-0: <zero fill>
hrs_h_filler1	I2	2	1	Unassigned (no value)
hrs_h_statchrecnb	I2	2	1	record number of status change (if 0, none occurred)
hrs_h_inststat2	I4	4	1	second instrument status (if previous word is 0, no change)
hrs_h_scnlin	I2	2	1	count of scan lines in this data set
hrs_h_calloclsclin	I2	2	1	count of calibrated, Earth located scan lines in this data set
hrs_h_missclin	I2	2	1	count of missing scan lines
hrs_h_datagaps	I2	2	1	count of data gaps in this data set
hrs_h_okdatafr	I2	2	1	count of data frames without frame sync word errors (NOAA) zero fill (Metop)
hrs_h_pacsparityerr	I2	2	1	count of PACS detected TIP parity errors (NOAA) zero fill (Metop)
hrs_h_auxsyncerrsum	I2	2	1	sum of all auxiliary sync errors detected in the input data (NOAA) zero fill (Metop)
hrs_h_timeseqerr	I2	2	1	time sequence error 0=none otherwise the record number of the first occurrence
hrs_h_timeseqerrcode	I2	2	1	time sequence error code if a bit is on(=1) then the statement is true bits 15-8: <zero fill> bit 7: time field is bad but can probably be inferred from the previous good time bit 6: time field is bad and can't be inferred from the previous good time bit 5: this record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity);may be associated with a spacecraft clock update

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				bit 4: start of a sequence that apparently repeats scan times that have been previously accepted bit3-0: <zero fill>
hrs_h_socclockupind	I2	2	1	socc clock update indicator 0=none during this orbit otherwise the record number of the first occurrence
hrs_h_locerrind	I2	2	1	Earth location error indicator 0=none during this orbit otherwise the record number of the first occurrence
hrs_h_locerrcode	I2	2	1	Earth location error code if a bit is on(=1) then the statement is true bit 15-8: <zero fill> bit 7: not Earth located because of bad time; Earth location fields zero-filled bit 6: Earth location questionable: questionable time code bit 5: Earth location questionable: Marginal agreement with reasonableness check bit 4: Earth location questionable: Fails reasonableness check bit 3-2: <zero fill> bit 1: not Earth located because of satellite in-plane maneuver(Metop) <zero fill>(NOAA) bit 0: not Earth located because of satellite out-of-plane maneuver(Metop) <zero fill>(NOAA)
hrs_h_pacsstatfield	I2	2	1	PACS status bit field NOAA: values defined below Metop: zero fill bits 15-3 : spare (zero fill) bit 2 : pseudo noise 0=normal data 1=pseudo noise data bit 1 : tape direction 0=reverse playback (time decrementing) bit 0 : data mode 0=test data 1=flight data
hrs_h_pacsdatasrc	I2	2	1	Pacs data source 0=unused 1=Fairbanks, AK 2=Wallops Is, VA 3=SOCC 4=Svalbard, Norway 5=Monterey, CA



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hrs_h_filler2	I4	4	1	Unassigned (no value)
hrs_h_spare1	C	8	1	spare <reserved for the ingester>
hrs_h_spare2	C	8	1	spare <reserved for the decommutation>
hrs_h_filler3	I2	2	5	Unassigned (no value)
<b>CALIBRATION</b>				
hrs_h_autocalind	I2	2	1	ramp/auto calibration indicators bit 15-1: zero fill bit 0 : auto calibration override switch for HIRS/3-HIRS/4 0=normal calibration sequence enabled during entire time period of this data set 1=calibration sequence was disabled at some point during time period of this data set
hrs_h_solarcalyr	I2	2	1	year of most recent solar ch. calib.
hrs_h_solarcaldy	I2	2	1	day of year of most recent solar channel calibration
hrs_h_calinf	I4	4	4*20	calibration information order of the channels : 1, 17, 2, 3, 13, 4, 18, 11, 19, 7, 8,20, 10, 14, 6, 5, 15, 12, 16, 9. 10 <sup>6</sup> *(mean calibration slope of channel nochannel) 10 <sup>6</sup> *(stantard deviation of calibration slope) 10 <sup>6</sup> *(B1 for channel nochannel) 10 <sup>6</sup> *(stantard deviation of linear regression for B1 for channel nochannel)
hrs_h_filler5	I4	4	2	Unassigned (no value)
<b>TEMPERATURE TO RADIANCE CONVERSION</b>				
hrs_h_tempradcnv	I4	4	3*19	temperature-radiance conversion order of channels = 1,2,3,4,....,18,19 for nochannel = 1 to 19 : 10 <sup>6</sup> x (nochannel central wavenumber for ch1 to ch 12) 10 <sup>5</sup> x (nochannel central wavenumber for ch13 to ch 19) 10 <sup>6</sup> x (nochannel constant 1) 10 <sup>6</sup> x (nochannel constant 2)
hrs_h_20solfiltirrad	I2	2	1	10 <sup>2</sup> x (albedo-radiance ch20 solar filtered irradiance) (Note scale factor different from pre-2005 format)
hrs_h_20equifiltwidth	I2	2	1	10 <sup>4</sup> x (albedo-radiance ch 20 equivalent filter width) (Note scale factor different from pre-2005 format)

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hrs_h_filler5	I4	4	1	Unassigned (no value)
<b>NAVIGATION</b>				
hrs_h_modelid	C	8	1	Reference Ellipsoid Model ID ="GRS 80" in the actual version of AAPP
hrs_h_nadlctol	I2	2	1	10*(nadir Earth location tolerance in kilometers)
hrs_h_locbit	I2	2	1	Earth location bit field bits 15-3: <zero fill> bit 2: dynamic attitude error correction (0=not performed;1=performed) bit 1: reasonableness test (0=inactive; 1=active) bit 0: constant attitude error correction (0=not performed;1=performed)
hrs_h_filler6	I2	2	1	Unassigned (no value)
hrs_h_rollerr	I2	2	1	10 <sup>3</sup> x (constant roll attitude error (dg))
hrs_h_pitcherr	I2	2	1	10 <sup>3</sup> x (constant pitch attitude error (dg))
hrs_h_yawerr	I2	2	1	10 <sup>3</sup> x (constant yaw attitude error (dg))
hrs_h_epoyr	I2	2	1	epoch year for orbit vector
hrs_h_epody	I2	2	1	day of epoch year for orbit vector
hrs_h_epotime	I4	4	1	epoch UTC time of day in milliseconds for orbit vector
hrs_h_smaxis	I4	4	1	10 <sup>5</sup> x (semi-major axis in kilometers)
hrs_h_eccen	I4	4	1	10 <sup>8</sup> x (eccentricity)
hrs_h_incli	I4	4	1	10 <sup>5</sup> x (inclination in degrees)
hrs_h_argper	I4	4	1	10 <sup>5</sup> x (argument of perigee in degrees)
hrs_h_rascnod	I4	4	1	10 <sup>5</sup> x (right ascension of the ascending node in degrees)
hrs_h_manom	I4	4	1	10 <sup>5</sup> x (mean anomaly in degrees)
hrs_h_xpos	I4	4	1	10 <sup>5</sup> x (position vector X component in km)
hrs_h_ypos	I4	4	1	10 <sup>5</sup> x (position vector Y component in km)
hrs_h_zpos	I4	4	1	10 <sup>5</sup> x (position vector Z component in km)
hrs_h_xvel	I4	4	1	10 <sup>8</sup> x (velocity vector X-dot component in kilometers/seconds)
hrs_h_yvel	I4	4	1	10 <sup>8</sup> x (velocity vector Y-dot component
hrs_h_zvel	I4	4	1	10 <sup>8</sup> x (velocity vector Z-dot component in kilometers/seconds)
hrs_h_earthsun	I4	4	1	10 <sup>6</sup> x (Earth/sun distance ratio)
hrs_h_filler7	I4	4	4	Unassigned (no value)
<b>ANALOG TELEMETRY CONVERSION</b> (volts to engineering units, scaling factors 10 <sup>(2, 2, 3, 3, 3, 5)</sup> )				
hrs_h_rdttemp	I4	4	6	radiator temp.conversion coefficients
hrs_h_bptemp	I4	4	6	base plate temp. conv. coef.
hrs_h_elttemp	I4	4	6	electronics temp. conv. coef.

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hrs_h_pchtemp	I4	4	6	patch temp. conv. coef.
hrs_h_fhcc	I4	4	6	filter housing controller current conv. coef.
hrs_h_scnmtemp	I4	4	6	scan motor temperature conv. coef.
hrs_h_fwtemp	I4	4	6	filter wheel motor temp. conv. coef.
hrs_h_p5v	I4	4	6	+5 VDC monitor conv. coef.
hrs_h_p10v	I4	4	6	+10 VDC TLM/DC/DC conv. conv.coef.
hrs_h_p75v	I4	4	6	+7.5 VDC TLM/DC/DC conv. conv. coef.
hrs_h_m75v	I4	4	6	-7.5 VDC TLM/DC/DC conv. conv. coef.
hrs_h_p15v	I4	4	6	+15 VDC monitor conv. coef.
hrs_h_m15v	I4	4	6	-15 VDC monitor conv. coef.
hrs_h_fwmcure	I4	4	6	filter wheel motor current conv. coef.
hrs_h_scmure	I4	4	6	scan motor current conv. coef.
hrs_h_pchcpow	I4	4	6	patch controller power conv. coef.
<b>DIGITAL A TELEMETRY CONVERSION</b>				
hrs_h_iwtenttmp	I4	4	5*6	internal Warm Target, temperature sensors 4 sensors for NOAAKLM 5 sensors for NOAANN'and Metop 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_ictenttmp	I4	4	4*6	internal Cold Target, temperature sensors 4 sensors for NOAAKLM 1 sensor for NOAANN' and Metop 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_tttenttmp	I4	4	6	tertiary telescope, temperature sensor 0 sensor for NOAAKLM 1 sensor for NOAANN'and Metop 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_fwenttmp	I4	4	4*6	filter wheel housing, temperature sensors 4 sensors. 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_patchexpenttmp	I4	4	6	patch temperature (expanded Scale) 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_fsradenttmp	I4	4	6	first stage radiator temperature sensor 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_scmirenttmp	I4	4	6	scan mirror temperature 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_pttenttmp	I4	4	6	primary telescope, temperature sensor 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_sttenttmp	I4	4	6	secondary telescope, temperature sensor 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_bpenttmp	I4	4	6	baseplate temperature 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_electenttmp	I4	4	6	electronics temperature 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_patchfcnttmp	I4	4	6	patch temperature full range 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_scmotenttmp	I4	4	6	scan motor temperature 6 scaling factors 10^(6, 9, 14, 17, 21, 25)

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hrs_h_fwmcnttmp	I4	4	6	filter wheel motor temperature 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_chsgcnttmp	I4	4	6	cooler housing temperature 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_conversions	I4	4	11	Conversion constants word1: 10^9 x filter wheel housing heater current word2: 10 x electronic calibration digital to analog converter word3: 10^17 x patch control power word4: 10^9 x scan motor current word5: 10^9 x filter motor current word6: 10^8 x +15 VDC word7: 10^8 x -15 VDC word8: 10^8 x +7.5 VDC word9: 10^8 x -7.5 VDC word10: 10^8 x +10 VDC word11: 10^8 x +5 VDC

**LUNAR CONTAMINATION**

hrs_h_moonsclin	I2	2	1	count of scans with moon in space view = -1 if the detection algorithm for lunar contamination is turned off = 0 if the detection algorithm is turned on and no lunar-contaminated space view scans were found. =>0 if the detection algorithm is turned on and the value in this field represents the number of lunar-contaminated space view scans.
hrs_h_moonthresh	I2	2	1	100 x lunar angle threshold in degrees any space view whose lunar angle is less than this value is flagged as being "lunar contaminated" and is not used in the calibration.

**24-HOUR AVERAGE SPACE VIEW COUNTS**

hrs_h_avspcounts	I4	4	20	24-hour average space view counts for each channel order of the channels: 1,17,2,3,13,4,18,11,19,7,8,20,10,14,6,5,15,12,16,9
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**METOP MANOEUVRES IDENTIFICATION**

hrs_h_startmanyr	I2	2	1	start of manoeuvre year (4 digit year)
hrs_h_startmandy	I2	2	1	start of manoeuvre day of year
hrs_h_startmantime	I4	4	1	start of manoeuvre UTC time of day in milliseconds
hrs_h_endmanyr	I2	2	1	end of manoeuvre year (4 digit year)
hrs_h_endmandy	I2	2	1	end of manoeuvre day of year
hrs_h_endmantime	I4	4	1	end of manoeuvre UTC time of day in

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				milliseconds
hrs_h_deltav	I4	4	3	change in spacecraft velocity
hrs_h_mass	I4	4	2	spacecraft mass before and after
hrs_h_filler8	I2	2	1302	zero fill

**One Data Record for one HIRS scan line**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>SCAN LINE INFORMATION</b>				
hrs_scnlin	I2	2	1	scan line number (cumulative, starting with 1)
hrs_scnlinyr	I2	2	1	scan line year
hrs_scnlindy	I2	2	1	scan line day of year
hrs_clockdrift	I2	2	1	satellite clock drift delta in milliseconds
hrs_scnlintime	I4	4	1	scan line UTC time of day in milliseconds
hrs_scnlinf	I2	2	1	scan line bit field bit 15: satellite direction 0=northbound 1=southbound bit 14: clock drift correction 0=not corrected 1=scan time corrected for clock drift bits13-0: <zero fill>
hrs_mjfrent	I2	2	1	major frame count for NOAA (cumulative, starting with 1) zero fill for Metop
hrs_scnpos	I2	2	1	scan position number in 32 seconds cycle
hrs_scntyp	I2	2	1	scan type code 0 : Earth view 1 : space view 2 : cold black body view 3 : main black body view
hrs_filler1	I4	4	2	Unassigned (no value)
<b>QUALITY INDICATORS</b>				
hrs_qualind	I4	4	1	quality indicator bit field if a bit is on(=1) then the statement is true. bit 31: do not use scan for product generation bit 30: time sequence error detected with this scan bit 29: data gap precedes this scan bit 28: insufficient data for calibration bit 27: Earth location data not available bit 26: first good time following a clock

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				update (nominally 0) bit 25: instrument status changed with this scan bit 24-0: <zero fill>
hrs_linqualflgs	I4	4	1	scan line quality flags if a bit is on(=1) then the statement is true <b>additional calibration problem code :</b> bit 31: not calibrated because of satellite manoeuvre (METOP) zero fill (NOAA) bit 30-24: <zero fill>  <b>time problem code :</b> (all bits off implies the scan time is as expected) bit 23: time field is bad but can probably be inferred from the previous good time bit 22: time field is bad and can't be inferred from the previous good time bit 21: this record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity). This may or may not be associated with a spacecraft clock update. (see bit 26 above) bit 20: start of a sequence that apparently repeats scan times that have been previously accepted. bits 19-16: <zero fill>  <b>calibration problem code :</b> (Note these bits complement the channel indicators; all bits set to 0 indicates normal calibration) bit 15: scan line was not calibrated because of bad time bit 14: scan line was calibrated using fewer than the preferred number of scan lines because of proximity to start or end of data set or to a data gap. bit 13: scan line was not calibrated because of bad or insufficient PRT data bit 12: scan line was calibrated but with marginal PRT data bit 11: some uncalibrated channels of this scan. See channel indicators. bit 10: uncalibrated due to instrument mode bit 9: space view is lunar contaminated bit 8: lunar-contaminated space view scan was corrected (only applicable if bit 9 is set)

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				<p><b>Earth location problem code</b> (all bits set to 0 implies the Earth location was normal)</p> <ul style="list-style-type: none"> <li>bit 7: not Earth located because of bad time</li> <li>bit 6: Earth location questionable because of questionable time code (see time problem flags above)</li> <li>bit 5: Earth location questionable. Only marginal agreement with reasonableness check.</li> <li>bit 4: Earth location questionable. Fails reasonableness check</li> <li>bit 3-2: &lt;zero fill&gt;</li> <li>bit 1: Not calibrated because of in-plane manoeuvre (Metop)</li> <li>bit 0: Not calibrated because of out-of-plane manoeuvre (Metop)</li> </ul>
hrs_chqualflg	I2	2	20	<p>quality flag for each channel order of the channels: 1, 17, 2, 3, 13, 4, 18, 11, 19, 7, 8, 20, 10, 14, 6, 5, 15, 12, 16, 9.</p> <p>(all bits off implies a good calibration)</p> <ul style="list-style-type: none"> <li>bit 15-6: &lt;zero fill&gt;</li> <li>bit 5: all bad blackbody counts for scan line</li> <li>bit 4: all bad space view counts for scan line</li> <li>bit 3: all bad PRTs counts for scan line</li> <li>bit 2: marginal blackbody view counts for this line</li> <li>bit 1: marginal space view counts for this line</li> <li>bit 0: marginal PRTs counts for scan line</li> </ul>
hrs_mnfrqual	C	1	64	<p>minor frame quality indicators for nel 0 to 63 (for bits 7 through 1, if bit is on(=1) then statement is true)</p> <ul style="list-style-type: none"> <li>bit 7 : 1 = this frame suspect due to a time error (NOAA)</li> <li>bit 6 : 1 = this frame contains data gap data fill (NOAA)</li> <li>bit 5 : 1 = this frame contains TIP dwell data fill (NOAA)</li> <li>bit 4 : 1 = data suspect due to PACS QC error (NOAA)</li> <li>bit 3 : 1 = mirror locked during this frame</li> <li>bit 2 : 1 = mirror position error during this frame</li> <li>bit 1 : 1 = mirror was moving during this frame</li> </ul>

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				bit 0 : minor word odd parity bit
hrs_filler2	I4	4	4	Unassigned (no value)
<b>CALIBRATION COEFFICIENTS</b>				
hrs_calcof	I4	4	3*20	calibration coefficients order of the channels: 1, 17, 2, 3, 13, 4, 18, 11, 19, 7, 8, 20, 10, 14, 6, 5, 15, 12, 16, 9. - 10 <sup>12</sup> *the second one - 10 <sup>9</sup> *the first one - 10 <sup>6</sup> *the zeroth one
hrs_scalcof	I4	4	3*20	second calibration coefficients order of the channels: 1, 17, 2, 3, 13, 4, 18, 11, 19, 7, 8, 20, 10, 14, 6, 5, 15, 12, 16, 9. - 10 <sup>12</sup> *the second one - 10 <sup>9</sup> *the first one - 10 <sup>6</sup> *the zeroth one
<b>NAVIGATION</b>				
hrs_yawsteering	I2	2	3	computed yaw steering angles for METOP Yaw, pitch, roll (degrees)
hrs_totattcorr	I2	2	3	total applied attitude correction for METOP 1000* Yaw, pitch, roll (degrees)
hrs_navstat	I4	4	1	navigation status bit field (bits20-18 are Metop specific and will contain zero fill for NOAA) (bits11-0 are NOAA specific and will contain zero fill for Metop)  bits31-21: <zero fill> bits20-19: yaw steering parameters usage indicator 0=no yaw steering correction 1=computed parameters from Metop data stream 2=measured parameters from Metop data stream 3=computed parameters from AELDS bit 18 : Metop maneuver indicator 0=scan does not occur during a Metop in-plane or out-of-plane maneuver 1=scan, or some part of it, occurs during a maneuver bit 17 : Earth location at the satellite subpoint is accurate and reasonable, i.e., is within tolerance defined by "nadir Earth location tolerance" in header 0=out of tolerance 1=in tolerance



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				bit 16 :Earth location corrected for Euler angles 0=false  1=true  bits15-12: Earth location indicator 0=Earth location available 1=user ephemerics files greater than 24hours old 2=no Earth location available bits11-08: spacecraft attitude control 0=operating in YGC or nominal mode 1=operating in another mode 2=attitude exceeds nominal tolerance 3=both 1 and 2 bits07-04: attitude SMODE 0=nominal mode 1=rate nulling mode 2=YGC mode 3=search mode 4=coast mode bits03-00: attitude PWT1\$AC 0=nominal mode/no test 1=yaw axis test in progress 2=roll axis test in progress 3=pitch axis test in progress
hrs_attangtime	I4	4	1	time associated angles (seconds)
hrs_rollang	I2	2	1	10 <sup>3</sup> xRoll angle in degrees
hrs_pitchang	I2	2	1	10 <sup>3</sup> xPitch angle in degrees
hrs_yawang	I2	2	1	10 <sup>3</sup> xYaw angle in degrees
hrs_scalti	I2	2	1	10*spacecraft altitude (MSL) in km
hrs_ang	I2	2	168	scan angles in degrees word1: 100*solar zenith angle, point 1 word2: 100*satellite zenith angle, point 1 word3: 100*local azimuth angle, point 1 word4: 100*solar zenith angle, point 2 word5: 100*satellite zenith angle, point 2 word6: 100*local azimuth angle, point 2 ..... word168: 100*solar zenith angle, point 56 word168: 100*satellite zenith angle, point 56 word168: 100*local azimuth angle, point 56
hrs_pos	I4	4	112	Earth location (north latitude and east longitude are positive) word1: 10 <sup>4</sup> *latitude in degrees, point 1 word2: 10 <sup>4</sup> *longitude in degrees, point 1 word3: 10 <sup>4</sup> *latitude in degrees, point 2 word4: 10 <sup>4</sup> *longitude in degrees, point 2 ..... word112: 10 <sup>4</sup> *longitude in degrees, point 56

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hrs_moonang	I2	2	1	100*angle between moon and space view
hrs_filler4	I2	2	3	Unassigned (no value)
<b>HIRS DATA ELEMENTS</b>				
hrs_elem	I2	2	24*64	<p>element data</p> <p><b>for nel 0 to 63</b></p> <p>word 1 bits 15-8 : scan encoder position bits 7-3 : electronic cal level indicator bits 2-0 : spare</p> <p>word 2 bits 15-13: spare bits 12-7 : channel 1 period monitor bits 6-1 : element number bit 0 : filter sync designator</p> <p>word 23 bits flag bit 15 : valid data flag bit 14 : odd bit parity bits 13-0 : spare</p> <p>word 24 zero fill</p> <p><b>for nel 0 to 55</b></p> <p>word 3-22: radiometric channel no. 1, 17, 2, 3, 13, 4, 18, 11, 19, 7, 8, 20, 10, 14, 6, 5, 15, 12, 16, 9</p> <p><b>for nel 56</b></p> <p>word 3-22: positive calibration channel no. 1, 17, 2, 3, 13, 4, 18, 11, 19, 7, 8, 20, 10, 14, 6, 5, 15, 12, 16, 9</p> <p><b>for nel 57</b></p> <p>word 3-22: negative calibration channel no. 1, 17, 2, 3, 13, 4, 18, 11, 19, 7, 8, 20, 10, 14, 6, 5, 15, 12, 16, 9</p> <p><b>for nel 58</b></p> <p>word 3-7: internal warm target, temp sensor #1 (5 readings) word 8-12: internal warm target, temp sensor #2 word 13-17: internal warm target, temp sensor #3 word 18-22: internal warm target, temp sensor #4</p> <p><b>for nel 59</b></p> <p>word 3-7: internal cold target, temp sensor #1 (5 readings) word 8-12 HIRS/4: Analog ground 3 word 8-12 HIRS/3: internal cold target, temp</p>

				<p>sensor #2 word 13-17 HIRS/4: Internal Warm Target, temp Sensor #5 word 13-17 HIRS/3: internal cold target, temp sensor #3 word 18-22 HIRS/4: Tertiary Telescope Temperature Sensor word 18-22 HIRS/3: internal cold target, temp sensor #4</p> <p><b>for nel 60</b> word 3-7: internal filter wheel housing, temp sensor #1 (5 readings) word 8-12: internal filter wheel housing, temp sensor #2 word 13-17: internal filter wheel housing, temp sensor #3 word 18-22: internal filter wheel housing, temp sensor #4</p> <p><b>for nel 61</b> word 3-7: patch temp (5 readings) word 8-12: 1st stage radiator word 13-17: filter wheel housing heater current word 18-22: elec.cal.digital to analog converter</p> <p><b>for nel 62</b> word 3 scan mirror temperature word 4 primary telescope temperature word 5 secondary telescope temperature word 6 HIRS baseplate temperature word 7 HIRS electronics temperature word 8 patch temperature full range word 9 scan motor temperature word 10 filter wheel motor temperature word 11 cooler housing temperature word 12 patch control power word 13 scan motor current word 14 filter motor current word 15 +15 VDC word 16 -15 VDC word 17 +7.5 VDC word 18 -7.5 VDC word 19 +10 VDC word 20 + 5 VDC word 21 analog ground word 22 analog ground</p>
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				<b>for nel 63</b> word 3 line counter word 4 first status word bits 15-8 : <zero fill> bit 7 : instrument on/off bit 6 : scan motor on/off bit 5 : filter wheel on/off bit 4 : electronics on/off bit 3 : cooler heat on/off bit 2 : internal warm target pos. bit 1 : internal cold target pos. bit 0 : space position word 5 second status word bits 15-8 : <zero fill> bit 7 : nadir pos. bit 6 : calibration enable/disable bit 5 : cooler door release enable/disable bit 4 : cooler door open bit 3 : cooler door closed bit 2 : filter housing heat on/off bit 1 : patch temp. control on/off bit 0 : filter motor power high word 6 Data verification binary code word 7-22: spare
hrs_filler5	I4	4	3	Unassigned (no value)
<b>DIGITAL B DATA</b>				
hrs_digitbupdatefg	I2	2	1	digital "B" telemetry update flags (if bit=0, associated telemetry item is up-to-date. if bit=1, associated telemetry item was not updated during most recent telemetry cycle-possibly due to lost frame)
hrs_digitbwrdr	I2	2	1	digital "B" data from TIP bit 15: instrument power (0=off,1=on) bit 14: electronics power (0=off,1=on) bit 13: filter motor power (0=off,1=on) bit 12: scan motor power (0=off,1=on) bit 11: cooler heater (0=off,1=on) bit 10: filter housing heater (0=off,1=on) bit 9 : cooler door release (0=disabled,1=enabled) bit 8 : cooler window heater (0=on,1=off) bit 7 : go to nadir position (0=no,1=yes/initiated) bit 6 : calibration sequence (0=disabled,1=enabled) bit 5 : cooler door closed (0=yes,1=no) bit 4 : cooler door fully open (0=yes,1=no) bit 3 : filter motor power level

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				(0=normal,1=yes) bit 2 : patch temperature controller (0=off,1=on) bit 1-0: <zero fill>
<b>ANALOG TELEMETRY</b>				
hrs_analogupdatefg	I4	4	1	analog telemetry update flags (if bit=0, associated telemetry item is up-to-date. if bit=1, associated telemetry item was not updated during most recent telemetry cycle-possibly due to lost frame) bits 31-17 : <zero fill> bit 16 : patch controller power bit 15: scan motor current bit 14: filter wheel motor current bit 13: -15VDC monitor bit 12: +15VDC monitor bit 11: -7.5 VDC TLM/DC/DC conv. bit 10: +7.5 VDC TLM/DC/DC conv. bit 9: +10V VDC TLM/DC/DC conv. bit 8: +5 VDC monitor bit 7: filter wheel motor temperature bit 6: scan motor temperature bit 5: filter housing controller current bit 4: patch temperature bit 3: electronics temperature bit 2: base plate temperature bit 1: radiator temperature bit 0: <zero fill>
hrs_anwrđ	C	1	16	Word 1 : Radiator temperature Word 2 : Base Plate Temperature Word 3 : Electronics Temperature Word 4 : Patch Temperature Word 5 : Filter Housing Controller Current Word 6 : Scan Motor Temperature Word 7 : Filter Wheel Motor Temperature Word 8 : +5 VDC Monitor Word 9 : +10 VDC TLM/DC/DC Conv. Word 10 : +7.5 VDC TLM/DC/DC Conv. Word 11 : -7.5 VDC TLM/DC/DC Conv. Word 12 : +15 VDC Monitor Word 13 : -15 VDC Monitor Word 14 : Filter Wheel Motor Current Word 15 : Scan Motor Current Word 16 : Patch Controller Power
<b>FILLER</b>				
hrs_filler5	I4	4	11	Unassigned (no value)

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## 11. FORMAT OF THE AMSUA.L1B FILE

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

AMSU-A.11a format = AMSU-A.11b format (in AMSU-A.11a, calibration and location fields are empty).

### Header and record length

Header length = record length

2560 bytes

### Type

C = character

I2 = integer\*2

I4 = integer\*4

### Header Record

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>GENERAL INFORMATION</b>				
ama_h_siteid	C	3	1	Data set creation site ID
ama_h_blank	C	1	1	ASCII blank
ama_h_11bversnb	I2	2	1	level 1b format version number
ama_h_11bversyr	I2	2	1	level 1b format version year
ama_h_11bversdy	I2	2	1	level 1b format version day of year
ama_h_reclg	I2	2	1	record length
ama_h_blkisz	I2	2	1	blocksize
ama_h_hdrent	I2	2	1	count of header records in data set
ama_h_filler1	I2	2	3	filler
ama_h_dataname	C	42	1	data set name
ama_h_prblkid	C	8	1	processing block identification
ama_h_satid	I2	2	1	NOAA spacecraft identification code 4=NOAA-15 (NOAA-K) 2=NOAA-16 (NOAA-L) 6=NOAA-17 (NOAA-M) 7=NOAA-18 (NOAA-N) 8= NOAA-19 (NOAA-N') 11=Metop-B (Metop-1) 12=Metop-A (Metop-2) 13=Metop-C (Metop-3) 14=Metop simulator
ama_h_instid	I2	2	1	AMSU-A instrument identification (Bits 15-8:AMSU-A2 ID - 2=EM, 6=PFM,

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				10=F1, 14=F2) (Bits 7-0: AMSU-A1 ID - 1=EM, 5=PFM, 9=F1, 13=F2)
ama_h_datatyp	I2	2	1	data type code (10 = AMSU-A)
ama_h_tipsrc	I2	2	1	TIP source code (0 = N/A; 1 = embedded; 2 = stored; 3 = third CDA)
ama_h_startdatajd	I4	4	1	start of data set julian day (count from 00h 1 Jan 1950)
ama_h_startdatayr	I2	2	1	start of data set year
ama_h_startdatady	I2	2	1	start of data set day of year
ama_h_startdatatime	I4	4	1	start of data set UTC time of day in milliseconds
ama_h_enddatajd	I4	4	1	end of data set julian day (count from 00h 1 Jan 1950)
ama_h_enddatayr	I2	2	1	end of data set year
ama_h_enddatady	I2	2	1	end of data set day of year
ama_h_enddatatime	I4	4	1	end of data set UTC time of day in milliseconds
ama_h_cpidsupdyr	I2	2	1	year of last CPIDS update
ama_h_cpidsupddy	I2	2	1	day of year of last cpids update
ama_h_fov1offset	I2	2	1	time offset for FOV 1 (ms)
ama_h_calparid	C	2	1	Redundant, but retain for compatibility
ama_h_filler2	I2	2	5	filler
<b>DATA SET QUALITY INDICATORS</b>				
ama2_h_inststat1	I4	4	1	AMSU-A2 instrument status Bit 31-15:<zero fill> Bit 14:Cold Cal pos msb Bit 13:Cold cal pos lsb (0=6.667, 1=8.333, 2=9.999, 3=13.332 degrees) Bit 12:park nadir Bit 11:park cold Bit 10:park warm Bit 9:full scan Bit 8-5:<zero fill> Bit 4:survival heater on Bit 3:module power Bit 2:comp motor Bit 1:scanner A2 power Bit 0:<zero fill>
ama_h_filler3	I2	2	1	filler
ama2_h_statchrecnb	I2	2	1	record number of status change ( if 0, none occurred)
ama2_h_inststat2	I4	4	1	AMSU-A2 second instrument status ( if previous word is 0, no change)

ama1_h_inststat1	I4	4	1	AMSU-A1 instrument status Bit 31-15:<zero fill> Bit 14:Cold Cal pos msb Bit 13:Cold cal pos lsb, (0=6.667, 1=8.333, 2=9.999, 3=13.332 degrees) Bit 12:park nadir Bit 11:park cold Bit 10:park warm Bit 9:full scan, (if all zero, instrument is parked in warm cal) Bit 8-6:<zero fill> Bit 5:module power connect Bit 4:survival heater on, Bit 3:phase lock loop (0=redundant, 1=primary), Bit 2:scanner A1-2 power Bit 1:scanner A1-1 power Bit 0:<zero fill>
ama_h_filler4	I2	2	1	filler
ama1_h_statchrecnb	I2	2	1	record number of status change ( if 0, none occurred)
ama1_h_inststat2	I4	4	1	AMSU-A1 second instrument status ( if previous word is 0, no change)
ama_h_sclin	I2	2	1	count of scan lines in this data set
ama_h_calocsclin	I2	2	1	count of calibrated, Earth located scan lines in this data set
ama_h_missclin	I2	2	1	count of missing scan lines
ama_h_datagaps	I2	2	1	count of data gaps in this data set
ama_h_okdatafr	I2	2	1	count of data frames without frame sync word errors
ama_h_pacsparityerr	I2	2	1	count of PACS detected TIP parity errors
ama_h_auxsyncerrsum	I2	2	1	sum of all auxiliary sync errors detected in the input data
ama_h_timeseqerr	I2	2	1	time sequence error (0 =none; otherwise the record number of the first occurrence)
ama_h_timeseqerrcode	I2	2	1	time sequence error code (taken from Scan Line Quality Flags, at the time of first occurrence)
ama_h_socclockupind	I2	2	1	socc clock update indicator ( 0 = none during this orbit; otherwise the record number of the first occurrence)
ama_h_locerrind	I2	2	1	Earth location error indicator ( 0 = none during this orbit; otherwise the record number of the first occurrence)
ama_h_locerrcode	I2	2	1	Earth location error code (taken from Scan Line Quality Flags, at the



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				time of first occurrence)
ama_h_pacsstatfield	I2	2	1	PACS Status Bit Field bits 15-3 : zero fill bit 2 : pseudo noise (0=normal data; 1=P/N data) bit 1 : tape direction (0=time decrementing) bit 0 : data mode (0=test data, 1=flight data)
ama_h_pacsdatasrc	I2	2	1	PACS data source 0=unused, 1=Gilmore, 2=Wallops, 3=SOCC
ama_h_filler5a	I4	4	1	filler
ama_h_spare2	C	8	1	reserved for ingester
ama_h_spare3	C	8	1	reserved for decommutation
ama_h_filler5	I4	4	4	filler
<b>CALIBRATION PARAMETERS</b>				
ama_h_plluid	I2	2	1	filler
ama_h_tsensid	I2	2	3	Instrument temperature sensor ID A1-1, A1-2 and A2; 0=RF shelf, 1=RF Mux
ama_h_reftemp	I2	2	12	Instrument reference temps, RF Shelf 3 temperatures for A1-1, A1-2, A2 and A1-1 PLLO#2
ama_h_muxtemp	I2	2	12	Instrument reference temps, RF Mux 3 temperatures for A1-1, A1-2, A2 and A1-1 PLLO#2
ama_h_bias	I2	2	78	Calibration bias corrections Warm target bias at 3 temps and cold bias for 15 channels, then warm target bias at 3 temps for Channels 9-14 PLLO#2.
ama_h_nonlin	I4	4	63	Nonlinearity corrections At 3 temps for Ch 1-15 and Ch 9-14 PLLO#2.
ama_h_filler6	I4	4	4	filler
<b>TEMPERATURE TO RADIANCE CONVERSION FACTORS</b>				
ama_h_temrad	I4	4	45	$10^6 \cdot (\text{Central wavenumber, Const1, Const2} \text{ (slope)})$ for 15 channels
ama_h_filler7	I4	4	3	filler
<b>NAVIGATION</b>				
ama_h_modelid	C	8	1	Reference Ellipsoid Model ID ="GRS 80" in the actual version of AAPP
ama_h_nadlctol	I2	2	1	10 x (nadir Earth location tolerance in km)
ama_h_locbit	I2	2	1	Earth location bit field bits 15-3: <zero fill> bit 2: dynamic attitudeerror correction (0=not performed) bit 1: reasonableness test active (0=inactive, 1=active) bit 0: constant attitude error correction (0 = not performed)

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ama_h_filler8	I2	2	1	filler
ama_h_rollerr	I2	2	1	10 <sup>3</sup> x (constant roll attitude error, deg)
ama_h_pitcherr	I2	2	1	10 <sup>3</sup> x (constant pitch attitude error, deg)
ama_h_yawerr	I2	2	1	10 <sup>3</sup> x (constant yaw attitude error in deg)
ama_h_epoyr	I2	2	1	epoch year for orbit vector
ama_h_epody	I2	2	1	day of epoch year for orbit vector
ama_h_epotime	I4	4	1	epoch UTC time of day in milliseconds for orbit vector
ama_h_smaxis	I4	4	1	10 <sup>6</sup> x (semi-major axis in kilometers)
ama_h_eccen	I4	4	1	10 <sup>8</sup> x (eccentricity)
ama_h_incli	I4	4	1	10 <sup>5</sup> x (inclination in degrees)
ama_h_argper	I4	4	1	10 <sup>5</sup> x (argument of perigee in degrees)
ama_h_rascnod	I4	4	1	10 <sup>5</sup> x (right ascension of the ascending node in degrees)
ama_h_manom	I4	4	1	10 <sup>5</sup> x (mean anomaly in degrees)
ama_h_xpos	I4	4	1	10 <sup>6</sup> x (position vector x component in kilometers)
ama_h_ypos	I4	4	1	10 <sup>6</sup> x (position vector y component in kilometers)
ama_h_zpos	I4	4	1	10 <sup>6</sup> x (position vector z component in kilometers)
ama_h_xvel	I4	4	1	10 <sup>8</sup> x (velocity vector x-dot component in kilometers/second)
ama_h_yvel	I4	4	1	10 <sup>8</sup> x (velocity vector y-dot component in kilometers/second)
ama_h_zvel	I4	4	1	10 <sup>8</sup> x (velocity vector z-dot component in kilometers/second)
ama_h_earthsun	I4	4	1	10 <sup>6</sup> x (Earth/sun distance ratio)
ama_h_filler9	I4	4	4	filler
<b>DIGITAL A AND ANALOG TELEMETRY CONVERSION COEFFICIENTS</b>				
ama1_h_digacoef	I4	4	180	4 coefficients for: Scan motor A1-1; Scan motor A1-2; Horn A1-1; Horn A1-2; RF Mux A1-1; RF Mux A1-2; LO Chan 3-8 and 15; PLL0#2; PLL0#1; PLL0 (Ref Osc); Mixer Chan 3-9 and 15; IF Amp Ch 11/14, 9, 10, 11; DC/DC convertor; IF Amp Ch 13, 14,12; RF Shelf A1-1 and A1-2; Det/Pre-amp; A1-1 warm load 1-4 and centre; A1-2 warm load 1-4 and centre.
ama_h_filler10	I4	4	1	filler
ama1_h_analcoef	I4	4	54	Intercept and slope for 27 parameters
ama_h_filler11	I4	4	1	filler
ama2_h_digacoef	I4	4	76	4 coefficients for: Scan motor A2; Horn A2; RF Mux A2; Mixer/IF Amp Chan 1-2; LO Chan 1-2; Compensation motor, Subreflector, DC/DC convertor; RF Shelf; Det/Pre-amp; A2

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				warm load centre and 1-6.
ama_h_filler12	I4	4	1	filler
ama2_h_analcoef	I4	4	30	Intercept and slope for 15 parameters
ama_h_filler13	I4	4	2	filler
<b>LUNAR CONTAMINATION CORRECTION (NESDIS)</b>				
ama_h_moonsclin	I2	2	1	count of scans with Moon in space view (-1 = detection algorithm turned off)
ama_h_moondist	I2	2	1	100*average dist to Moon in Earth radii
ama_h_moonsunang	I2	2	1	100*angle between Moon and Sun in degrees
ama_h_filler14	I2	2	1	
<b>METOP MANOEUVRES IDENTIFICATION (zero fill for NOAA)</b>				
ama_h_startmanyr	I2	2	1	4 digit year
ama_h_startmandy	I2	2	1	Day of year
ama_h_startmantime	I4	4	1	Time of day in milliseconds
ama_h_endmanyr	I2	2	1	4 digit year
ama_h_endmandy	I2	2	1	Day of year
ama_h_endmantime	I4	4	1	Time of day in milliseconds
ama_h_deltav	I4	4	3	Change in velocity
ama_h_mass	I4	4	2	Spacecraft mass before and after
ama_h_filler15	I4	4	40	filler

**One Data Record for one AMSU-A scan line**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>SCAN LINE INFORMATION</b>				
ama_sclin	I2	2	1	scan line number
ama_sclinyr	I2	2	1	scan line year
ama_sclinidy	I2	2	1	scan line day of year
ama_clockdrift	I2	2	1	satellite clock drift delta in milliseconds
ama_sclintime	I4	4	1	scan line UTC time of day in milliseconds
ama_sclinbit	I2	2	1	scan line bit field Bit 15: 0=northbound, 1=southbound Bit 14: 1=scan time corrected for clock drift Bit 13-0: <zero fill>
ama_tipmf	I2	2	1	Major frame count
ama_filler1	I4	4	2	filler
ama_qualind	I4	4	1	quality indicator bit field
ama_linqualflgs	I4	4	1	scan line quality
ama_chqualfg	I2	2	16	Calibration quality flags for each channel (last word zero fill)
ama_filler2	I4	4	4	filler

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<b>CALIBRATION COEFFICIENTS</b>				
ama_pmcal	I4	4	45	Primary calib. coeffs Second, first and zeroth order coefficients for 15 channels
ama_sdcals	I4	4	45	Secondary calib. coeffs Second, first and zeroth order coefficients for 15 channels
ama_filler3	I4	4	1	filler
<b>NAVIGATION</b>				
ama_yawsteering	I2	2	3	computed yaw steering angles for METOP Yaw, pitch, roll (degrees)
ama_totattcorr	I2	2	3	Total applied attitude correction for METOP 1000* Yaw, pitch, roll (degrees)
ama_navstat	I4	4	1	navigation status bit field bits31-17: zero fill  bit 16: 1=Earth location corrected for TIP Euler angles bits15-12: Earth location indicator 0=Earth location available 1=user ephemerics files greater than 24hours old 2=no Earth location available bits11-08: spacecraft attitude control 0=operating in YGC or nominal mode 1=operating in another mode 2=attitude exceeds nominal tolerance 3=both 1 and 2 bits07-04: attitude SMODE 0=nominal mode 1=rate nulling mode 2=YGC mode 3=search mode 4=coast mode bits03-00: attitude PWTIP\$AC 0=nominal mode/no test 1=yaw axis test in progress 2=roll axis test in progress 3=pitch axis test in progress
ama_attangtime	I4	4	1	time associated with TIP Euler angles (secs)
ama_rollang	I2	2	1	10 <sup>3</sup> *Roll angle in degrees
ama_pitchang	I2	2	1	10 <sup>3</sup> *Pitch angle in degrees
ama_yawang	I2	2	1	10 <sup>3</sup> *Yaw angle in degrees
ama_scalti	I2	2	1	10*spacecraft altitude (MSL) in km
ama_ang	I2	2	90	scan angles in degrees word1: 100*solar zenith angle, point 1 word2: 100*satellite zenith angle, point 1

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				word3: 100*local azimuth angle, point 1 word4: 100*solar zenith angle, point 2 word5: 100*satellite zenith angle, point 2 word6: 100*local azimuth angle, point 2 ..... word88: 100*solar zenith angle, point 30 word89: 100*satellite zenith angle, point 30 word90: 100*local azimuth angle, point 30
ama_pos	I4	4	60	Earth location (north latitude and east longitude are positive) word1: 10 <sup>4</sup> *latitude in degrees, point 1 word2: 10 <sup>4</sup> *longitude in degrees, point 1 word3: 10 <sup>4</sup> *latitude in degrees, point 2 word4: 10 <sup>4</sup> *longitude in degrees, point 2 ..... word60: 10 <sup>4</sup> *longitude in degrees, point 30
ama_filler4	I4	4	1	filler
<b>AMSU-A1 DIGITAL A TELEMETRY</b>				
ama1_sync	I2	2	1	Synchronization Sequence (hex FF)
ama1_id	I2	2	1	n.b. includes 3rd sync character
ama1_dhk	I2	2	2	Digital Housekeeping
ama1_earth_data	I2	2	17*30	4 position + 13 channels (3-15) at each antenna position
ama1_coldcal	I2	2	30	4 position + 13 channels(3-15) + 13 channels repeat, cold view
ama1_temps	I2	2	46	46 temperatures
ama1_warmcal	I2	2	30	4 position + 13 channels(3-15) + 13 channels repeat, warm view
ama_filler5	I4	4	1	filler
<b>AMSU-A1 DIGITAL B TELEMETRY</b>				
ama1_digbval	I2	2	1	Indicates validity of ama1_digb bits (0=valid)
ama1_digb	I2	2	1	Digital "B" Telemetry for AMSU-A1
ama_filler6	I4	4	1	filler
<b>AMSU-A1 ANALOG HOUSEKEEPING DATA (TIP)</b>				
ama1_ahkval	I4	4	1	Each bit indicates validity of ama1_ahk word (0 = valid, 1=invalid)
ama1_ahk	C	1	28	27 analogue words (word 28 is zero-fill)
ama_filler7	I4	4	1	filler
<b>AMSU-A2 DIGITAL A TELEMETRY</b>				
ama2_sync	I2	2	1	Synchronization Sequence (hex FF)
ama2_id	I2	2	1	n.b. includes 3rd sync character
ama2_dhk	I2	2	2	Digital Housekeeping
ama2_earth_data	I2	2	4*30	2 position + 2 channels (1-2) at each antenna position
ama2_coldcal	I2	2	6	2 position + 2 channels(1-2) + 2 channels repeat, cold view
ama2_temps	I2	2	20	20 temperatures

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ama2_warmcal	I2	2	6	2 position + 2 channels(1-2) + 2 channels repeat, warm view
ama_filler8	I4	4	1	filler
<b>AMSU-A2 DIGITAL B TELEMETRY</b>				
ama2_digbval	I2	2	1	Indicates validity of ama2_digb (0=valid)
ama2_digb	I2	2	1	Digital "B" Telemetry for AMSU-A2
ama_filler9	I4	4	1	filler
<b>AMSU-A2 ANALOG HOUSEKEEPING DATA (TIP)</b>				
ama2_ahkval	I4	4	1	Each bit indicates validity of ama2_ahk word (0 = valid, 1=invalid)
ama2_ahk	C	1	16	15 analogue words (word 16 is zero-fill)
<b>LUNAR CONTAMINATION CORRECTION (NESDIS method using antenna patterns)</b>				
ama_mooncountcor	C	1	15	Raw count minus corrected (0 to 255)
ama_filler10	C	1	1	filler
ama_moonazimuth	I2	2	3	100*azimuth in deg for A1-1, A1-2, A2
ama_moonelev	I2	2	3	100*elevation in deg for A1-1, A1-2, A2
ama_filler11	I4	4	1	filler

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## **12. FORMAT OF THE AMSUB.L1B FILE**

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

AMSU-B.11a format = AMSU-B.11b format (in AMSU-B.11a, calibration and location fields are empty).

### Header and record length

Header length = record length

3072 bytes

### Type

C = character

I2 = integer\*2

I4 = integer\*4

### **Header Record**

<b>Name in AAPP code</b>	<b>Type</b>	<b>Word Size in byte</b>	<b>Number of words</b>	<b>Meaning</b>
<b>GENERAL INFORMATION</b>				
amb_h_siteid	C	3	1	Data set creation site ID CMS = Centre de MeteorologiSpatale/France NSS = NESDIS/USA UKM = UK Met Office
amb_h_blank	C	1	1	Zero fill
amb_h_11bversnb	I2	2	1	level 1b format version number
amb_h_11bversyr	I2	2	1	level 1b format version year
amb_h_11bversdy	I2	2	1	level 1b format version day of year
amb_h_reclg	I2	2	1	logical record length
amb_h_blksz	I2	2	1	blocksize
amb_h_hdrcnt	I2	2	1	count of header records in data set
amb_h_filler1	I2	2	3	Zero fill
amb_h_dataname	C	42	1	data set name
amb_h_prblkid	C	8	1	processing block identification
amb_h_satid	I2	2	1	Spacecraft identification code 4=NOAA-15 (NOAA-K) 2=NOAA-16 (NOAA-L) 6=NOAA-17 (NOAA-M)
amb_h_instid	I2	2	1	AMSU-B instrument identification
amb_h_datatyp	I2	2	1	data type code (11 = AMSU-B)
amb_h_tipsrc	I2	2	1	TIP source code (0 = N/A; 1 = embedded; 2 = stored; 3 = third CDA; 4 = HRPT embedded)

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amb_h_startdatajd	I4	4	1	start of data set julian day
amb_h_startdatayr	I2	2	1	start of data set year
amb_h_startdatady	I2	2	1	start of data set day of year
amb_h_startdatatime	I4	4	1	start of data set UTC time of day in milliseconds
amb_h_enddatajd	I4	4	1	end of data set julian day
amb_h_enddatayr	I2	2	1	end of data set year
amb_h_enddatady	I2	2	1	end of data set day of year
amb_h_enddatatime	I4	4	1	end of data set UTC time of day in milliseconds
amb_h_cpidsupdyr	I2	2	1	year of last CPIDS update
amb_h_cpidsupddy	I2	2	1	day of year of last cpids update
amb_h_fov1offset	I2	2	1	time offset for FOV 1 (ms)
amb_h_calparid	C	2	1	Redundant, but retain for compatibility
amb_h_filler2	I2	2	5	Zero fill
<b>DATA SET QUALITY INDICATORS</b>				
amb_h_inststat1	I4	4	1	AMSU-B instrument status
amb_h_filler3	I2	2	1	Zero fill
amb_h_statchrecnb	I2	2	1	record number of status change ( if 0, none occurred)
amb_h_inststat2	I4	4	1	AMSU-B second instrument status ( if previous word is 0, no change)
amb_h_scnlin	I2	2	1	count of scan lines in this data set
amb_h_calloclsclin	I2	2	1	count of calibrated, Earth located scan lines in this data set
amb_h_missscnlin	I2	2	1	count of missing scan lines
amb_h_datagaps	I2	2	1	count of data gaps in this data set
amb_h_okdatafr	I2	2	1	count of data frames without frame sync word errors
amb_h_pacsparityerr	I2	2	1	count of PACS detected TIP parity errors
amb_h_auxsyncerrsum	I2	2	1	sum of all auxiliary sync errors detected in the input data
amb_h_timeseqerr	I2	2	1	time sequence error (0 =none; otherwise the record number of the first occurrence)
amb_h_timeseqerrcode	I2	2	1	time sequence error code
amb_h_socclockupind	I2	2	1	socc clock update indicator ( 0 = none during this orbit; otherwise the record number of the first occurrence)
amb_h_locerrind	I2	2	1	Earth location error indicator ( 0 = none during this orbit; otherwise the record number of the first occurrence)
amb_h_locerrcode	I2	2	1	Earth location error code
amb_h_pacsstatfield	I2	2	1	PACS Status Bit Field bits 15-3 : zero fill bit 2 : pseudo noise (0=normal data; 1=P/N data)



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				bit 1 : tape direction (0=time decrementing) bit 0 : data mode (0=test data, 1=flight data)
amb_h_pacsdatasrc	I2	2	1	PACS data source 0=unused, 1=Gilmore, 2=Wallops, 3=SOCC
amb_h_spare2	C	8	1	reserved for ingester
amb_h_spare3	C	8	1	reserved for decommutation
amb_h_filler4	I4	4	4	Zero fill
<b>CALIBRATION PARAMETERS</b>				
amb_h_tsensid	I2	2	1	Instrument temperature sensor ID (0 = Mixer Ch 18-20; 1 = Mixer Ch 16)
amb_h_filler5	I2	2	1	Zero fill
amb_h_reftemp	I2	2	3	Instrument reference temps (Mixer 18-20)
amb_h_reftemp2	I2	2	3	Instrument reference temps (Mixer 16)
amb_h_bias	I2	2	20	Calibration bias corrections
amb_h_nonlin	I4	4	15	Nonlinearity corrections
amb_h_filler6	I4	4	4	Zero fill
<b>TEMPERATURE TO RADIANCE CONVERSION FACTORS</b>				
amb_h_temrad	I4	4	15	$10^6 \times$ (Central wavenumber, const1 and const2)
amb_h_filler7	I4	4	4	Zero fill
<b>NAVIGATION – EARTH LOCATION</b>				
amb_h_modelid	C	8	1	Reference Ellipsoid Model ID =“GRS 80” in the actual version of AAPP
amb_h_nadloctol	I2	2	1	$10 \times$ (nadir Earth location tolerance in kilometers)
amb_h_locbit	I2	2	1	Earth location bit field bit 0 : constant attitude error correction (0 = not performed) bit 1 : reasonableness test (0= inactive, 1=active) bit 2 : dynamic attitude error correction (0=not performed)
amb_h_filler8	I2	2	1	Zero fill
amb_h_rollerr	I2	2	1	$10^3 \times$ (constant roll attitude error in degrees)
amb_h_pitcherr	I2	2	1	$10^3 \times$ (constant pitch attitude error in degrees)
amb_h_yawerr	I2	2	1	$10^3 \times$ (constant yaw attitude error in degrees)
amb_h_epoyr	I2	2	1	epoch year for orbit vector
amb_h_epody	I2	2	1	day of epoch year for orbit vector
amb_h_epotime	I4	4	1	epoc UTC time of day in milliseconds for orbit vector
amb_h_smaxis	I4	4	1	$10^6 \times$ (semi-major axis in kilometers)
amb_h_eccen	I4	4	1	$10^8 \times$ (eccentricity)
amb_h_incli	I4	4	1	$10^5 \times$ (inclination in degrees)
amb_h_argper	I4	4	1	$10^5 \times$ (argument of perigee in degrees)
amb_h_rascnod	I4	4	1	$10^5 \times$ (right ascension of the ascending node in degrees)
amb_h_manom	I4	4	1	$10^5 \times$ (mean anomaly in degrees)

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amb_h_xpos	I4	4	1	10 <sup>6</sup> x (position vector x component in kilometers)
amb_h_ypos	I4	4	1	10 <sup>6</sup> x (position vector y component in kilometers)
amb_h_zpos	I4	4	1	10 <sup>6</sup> x (position vector z component in kilometers)
amb_h_xvel	I4	4	1	10 <sup>8</sup> x (velocity vector x-dot component in kilometers/second)
amb_h_yvel	I4	4	1	10 <sup>8</sup> x (velocity vector y-dot component in kilometers/second)
amb_h_zvel	I4	4	1	10 <sup>8</sup> x (velocity vector z-dot component in kilometers/second)
amb_h_earthsun	I4	4	1	10 <sup>6</sup> x (Earth/sun distance ratio)
amb_h_filler9	I4	4	4	Zero fill
<b>DIGITAL A AND ANALOG TELEMETRY CONVERSION COEFFICIENTS</b>				
amb_h_digacoef	I2	2	96	AMSU-B digital A coeffs
amb_h_filler10	I4	4	4	Zero fill
amb_h_analcoef	I4	4	72	AMSU-B analogue coeffs
<b>CORRECTIONS FOR S-BAND TRANSMITTER INTERFERENCE</b>				
amb_h_filler11	I4	4	2	Zero fill
amb_h_CountsCorr	I2	2	5*21*4	Normal bias
amb_h_filler12	I4	4	2	Zero fill
amb_h_txpow	I2	2	4	
amb_h_filler13	I4	4	2	Zero fill
amb_h_NewCorr	I2	2	5*33*3	Anomalous bias
<b>LUNAR CONTAMINATION</b>				
amb_h_monscnlin	I2	2	1	count of scans with moon in space view (-1 = detection algorithm turned off)
amb_h_moonthresh	I2	2	1	100 x lunar angle threshold in degrees
<b>SPARE WORDS</b>				
amb_h_filler14	I2	2	107	Zero fill

**One Data Record for one AMSU-B scan line**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>SCAN LINE INFORMATION</b>				
amb_scnlin	I2	2	1	scan line number
amb_scnlinyr	I2	2	1	scan line year
amb_scnlindy	I2	2	1	scan line day of year
amb_clockdrift	I2	2	1	satellite clock drift delta in milliseconds
amb_scnlintime	I4	4	1	scan line UTC time of day in milliseconds
amb_scnlinbit	I2	2	1	scan line bit field

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				Bit 15: 0=northbound, 1=southbound Bit 14: 1=scan time corrected for clock drift Bit 13-0: <zero fill>
amb_tipmf	I2	2	1	Major frame count
amb_filler1	I4	4	2	Zero fill
amb_qualind	I4	4	1	quality indicator bit field
amb_linqualflgs	I4	4	1	scan line quality
amb_chqualflg	I2	2	5	Calibration quality flags for each channel
amb_filler2	I2	2	9	Zero fill
<b>CALIBRATION COEFFICIENTS</b>				
amb_pmcal	I4	4	15	Primary calib. coeffs Second, first and zeroth order coefficients for 5 channels
amb_sdcals	I4	4	15	Secondary calib. coeffs Second, first and zeroth order coefficients for 5 channels
amb_filler3	I2	2	5	Zero fill
<b>NAVIGATION</b>				
amb_totattcorr	I2	2	3	Total applied attitude correction 1000*yaw, pitch, roll (degrees)
amb_navstat	I4	4	1	navigation status bit field bit 17: Nadir Earth location OK (see amb_h_nadloc1) (1=true) bit 16: Earth location corrected for Euler angles (1=true) bits15-12: Earth location indicator 0=Earth location available 1=user ephemerics files greater than 24hours old 2=no Earth location available bits11-08: spacecraft attitude control 0=operating in YGC or nominal mode 1=operating in another mode 2=attitude exceeds nominal tolerance 3=both 1 and 2 bits07-04: attitude SMODE 0=nominal mode 1=rate nulling mode 2=YGC mode 3=search mode 4=coast mode bits03-00: attitude PWT1\$AC 0=nominal mode/no test 1=yaw axis test in progress 2=roll axis test in progress 3=pitch axis test in progress
amb_attangtime	I4	4	1	time associated angles (seconds)
amb_rollang	I2	2	1	10 <sup>3</sup> *Roll angle in degrees

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amb_pitchang	I2	2	1	10 <sup>3</sup> *Pitch angle in degrees
amb_yawang	I2	2	1	10 <sup>3</sup> *Yaw angle in degrees
amb_scalti	I2	2	1	10*spacecraft altitude (MSL) in km
amb_ang	I2	2	270	scan angles in degrees word1: 100*solar zenith angle, point 1 word2: 100*satellite zenith angle, point 1 word3: 100*local azimuth angle, point 1 word4: 100*solar zenith angle, point 2 word5: 100*satellite zenith angle, point 2 word6: 100*local azimuth angle, point 2 ..... word268: 100*solar zenith angle, point 90 word269: 100*satellite zenith angle, point 90 word270: 100*local azimuth angle, point 90
amb_pos	I4	4	180	Earth location (north latitude and east longitude are positive) word1: 10 <sup>4</sup> *latitude in degrees, point 1 word2: 10 <sup>4</sup> *longitude in degrees, point 1 word3: 10 <sup>4</sup> *latitude in degrees, point 2 word4: 10 <sup>4</sup> *longitude in degrees, point 2 ..... word180: 10 <sup>4</sup> *longitude in degrees, point 90
amb_moonang	I2	2	4	100*angle (deg) between moon and each space view
<b>AMSU-B SENSOR DATA</b>				
amb_earth_data	I2	2	540	Word1: shaft position for FOV1 Word2: scene counts FOV1, channel 16 Word3: scene counts FOV1, channel 17 Word4: scene counts FOV1, channel 18 Word5: scene counts FOV1, channel 19 Word6: scene counts FOV1, channel 20 Word7: shaft position for FOV2 ..... Word540: scene counts FOV90, channel 20
amb_filler5	I4	4	2	Zero fill
<b>AMSU-B CALIBRATION DATA</b>				
amb_coldcal	I2	2	24	Word1: shaft position for space view 1 Word2: counts for space view 1, channel 16 Word3: counts for space view 1, channel 17 Word4: counts for space view 1, channel 18 Word5: counts for space view 1, channel 19 Word6: counts for space view 1, channel 20 Word7: shaft position for space view 2 ..... Word24: counts for space view 4, channel 20
amb_warmcal	I2	2	24	Word1: shaft position for target view 1 Word2: counts for target view 1, channel 16 Word3: counts for target view 1, channel 17

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				Word4: counts for target view 1, channel 18 Word5: counts for target view 1, channel 19 Word6: counts for target view 1, channel 20 Word7: shaft position for target view 2  ..... Word24: counts for target view 4, channel 20
amb_filler6	I4	4	2	Zero fill
<b>AMSU-B DIGITAL A TELEMETRY</b>				
amb_digaval	I4	4	1	Invalid data bit flags
amb_filler7	I4	4	1	Zero fill
amb_diga	I2	2	2	digital data words A01 and A02
amb_temps	I2	2	24	digital data words A03 through A26
amb_filler8	I4	4	3	Zero fill
<b>AMSU-B ANALOG TELEMETRY</b>				
amb_ahkval	I4	4	1	Invalid analogue data bit flags
amb_ahk	I2	2	27	Added STX and SARR information
<b>FILLERS</b>				
amb_filler9	I2	2	1	Zero fill
amb_filler10	I4	4	67	Zero fill

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### 13. FORMAT OF THE MHS.L1B FILE

MHS.11a format = MHS.11b format (in MHS.11a, calibration and location fields are empty).

#### Header and record length

Header length = record length

3072 bytes

#### Type

C = character

I2 = integer\*2

I4 = integer\*4

#### Header Record

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>GENERAL INFORMATION</b>				
mhs_h_siteid	C	3	1	Data set creation site ID CMS = Centre de Meteorologie Spatiale/France NSS = NESDIS/USA UKM = UK Met Office
mhs_h_blank	C	1	1	Zero fill
mhs_h_11bversnb	I2	2	1	level 1b format version number
mhs_h_11bversyr	I2	2	1	level 1b format version year
mhs_h_11bversdy	I2	2	1	level 1b format version day of year
mhs_h_reclg	I2	2	1	logical record length
mhs_h_blkisz	I2	2	1	blocksize
mhs_h_hdrcnt	I2	2	1	count of header records in data set
mhs_h_filler1	I2	2	3	Zero fill
mhs_h_dataname	C	42	1	data set name
mhs_h_prblkid	C	8	1	processing block identification
mhs_h_satid	I2	2	1	Spacecraft identification code: 7=NOAA-18 (NOAA-N) 8=NOAA-19 (NOAA-N') 11=Metop-B (Metop-1) 12=Metop-A (Metop-2) 13=Metop-C (Metop-3) 14=Metop simulator
mhs_h_instid	I2	2	1	MHS instrument identification (0 = EM, 1 = PFM (NOAA-N), 2 = FM2 (NOAA-N'), 3 = FM3 (Metop-1) (TBC), 4 = FM4 (Metop-3) (TBC), 5 = FM5 (Metop- 2) (TBC))

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mhs_h_datatyp	I2	2	1	data type code (12 = MHS)
mhs_h_tipsrc	I2	2	1	TIP source code (0 = unused, i.e. GAC/HRPT/LAC data; 1 = GAC-embedded AMSU and TIP; 2 = stored TIP; 3 = HRPT-embedded AMSU and TIP; 4 = stored AIP (SAIP))
mhs_h_startdatajd	I4	4	1	start of data set julian day starting from 0 at 00h, 1 Jan 1950.
mhs_h_startdatayr	I2	2	1	start of data set year, 4 digits.
mhs_h_startdatady	I2	2	1	start of data set day of year
mhs_h_startdatatime	I4	4	1	start of data set UTC time of day in milliseconds
mhs_h_enddatajd	I4	4	1	end of data set julian day
mhs_h_enddatayr	I2	2	1	end of data set year
mhs_h_enddatady	I2	2	1	end of data set day of year
mhs_h_enddatatime	I4	4	1	end of data set UTC time of day in milliseconds
mhs_h_cpidsupdyr	I2	2	1	year of last CPIDS update
mhs_h_cpidsupddy	I2	2	1	day of year of last cpids update
mhs_h_fov1offset	I2	2	1	time offset for FOV 1 (ms)
mhs_h_filler2	I2	2	5	Zero fill
<b>DATA SET QUALITY INDICATORS</b>				
mhs_h_inststat1	I4	4	1	MHS instrument status Bits 31-24: as for mhs_mode Bits 23-00: as for mhs_switchstat
mhs_h_filler3	I2	2	1	Zero fill
mhs_h_statchrecnb	I2	2	1	record number of status change ( if 0, none occurred)
mhs_h_inststat2	I4	4	1	MHS second instrument status ( if previous word is 0, no change)
mhs_h_scnlin	I2	2	1	count of scan lines in this data set
mhs_h_calloccselin	I2	2	1	count of calibrated, Earth located scan lines in this data set
mhs_h_misscnlin	I2	2	1	count of missing scan lines
mhs_h_datagaps	I2	2	1	count of data gaps in this data set
mhs_h_moonscnlin	I2	2	1	count of scans with moon in space view (-1 = detection algorithm turned off)
mhs_h_okdatafr	I2	2	1	count of data frames without frame sync word errors
mhs_h_pacsparityerr	I2	2	1	count of PACS detected TIP parity errors
mhs_h_auxsyncerrsum	I2	2	1	sum of all auxiliary sync errors detected in the input data
mhs_h_timeseqerr	I2	2	1	time sequence error (0 =none; otherwise the record number of the first occurrence)
mhs_h_timeseqerrcode	I2	2	1	time sequence error code

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mhs_h_socclockupind	I2	2	1	socc clock update indicator ( 0 = none during this orbit; otherwise the record number of the first occurrence)
mhs_h_locerrind	I2	2	1	earth location error indicator ( 0 = none during this orbit; otherwise the record number of the first occurrence)
mhs_h_locerrcode	I2	2	1	Earth location error code
mhs_h_pacsstatfield	I2	2	1	PACS Status Bit Field bits 15-3 : zero fill bit 2 : pseudo noise (0=normal data; 1=P/N data) bit 1 : tape direction (0=time decrementing) bit 0 : data mode (0=test data, 1=flight data)
mhs_h_pacsdatasrc	I2	2	1	PACS data source 0=unused, 1=Gilmore, 2=Wallops, 3=SOCC
mhs_h_spare2	C	8	1	reserved for ingester
mhs_h_spare3	C	8	1	reserved for decommutation
mhs_h_filler4	I2	2	8	Zero fill
<b>CALIBRATION PARAMETERS</b>				
mhs_h_tsensid	I2	2	1	Instrument temperature sensor ID 0 = primary (LO H5 temperature [QBS5]) 1 = secondary (LO H1 temperature [QBS1])
mhs_h_filler5	I2	2	1	Zero fill
mhs_h_reftemp	I2	2	6	Instrument reference temps, min, nominal, max (primary and secondary)
mhs_h_bias	I2	2	35	Calibration bias corrections. For each of 5 channels: Warm load temp corr (at 3 instr temps) Cold space temp corr (for 4 profiles)
mhs_h_nonlin	I4	4	30	Nonlinearity corrections. For each LO (LO A and LO B): For each of 5 channels: Nonlin correction at 3 instr temps (min,nom,max)
mhs_h_filler6	I4	4	4	Zero fill
<b>TEMPERATURE TO RADIANCE CONVERSION FACTORS</b>				
mhs_h_temrad	I4	4	15	$10^6 * (\text{Central wavenumber, const1 and const2})$
mhs_h_filler7	I4	4	4	Zero fill
<b>NAVIGATION – EARTH LOCATION</b>				
mhs_h_modelid	C	8	1	Reference Ellipsoid Model ID
mhs_h_nadloctol	I2	2	1	10 x (nadir Earth location tolerance in



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				kilometers)
mhs_h_locbit	I2	2	1	Earth location bit field Bit 2: dynamic attitude error correction (0=not performed, 1=performed) Bit 1: reasonableness test (0=inactive, 1=active) Bit 0 : constant attitude error correction (0 = not performed, 1=performed)
mhs_h_filler8	I2	2	1	Zero fill
mhs_h_rollerr	I2	2	1	10 <sup>3</sup> x (constant roll attitude error in degrees)
mhs_h_pitcherr	I2	2	1	10 <sup>3</sup> x (constant pitch attitude error in degrees)
mhs_h_yawerr	I2	2	1	10 <sup>3</sup> x (constant yaw attitude error in degrees)
mhs_h_epoyr	I2	2	1	epoch year for orbit vector
mhs_h_epody	I2	2	1	day of epoch year for orbit vector
mhs_h_epotime	I4	4	1	epoc UTC time of day in milliseconds for orbit vector
mhs_h_smaxis	I4	4	1	10 <sup>6</sup> x (semi-major axis in kilometers)
mhs_h_eccen	I4	4	1	10 <sup>8</sup> x (eccentricity)
mhs_h_incli	I4	4	1	10 <sup>5</sup> x (inclination in degrees)
mhs_h_argper	I4	4	1	10 <sup>5</sup> x (argument of perigee in degrees)
mhs_h_rascnod	I4	4	1	10 <sup>5</sup> x (right ascension of the ascending node in degrees)
mhs_h_manom	I4	4	1	10 <sup>5</sup> x (mean anomaly in degrees)
mhs_h_xpos	I4	4	1	10 <sup>6</sup> x (position vector x component in kilometers)
mhs_h_ypos	I4	4	1	10 <sup>6</sup> x (position vector y component in kilometers)
mhs_h_zpos	I4	4	1	10 <sup>6</sup> x (position vector z component in kilometers)
mhs_h_xvel	I4	4	1	10 <sup>8</sup> x (velocity vector x-dot component in kilometers/second)
mhs_h_yvel	I4	4	1	10 <sup>8</sup> x (velocity vector y-dot component in kilometers/second)
mhs_h_zvel	I4	4	1	10 <sup>8</sup> x (velocity vector z-dot component in kilometers/second)
mhs_h_earthsun	I4	4	1	10 <sup>6</sup> x (Earth/sun distance ratio relative to the mean distance of 1AU)
mhs_h_filler9	I4	4	4	Zero fill
<b>TEMPERATURE, CURRENT AND RESISTANCE CONVERSION COEFFICIENTS</b>				
mhs_h_therm	I4	4	5	5 coefficients for the 24 thermistors
mhs_h_filler10	I4	4	4	Zero fill
mhs_h_currcoef	I4	4	12	Current sensors 2 coeffs for each of 6 current sensors
mhs_h_prtcoef	I4	4	40	Cal target PRTs: resistance to temperature

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				For PIE-A and PIE-B, 4 coefficients for each of 5 PRTs
mhs_h_survival	I4	4	6	Survival volts to temperature conversion Same coefficients for all 3 sensors Note 1 volt = 0.02 counts
mhs_h_antpos	I4	4	1	Antenna degrees per count Value = 10 <sup>8</sup> x 0.00703125
mhs_h_refres	I4	4	6	10 <sup>4</sup> x reference resistance in ohms PIE-A 3 channels, PIE-B 3 channels
<b>THRESHOLDS</b>				
mhs_h_moonthresh	I2	2	1	100 x lunar angle threshold in degrees
<b>RFI CORRECTION, AS FOR AMSU-B, OR ZERO FILL IF NOT NEEDED</b>				
mhs_h_CountsCorr	I2	2	5*21*4	Normal bias, ordered by channel, FOV, transmitter
mhs_h_filler11	I2	2	4	Zero fill
mhs_h_txpow	I2	2	4	10*Mean power in counts
mhs_h_filler12	I2	2	5	Zero fill
<b>METOP MANOEUVRES IDENTIFICATION</b>				
mhs_h_startmanyr	I2	2	1	4 digit year
mhs_h_startmandy	I2	2	1	Day of year
mhs_h_startmantime	I4	4	1	Time of day in milliseconds
mhs_h_endmanyr	I2	2	1	4 digit year
mhs_h_endmandy	I2	2	1	Day of year
mhs_h_endmantime	I4	4	1	Time of day in milliseconds
mhs_h_delav	I4	4	3	Change in velocity
mhs_h_mass	I4	4	2	Spacecraft mass before and after
<b>SPARE WORDS</b>				
mhs_h_filler13	I2	2	642	

**One Data Record for one MHS scan line**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>SCAN LINE INFORMATION</b>				
mhs_scnlin	I2	2	1	scan line number
mhs_scnlinyr	I2	2	1	scan line year
mhs_scnlindy	I2	2	1	scan line day of year
mhs_clockdrift	I2	2	1	satellite clock drift delta in milliseconds
mhs_scnlintime	I4	4	1	scan line UTC time of day in milliseconds
mhs_scnlinbit	I2	2	1	scan line bit field Bit 15: 0=northbound, 1=southbound Bit 14: 0=not corrected, 1=scan time

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				corrected for clock drift Bit 13-0: <zero fill>
mhs_tipmf	I2	2	1	Major frame count
mhs_coarsetime	I4	4	1	Coarse MHS on board time (OBT) (Time since last reset to zero)
mhs_finetime	I2	2	1	Fine MHS OBT. Fraction of second since last increment of coarse time. Res 2 <sup>-16</sup> sec, range 0-65535
mhs_modeflg	C	1	1	MHS mode flag: 3=scan, 4=fixed view. Rest are empty science data.
mhs_filler1	C	1	1	Zero fill
<b>QUALITY INDICATORS</b>				
mhs_qualind	I4	4	1	quality indicator bit field bit 31: do not use for product generation bit 30: time sequence error detected within this scan bit 29: data gap precedes this scan bit 28: insufficient data for calibration bit 27: Earth location data not available bit 26: first good time following clock update bit 25: instrument status changed with this scan bit 24-5: zero fill
mhs_linqualflgs	I4	4	1	scan line quality bit 31: time field bad; probably inferred from previous good time bit 30: time field bad; can't be inferred from previous good time bit 29: time discontinuity bit 28: repeats scan times previously accepted bit 27-19: zero fill bit 18: not calibrated because of satellite manoeuvre (Metop) bit 17: one of more space views moon contaminated bit 16: moon-contaminated scan able to be calibrated bit 15: not calibrated because of bad time bit 14: calibrated using fewer than preferred no of scan lines bit 13: not calibrated because of bad or insufficient PRT data bit 12: calibrated with marginal PRT data bit 11: some uncalibrated channels bit 10: uncalibrated due to instrument mode bit 09: questionable calibration: antenna position error space view bit 08: questionable calibration: antenna

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				position error OBCT view bit 07: Not Earth located because of bad time bit 06: questionable Earth location: questionable time bit 05: questionable Earth location: marginal reasonableness check bit 04: questionable Earth location: fails reasonableness check bit 03: questionable Earth location: antenna position check bit 02: zero fill bit 01: not Earth located: satellite in-plane manoeuvre (Metop) bit 00: nor Earth located: satellite out-of-plane manoeuvre (Metop)
mhs_chqualflg	I2	2	5	Calibration quality flags for each channel Bits 15-07: zero fill Bit 06: last scan before, or first after, calibration jump Bit 05: all bad OBCT view counts Bit 04: all bad space view counts Bit 03: all bad PRTs Bit 02: some bad OBCT view counts Bit 01: some bad space view counts Bit 00: some bad PRT temps
mhs_filler2	I2	2	9	Zero fill
<b>CALIBRATION COEFFICIENTS</b>				
mhs_pmcal	I4	4	15	Primary calib. coeffs Second, first and zeroth order coefficients for 5 channels; scaling $10^{16}$ , $10^{10}$ , $10^6$
mhs_sdcals	I4	4	15	Secondary calib. coeffs Second, first and zeroth order coefficients for 5 channels
mhs_filler3	I2	2	2	Zero fill
<b>NAVIGATION</b>				
mhs_yawsteering	I2	2	3	computed yaw steering angles for METOP Yaw, pitch, roll (degrees)
mhs_totattcorr	I2	2	3	Total applied attitude correction for METOP 1000 x Yaw, pitch, roll (degrees)
mhs_navstat	I4	4	1	navigation status bit field bits 31-21: <zero fill> bits 20-19: METOP yaw steering usage indicator (0=no corr, 1=computed parameters from METOP data stream, 2=measured parameters from METOP data stream, 3=computed parameters from AELDS) bit 18: METOP manoeuvre occuring (1=true)

				<p>bit 17: Nadir Earth location OK (see mhs_h_nadlocol) (1=true)  bit 16: Earth location corrected for Euler angles (1=true)  bits15-12: Earth location indicator  0=Earth location available  1=user ephemerics files greater than 24hours old  2=no Earth location available  bits11-08: spacecraft attitude control  0=operating in YGC or nominal mode  1=operating in another mode  2=attitude exceeds nominal tolerance  3=both 1 and 2  bits07-04: attitude SMODE  0=nominal mode  1=rate nulling mode  2=YGC mode  3=search mode  4=coast mode  bits03-00: attitude PWTIP\$AC  0=nominal mode/no test  1=yaw axis test in progress  2=roll axis test in progress  3=pitch axis test in progress</p>
mhs_attangtime	I4	4	1	time associated with Euler angles (seconds)
mhs_rollang	I2	2	1	10 <sup>3</sup> *Roll angle in degrees
mhs_pitchang	I2	2	1	10 <sup>3</sup> *Pitch angle in degrees
mhs_yawang	I2	2	1	10 <sup>3</sup> *Yaw angle in degrees
mhs_scalti	I2	2	1	10*spacecraft altitude (MSL) in km
mhs_ang	I2	2	270	<p>scan angles in degrees  word1: 100*solar zenith angle, point 1  word2: 100*satellite zenith angle, point 1  word3: 100*local azimuth angle, point 1  word4: 100*solar zenith angle, point 2  word5: 100*satellite zenith angle, point 2  word6: 100*local azimuth angle, point 2  .....  word268: 100*solar zenith angle, point 90  word269: 100*satellite zenith angle, point 90  word270: 100*local azimuth angle, point 90</p>
mhs_pos	I4	4	180	<p>Earth location  (north latitude and east longitude are positive)  word1: 10<sup>4</sup>*latitude in degrees, point 1  word2: 10<sup>4</sup>*longitude in degrees, point 1  word3: 10<sup>4</sup>*latitude in degrees, point 2  word4: 10<sup>4</sup>*longitude in degrees, point 2  .....</p>

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				word180: 10 <sup>4</sup> *longitude in degrees, point 90
mhs_moonang	I2	2	4	100*angle (deg) between moon and each space view
<b>MHS SENSOR DATA</b>				
mhs_earth_data	I2	2	540	90 x [position, counts(H1-H5)]
mhs_filler4	I4	4	2	Zero fill
<b>MHS CALIBRATION DATA</b>				
mhs_coldcal	I2	2	24	4 x [position, counts(H1-H5)]
mhs_warmcal	I2	2	24	4 x [position, counts(H1-H5)]
mhs_filler5	I4	4	2	Zero fill
<b>MHS POSITION VALIDITY FLAGS</b>				
mhs_earthval	C	1	12	0= position OK. 1 bit per FOV FOV1-8 = Word 1 bits 0-7, etc. FOV89-90 = Word 12 bits 0-1
mhs_spaceval	C	1	1	Bits 0-3
mhs_targval	C	1	1	Bits 0-3
<b>MHS FULL HOUSEKEEPING DATA</b>				
mhs_mode	C	1	1	bits 7-4: 3=scan, 4=fixed view bit 3: 0=PIE-A, 1=PIE-B bits 2-0: Subcomm code (for telemetry packet data)
mhs_fault	C	1	5	Word 1-4 Telecommand acknowledgement Word 5 Fault code: bits 7-3: Fault in PSU current, thermistor, switch, processor, motor bit 2: DC offset error (change in DC offset required) bit 1: scan control error bit 0: ref clock error
mhs_switchstat	C	1	3	Word 1: bit 7: H4 backend (0=off, 1=on) bit 6: H3 backend (0=off, 1=on) bit 5: H3/H4 LO selected (0=A, 1=B) bit 4: H3/H4 front-end (0=off, 1=on) bit 3: H2 LO selected (0=A, 1=B) bit 2: H2 front-end (0=off, 1=on) bit 1: H1 LO selected (0=A, 1=B) bit 0: H1 front-end (0=off, 1=on) Word 2: bit 7: PROM (1=failed ON) bit 6: sig proc / scan electronics (0=off, 1=on) bit 5: Aux heaters (0=off, 1=on) bit 4: Scan mech operational heaters (0=off, 1=on) bit 3: Receiver operational heaters (0=off, 1=on) bit 2: Rx CV (0=off, 1=on) bit 1: H5 LO selected (0=A, 1=B)

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				bit 0: H5 receiver (0=off, 1=on) Word 3: Flywheel Drive Mechanism (FDM) and Reflector Drive Mech (RDM) bit 7/6: FDM/RDM motor current trip status (0=enabled, 1=disabled) bit 5/4: FDM/RDM motor supply (0=off, 1=on) bit 3/2: FDM/RDM motor sensors selected (0=A, 1=B) bit 1/0: FDM/RDM zero position sensors (0=A, 1=B)
mhs_temps	C	1	24	Range 0-255 for 24 thermistors Word 1-4: LO temps H1, H2, H3/H4, H5 Word 5-8: Mixer temps H1, H2, H3/H4, H5 Word 9-10: Quasi optic baseplate #1, #2 Word 11-12: IF baseplate #1, #2 Word 13-14: Scan mechanism core, housing Word 15-16: RDM, FDM Scan Sensor Head Module Word 17-19: Structure 1, 2, 3 Word 20: Processor module Word 21: Main DC/DC convertor Word 22-23: Scan Control Electronics RDM, FDM Word 24: RF DC/DC convertor
mhs_current	C	1	6	6 current sensors
mhs_filler6	C	1	1	Zero fill
<b>MHS STATUS WORD</b>				
mhs_stat	C	1	1	bit 7: DC offset valid (1=all channels OK) bit 6: Scan control valid (1=all views OK) bit 5-4: Scan profile (0=nominal, 1/2=alternate, 3>manual) bit 3-0: <unused>
mhs_filler7	C	1	7	Zero fill
<b>SIGNAL PROCESSING STATUS</b>				
mhs_dcoffset	C	1	5	DC offset, channels H1 to H5
mhs_chvalflgs	C	1	1	Channel validity bits 7-3: H1-H5 valid (all samples within ADC dynamic range) bits 2-0: SPE MUX code
mhs_chgains	C	1	3	Gains Word 1: H1 & H2 (bits 7-5 & 4-2) Word 2: H3 & H4 (bits 7-5 & 4-2) Word 3: H5 (bits 7-5)
mhs_filler8	C	1	7	Zero fill
<b>OBCT TEMPERATURE DATA</b>				
mhs_obctprt	I2	2	5	PRT counts
mhs_refrescts	I2	2	3	Reference resistor counts (upper, mid, lower)

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mhs_filler9	I2	2	1	Zero fill
mhs_obcttemp	I4	4	5	Computed temperatures (mK)
mhs_filler10	C	1	46	Zero fill
<b>MHS DISCRETE TELEMETRY (digb/analog)</b>				
mhs_discrete	C	1	6	6 status words, 1 or 0
mhs_survtemp	I2	2	3	3 Survival temps (receiver, electronics, scan)
mhs_stx	I2	2	9	STX 1-4 status, STX1-3 power, SARR A&B power
mhs_ahkval	I4	4	1	bits 0-17: 1 if item is up to date
mhs_filler11	I2	2	102	Zero fill



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#### **14. FORMAT OF THE MSU.L1B FILE**

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

MSU.11a format = MSU.11b format (in MSU.11a, calibration and location fields are empty).

##### Header and record length

Header length = record length

1024 bytes

##### Type

C = character

I2 = integer\*2

I4 = integer\*4

##### **Header Record**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>GENERAL INFORMATION</b>				
msu_h_siteid	C	3	1	Data set creation site ID CMS = Centre de MeteorologiSpatale/France NSS = NESDIS/USA UKM = UK Met Office
msu_h_blank	C	1	1	ASCII blank
msu_h_11bversnb	I2	2	1	level 1b format version number
msu_h_11bversyr	I2	2	1	level 1b format version year
msu_h_11bversdy	I2	2	1	level 1b format version day of year
msu_h_reclg	I2	2	1	reserved for logical record length
msu_h_blksz	I2	2	1	reserved for block size
msu_h_hdrcnt	I2	2	1	Count of header record in this data set
msu_h_filler0	I2	2	3	zero fill
msu_h_dataname	C	42	1	data set name
msu_h_prblkid	C	8	1	processing block identification
msu_h_satid	I2	2	1	Spacecraft identification code: 4=NOAA-15 (NOAA-K) 2=NOAA-16 (NOAA-L) 6=NOAA-17 (NOAA-M) 7=NOAA-18 (NOAA-N) 8=NOAA-19 (NOAA-N') 11=Metop-B (Metop-1) 12=Metop-A (Metop-2) 13=Metop-C (Metop-3) 14=Metop simulator

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msu_h_instid	I2	2	1	MSU instrument identification
msu_h_datatyp	I2	2	1	data type code (6 = MSU)
msu_h_tipsrc	I2	2	1	TIP source code (0 = not applicable; 1 = GAC embedded; 2 = stored; 3 = third CDA; 4 = HRPT embedded)
msu_h_startdatajd	I4	4	1	start of data set julian day
msu_h_startdatayr	I2	2	1	start of data set year
msu_h_startdatady	I2	2	1	start of data set day of year
msu_h_startdatatime	I4	4	1	start of data set UTC time of day in milliseconds
msu_h_enddatajd	I4	4	1	end of data set julian day
msu_h_enddatayr	I2	2	1	end of data set year
msu_h_enddatady	I2	2	1	end of data set day of year
msu_h_enddatatime	I4	4	1	end of data set UTC time of day in milliseconds
msu_h_cpidsyr	I2	2	1	year of Last CPIDS Update
msu_h_cpidsdy	I2	2	1	day of Year of Last CPIDS Update
msu_h_filler1	I2	2	4	Zero fill
<b>DATA SET QUALITY INDICATORS</b>				
msu_h_inststat1	I4	4	1	instrument status
msu_h_filler2	I2	2	1	zero fill
msu_h_statchrecnb	I2	2	1	record number of status change (if 0, none occurred)
msu_h_inststat2	I4	4	1	second instrument status (if previous word is 0, no change)
msu_h_scnlin	I2	2	1	count of scan lines in this data set
msu_h_callocsclin	I2	2	1	count of calibrated, Earth located scan lines in this data set
msu_h_misscnlin	I2	2	1	count of missing scan lines
msu_h_datagaps	I2	2	1	count of data gaps in this data set
msu_h_okdatafr	I2	2	1	count of data frames without frame sync word errors
msu_h_pacsparityerr	I2	2	1	count of PACS detected TIP parity errors
msu_h_auxsyncerrsum	I2	2	1	sum of all auxiliary sync errors detected in the input data
msu_h_timeseqerr	I2	2	1	time sequence error (0 = none; otherwise the record number of the first occurrence)
msu_h_timeseqerrcode	I2	2	1	time sequence error code
msu_h_socclockupind	I2	2	1	socc clock update indicator (0 = none during this orbit; otherwise the record number of the first occurrence)
msu_h_locerrind	I2	2	1	Earth location error indicator (0 = none during this orbit; otherwise the record number of the first occurrence)
msu_h_locerrcode	I2	2	1	Earth location error code

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msu_h_pacsstatfield	I2	2	1	PACS status bit field bit 15-3 : spare bit 2 : pseudo noise (0 = normal data; 1 = P/N data) bit 1 : tape direction (0 = time decrementing) bit 0 : data mode (0 = test data; 1 = flight data)
msu_h_pacsdatasrc	I2	2	1	PACS data source (0 = unused; 1 = Gilmore; 2 = Wallops; 3 = SOCC)
msu_h_filler3	I4	4	1	zero fill
msu_h_spare1	C	8	1	spare (reserved for ingester)
msu_h_spare2	C	8	1	spare (reserved of the decommutation)
msu_h_filler4	I2	2	5	zero fill
<b>CALIBRATION</b>				
msu_h_racalind	I2	2	1	ramp/auto calibration indicators bit field
msu_h_calinf	I4	4	4*4	calibration information for nochannel 1 to 4 : ?? x (mean calibration slope nochannel) ?? x (standard deviation calibration slope nochannel) ?? x (b-sub-1 nochannel) ?? x (standard deviation of linear regression for b-sub-1 nochannel)
<b>RADIANCE TO TEMPERATURE CONVERSION</b>				
msu_h_nolincor	I4	4	3*4	nonlinearity correction coefficients for nochannel 1 to 4 : 10 <sup>12</sup> x (second order term nochannel (zero in 1A data)) 10 <sup>6</sup> x ( first order term nochannel (zero in 1A data)) 10 <sup>6</sup> x (zeroth order term nochannel (zero in 1A data))
msu_h_prttores	I4	4	2	PRT count to resistance coefficients ?? x (first one K0 (Ohm) (zero in 1A data)) ?? x (second one K1 (Ohm) (zero in 1A data))
msu_h_iwttotemp	I4	4	3*4	Internal Warm Target PRT Resistance to temperature (K) coefficients for term in PRT 1A, PRT 2A, PRT 1B,PRT 2B : 10 <sup>12</sup> x (second order term (zero in 1A data)) 10 <sup>6</sup> x ( first order term (zero in 1A data)) 10 <sup>6</sup> x (zeroth order term (zero in 1A data))
msu_h_censperes	I4	4	4	centroid of spectral response functions for nochannel 1 to 4 : 10 <sup>4</sup> x (nochannel (cm-1)(zero in 1A data))
msu_h_radspa	I4	4	4	Radiance of space for nochannel 1 to 4 : 10 <sup>6</sup> x (radiance of space nochannel(cm-1)(zero in 1A data))

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msu_h_filler5	I4	4	3	zero fill
<b>NAVIGATION</b>				
msu_h_modelid	C	1	8	Reference Ellipsoid Model ID =“GRS 80” in the actual version of AAPP
msu_h_nadlctol	I2	2	1	10 x (nadir Earth location tolerance in kilometers)
msu_h_locbit	I2	2	1	Earth location bit field bit 0 : attitude error correction (0 = not corrected)
msu_h_filler6	I2	2	1	zero fill
msu_h_rollerr	I2	2	1	10 <sup>3</sup> x (constant roll attitude error in degrees)
msu_h_pitcherr	I2	2	1	10 <sup>3</sup> x (constant pitch attitude error in degrees)
msu_h_yawerr	I2	2	1	10 <sup>3</sup> x (constant yaw attitude error in degrees)
msu_h_epoyr	I2	2	1	epoch year for orbit vector
msu_h_epody	I2	2	1	day of epoch year for orbit vector
msu_h_epotime	I4	4	1	epoc UTC time of day in milliseconds for orbit vector
msu_h_smaxis	I4	4	1	10 <sup>5</sup> x (semi-major axis in kilometers)
msu_h_eccen	I4	4	1	10 <sup>8</sup> x (eccentricity)
msu_h_incli	I4	4	1	10 <sup>5</sup> x (inclination in degrees)
msu_h_argper	I4	4	1	10 <sup>5</sup> x (argument of perigee in degrees)
msu_h_rascnod	I4	4	1	10 <sup>5</sup> x (right ascension of the ascending node in degrees)
msu_h_manom	I4	4	1	10 <sup>5</sup> x (mean anomaly in degrees)
msu_h_xpos	I4	4	1	10 <sup>5</sup> x (position vector x component in kilometers)
msu_h_ypos	I4	4	1	10 <sup>5</sup> x (position vector y component in kilometers)
msu_h_zpos	I4	4	1	10 <sup>5</sup> x (position vector z component in kilometers)
msu_h_xvel	I4	4	1	10 <sup>8</sup> x (velocity vector x-dot component in kilometers/second)
msu_h_yvel	I4	4	1	10 <sup>8</sup> x (velocity vector y-dot component in kilometers/second)
msu_h_zvel	I4	4	1	10 <sup>8</sup> x (velocity vector z-dot component in kilometers/second)
msu_h_earthsun	I4	4	1	10 <sup>6</sup> x (Earth/sun distance ratio)
msu_h_filler7	I2	2	272	zero fill

**One Data Record for one MSU scan line**

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Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>SCAN LINE INFORMATION</b>				
msu_sclin	I2	2	1	scan line number
msu_sclinyr	I2	2	1	scan line year
msu_sclindy	I2	2	1	scan line day of year
msu_clockdrift	I2	2	1	satellite clock drift delta in ms
msu_sclintime	I4	4	1	scan line UTC time of day in ms
msu_sclinbit	I2	2	1	scan line bit field bit 15: (0 = ascending data; 1 = descending data) bit 14: (1 = scan time corrected for clock drift) bit 13: (1 = Earth location corrected for TIP attitude)
msu_mjfrcnt	I2	2	1	major frame count
msu_scnpos	I2	2	1	scan position number in 32 seconds
msu_filler1	I2	2	5	zero fill
<b>QUALITY INDICATORS</b>				
msu_qualind	I4	4	1	quality indicator bit field in all of the following if the bit is on (i.e., if it is set to 1) then the statement is true. Otherwise it is false. <b>General</b> bit 31: do not use scan for product generation bit 30: time sequence error detected with this scan (see below) bit 29: data gap precedes this scan bit 28: no calibration (see below) bit 27: no Earth location (see below) bit 26: first good time following a clock update bit 25: instrument status changed with this scan bit 24: spare <b>Time Problem Code</b> (All bits off implies the scan time is as expected.) bit 23: time field is bad but can probably be inferred from the previous good time. bit 22: time field is bad and can't be inferred from the previous good time. bit 21: this record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity). This may or may not be associated with a spacecraft clock update. (See bit 26 above) bit 20: start of a sequence that apparently repeats scan times that have been previously

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				<p>accepted.</p> <p><b>TIP Problem Code</b>          bit 19: TIP synch error          bit 18: TIP minor or major frame sequence error          bit 17: TIP status error          bit 16: TIP parity error</p> <p><b>Calibration Problem Code</b>          (Note these bits compliment the channel indicators; all bits set to 0 indicates normal calibration. )          bit 15: Scan line was not calibrated because of bad time.          bit 14: Scan line was calibrated using fewer than the preferred number of scan lines because of proximity to start or end of data set or to a data gap.          bit 13: Scan line was not calibrated because of bad or insufficient PRT data.          bit 12: Scan line was calibrated but with marginal PRT data.          bit 11: Some uncalibrated channels on this scan. (See channel indicators.)          bit 10: Uncalibrated due to instrument mode.          bit 09: spare          bit 08: spare</p> <p><b>Earth Location Problem Code</b>          (all bits set to 0 implies the Earth location was normal)          bit 07: Not Earth located because of bad time.          bit 06: Earth location questionable because of questionable time code. (See time problem flags above.)          bit 05: Earth location questionable -- only marginal agreement with reasonableness check.          bit 04: Earth location questionable -- fails reasonableness check.          bit 03-00: spare</p>
msu_sclinqual	I2	2	4	<p>quality flag for nochannel 1 to 4 :          (all bits off implies a good calibration)          bit 7: spare          bit 6: spare          bit 5: No good blackbody counts for scan line          bit 4: No good space view counts for scan line          bit 3: No good PRTs for this line          bit 2: Some bad blackbody view counts for</p>

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				this line bit 1: Some bad space view counts for this line bit 0: Some bad PRT temps on this line
msu_filler2	I2	2	8	zero fill
<b>CALIBRATION COEFFICIENTS</b>				
msu_pmcal	I4	4	3*4	primary calibration for nochannel 1 to 4 : ?? x (chn nochannel second order term, a2) ?? x (chn nochannel first order term, a1) ?? x (chn nochannel zeroth order term, a0)
msu_sdcals	I4	4	3*4	secondary calibration for nochannel 1 to 4 : ?? x (chn nochannel second order term, a2) ?? x (chn nochannel first order term, a1) ?? x (chn nochannel zeroth order term, a0)
<b>NAVIGATION</b>				
msu_navstat	I4	4		Navigation Status Bit Field bits 15 - 12: earth location indicator (0 = earth location available; 1 = user ephemeris files greater than 24 hours old; 2 = no earth location available) bits 11 - 8: spacecraft attitude control (0 = operating in YGC or NOMINAL mode; 1 = operating in another mode; 2 = attitude exceeds nominal tolerance; 3 = both 1 and 2) bits 7 - 4: attitude SMODE (0 = NOMINAL mode; 1 = rate nulling mode; 2 = YGC mode; 3 = search mode; 4 = coast mode) bits 3 - 0: attitude PWT1P\$AC (0 = NOMINAL mode/no test; 1 = yaw axis test in progress; 2 = roll axis test in progress; 3 = pitch axis test in progress)
msu_attangtime	I4	4		Time associated with attitude angles(seconds)
msu_rollang	I2	2		10 <sup>3</sup> x Roll Angle in Degrees
msu_pitchang	I2	2		10 <sup>3</sup> x Pitch Angle in Degrees
msu_yawang	I2	2		10 <sup>3</sup> x Yaw Angle in Degrees
msu_scalti	I2	2	1	Spacecraft Altitude (MSL) in km in this scan line)
msu_ang	I2	2	3*11	set of 3 angles in degrees first angle : 10 <sup>2</sup> x (solar zenith angle) second angle: 10 <sup>2</sup> x (satellite zenith angle) third angle : 10 <sup>2</sup> x (relative azimuth angle)
msu_filler3	I2	2	1	zero fill
msu_pos	I4	4	2*11	lat/lon pair in degrees for point 1 to point 11 every point first : 10 <sup>4</sup> x (latitude ) second : 10 <sup>4</sup> x (longitude )

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				(North latitude and East longitude are positive)
msu_filler4	I2	2	8	zero fill
<b>MSU DATA (as from TIP minor frame)</b>				
msu_data	I2	2	112	First to last MSU words for scan line
msu_filler5	I2	2	230	zero fill



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## 15. FORMAT OF THE DCS.L1B FILE

### Header and record length

Header length = record length

10752 bytes

### Type

C = character

I2 = integer\*2

I4 = integer\*4

### Header Record

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>GENERAL INFORMATION</b>				
des_h_siteid	C	3	1	Data set creation site ID
des_h_blank	C	1	1	ASCII blank
des_h_l1bversnb	I2	2	1	level 1b format version number
des_h_l1bversyr	I2	2	1	level 1b format version year
des_h_l1bversdy	I2	2	1	level 1b format version day of year
des_h_reclg	I2	2	1	reserved for logical record length
des_h_blkisz	I2	2	1	reserved for block size
des_h_hdrcnt	I2	2	1	count of header records in data set
des_h_filler0	I2	2	3	Zero fill
des_h_dataname	C	42	1	data set name
des_h_prblkid	C	8	1	processing block identification
des_h_satid	I2	2	1	Spacecraft identification code: 4=NOAA-15 (NOAA-K) 2=NOAA-16 (NOAA-L) 6=NOAA-17 (NOAA-M) 7=NOAA-18 (NOAA-N) 8=NOAA-19 (NOAA-N') 11=Metop-B (Metop-1) 12=Metop-A (Metop-2) 13=Metop-C (Metop-3) 14=Metop simulator
des_h_instid	I2	2	1	instrument identification
des_h_datatyp	I2	2	1	data type code
des_h_tipsrc	I2	2	1	TIP source code (0 = not applicable; 1 = GAC embedded; 2 = stored; 3 = third CDA; 4 = HRPT embedded)
des_h_startdatajd	I4	4	1	start of data set day count from 00h,1 Jan 1950
des_h_startdatayr	I2	2	1	start of data set year
des_h_startdatady	I2	2	1	start of data set day of year

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dcsh_startdatatime	I4	4	1	start of data set UTC time of day in milliseconds
dcsh_enddatajd	I4	4	1	end of data set day count from 00h,1 Jan 1950
dcsh_enddatayr	I2	2	1	end of data set year
dcsh_enddatady	I2	2	1	end of data set day of year
dcsh_enddatatime	I4	4	1	end of data set UTC time of day in milliseconds
dcsh_cpidsyr	I2	2	1	year of Last CPIDS Update
dcsh_cpidsdy	I2	2	1	Day of Year of Last CPIDS Update
dcsh_filler1	I4	4	2	filler
<b>DATA SET QUALITY INDICATORS</b>				
dcsh_inststat	I4	4	1	instrument status
dcsh_statchrecnb	I2	2	1	record number of status change (if 0, none occurred)
dcsh_scnlin	I2	2	1	count of scan lines in this data set
dcsh_datagaps	I2	2	1	count of data gaps in this data set
dcsh_okdatafr	I2	2	1	count of data frames without frame sync word errors
dcsh_pacsparityerr	I2	2	1	count of PACS detected TIP parity errors
dcsh_auxsyncerrsum	I2	2	1	Sum of all auxiliary sync errors detected in the input data.
dcsh_pacsstatfield	I2	2	1	PACS status bit field bit 15-3 : spare bit 2 : pseudo noise (0 = normal data; 1 = P/N data) bit 1 : tape direction (0 = time decrementing) bit 0 : data mode (0 = test data; 1 = flight data)
dcsh_pacsdatasrc	I2	2	1	PACS data source (0 = unused; 1 = Gilmore; 2 = Wallops; 3 = SOCC)
dcsh_spare1	C	8	1	spare (reserved for ingester)
dcsh_spare2	C	8	1	spare (reserved of the decommutation)
dcsh_filler2	I4	4	4	filler
<b>ANALOG TELEMETRY CONVERSION</b>				
dcsh_ancnv	I4	4	5*9	conversion coefficients for analog housekeeping telemetry (five consecutive 16-bit words per telemetry field) word 1 - 5: type 1 telemetry transfer coefficients word 6 - 10: type 2 telemetry transfer coefficients word 11 - 15: type 3 telemetry transfer coefficients word 16 - 20: type 4 telemetry transfer

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				coefficients word 21 - 25: type 5 telemetry transfer coefficients word 26 - 30: type 6 telemetry transfer coefficients word 31 - 35: type 7 telemetry transfer coefficients word 36 - 40: type 8 telemetry transfer coefficients word 41 - 45: type 9 telemetry transfer coefficients
des_h_filler3	I2	2	5202	filler

### Data Record

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>FRAME INFORMATION STRUCTURE</b>				
des_mjfrcnt	I2	2	1	major frame count
des_mjfrdy	I2	2	1	major frame year
des_mjfrdy	I2	2	1	major frame day of year
des_clockdrift	I2	2	1	satellite clock drift delta in milliseconds
des_mjfrtime	I4	4	1	scan line UTC time of day in milliseconds
des_mjfbf	I2	2	1	major frame bit field
des_filler1	I2	2	5	filler
<b>QUALITY INDICATORS</b>				
des_qualind	I4	4	1	quality indicator bit field
des_mjfqf	I4	4	1	major frame quality flags
des_filler2	I4	4	2	filler
<b>DCS MINOR FRAME DATA</b>				
des_data	I4	4	320*8	DCS minor frame data
des_filler3	I4	4	1	filler
<b>DIGITAL B TELEMETRY</b>				
des_digbinwbf	I2	2	1	invalid word bit flags
des_digbtlm	I2	2	1	digital B telemetry bit 15: relay A status bit 14: relay B status bit 13: DRU 1 bit 12: DRU 2 bit 11: DRU 3 bit 10: DRU 4 bit 9: DRU 5 bit 8: DRU 6 bit 7: DRU 7

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				bit 6: DRU 8 bit 5: Memory Overflow bit 4: DCS Time Code (MSB) bit 3: Pseudo message status bit 2: spare bit 1: spare bit 0: spare
dcf_filler4	I4	4	1	filler
<b>ANALOG TELEMETRY</b>				
dcf_aninvwbf	I2	2	1	invalid word bit flags
dcf_analog	I2	2	8	analog telemetry (16 8-bit words) word 1: RPU temperature (use type 1 transfer coefficients) word 2: SPU-A temperature (use type 1 transfer coefficients) word 3: SPU-B temperature (use type 1 transfer coefficients) word 4: converter voltage +5V (use type 2 transfer coefficients) word 5: converter voltage +12V (use type 3 transfer coefficients) word 6: converter voltage -5V (use type 4 transfer coefficients) word 7: converter voltage -12V (use type 5 transfer coefficients) word 8: converter temperature (use type 1 transfer coefficients) word 9: USO oven temperature (use type 6 transfer coefficients) word 10: USO thermal regulation (use type 7 transfer coefficients)
dcf_filler5	I2	2	221	filler

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## 16. FORMAT OF THE HIRS.L1C FILE

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

### Header and record length

Header length = record length

1664\*4 bytes

### Type

C = character

I2 = integer\*2

I4 = integer\*4

### Header Record

Name IN AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>GENERAL INFORMATION</b>				
hrs1c_h_site	C	3	1	dataset creation site ID
hrs1c_h_cfill1	C	1	1	zero fill
hrs1c_h_1bsite	C	3	1	creation site for original 1B data
hrs1c_h_cfill2	C	1	1	zero fill
hrs1c_h_versnb	I4	4	1	level 1c format version number
hrs1c_h_versyr	I4	4	1	level 1c format version year
hrs1c_h_versdy	I4	4	1	level 1c format version day of year
hrs1c_h_hdrcnt	I4	4	1	count of header records in this data set
hrs1c_h_satid	I4	4	1	satellite identification .15=NOAA-15 (NOAA-K) 16=NOAA-16 (NOAA-L) 17=NOAA-17 (NOAA-M) 18=NOAA-18 (NOAA-N) 19=NOAA-19 (NOAA-N') 1=Metop-B (Metop-1) 2=Metop-A (Metop-2) 3=Metop-C (Metop-3) 4=Metop simulator
hrs1c_h_instrument	I4	4	1	instrument code (5=HIRS)
hrs1c_h_satht	I4	4	1	nominal satellite altitude, km*10
hrs1c_h_period	I4	4	1	nominal orbit period (seconds)
hrs1c_h_startorbit	I4	4	1	orbit number (at start of file)
hrs1c_h_startdatayr	I4	4	1	start of data set year
hrs1c_h_startdatady	I4	4	1	start of data set day of the year
hrs1c_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)

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hrs1c_h_endorbit	I4	4	1	orbit number (at end of file)
hrs1c_h_enddatayr	I4	4	1	end of data set year
hrs1c_h_enddatady	I4	4	1	end of data set day of the year
hrs1c_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
hrs1c_h_scnlin	I4	4	1	count of scan lines in this data set
hrs1c_h_misscnlin	I4	4	1	count of missing scan lines
hrs1c_h_spare	I4	4	1	spare
<b>TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS</b>				
hrs1c_h_tempradcnv	I4	4	3*19	order of channels = 1,2,3,4,...,18,19 for nochannel = 1 to 19 : 10 <sup>6</sup> x (nochannel central wavenumber) 10 <sup>6</sup> x (nochannel constant 1) 10 <sup>6</sup> x (nochannel constant 2) (scaling factor for wavenumber changes to 10 <sup>5</sup> for channels 13-19 inclusive)
hrs1c_h_20solfiltirrad	I4	4	1	10 <sup>6</sup> x (albedo-radiance ch20 solar filtered irradiance,W/m2)
hrs1c_h_20equifiltwidth	I4	4	1	10 <sup>6</sup> x (albedo-radiance ch 20 equivalent filter width cm <sup>-1</sup> )
hrs1c_h_wmosatid	I4	4	1	WMO satellite id (e.g. 3 for METOP-1)
hrs1c_h_filler	I4	4	1583	zero fill

**One Data Record for one HIRS scan line**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
hrs1c_scnlin	I4	4	1	scan line number
hrs1c_scnlinyr	I4	4	1	scan line year
hrs1c_scnliny	I4	4	1	scan line day of year
hrs1c_scnlintime	I4	4	1	scan line UTC time of day in milliseconds
hrs1c_mjfrnt	I4	4	1	major frame count
hrs1c_qualind	I4	4	1	quality indicator bit field In all of the following, if the bit is on (= is set to 1) then the statement is true. Otherwise it is false. <b>general</b> bit 31: do not use scan for product generation bit 30: time sequence error detected with this scan bit 29: data gap precedes this scan bit 28: no calibration bit 27: no Earth location bit 26: first good time following a clock update

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				bit 25: instrument status changed with this scan bit 24-0: spare <zero fill>
hrs1c_scanqual	I4	4	1	scan line quality flags <b>time problem code</b> (all bits off implies the scan time is as expected) bit 31-24: spare <zero fill> bit 23: time field is bad but can probably be inferred from the previous good time bit 22: time field is bad and can't be inferred from the previous good time bit 21: this record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity). This may or may not be associated with a spacecraft clock update. (see bit 26 above) bit 20: start of a sequence that apparently repeats scan times that have been previously accepted. bits 19-16: spare <b>calibration problem code</b> (all bits set to 0 indicates normal calibration) bit 15: scan line was not calibrated because of bad time bit 14: scan line was calibrated using fewer than the preferred number of scan lines because of proximity to start or end of data set or to a data gap. bit 13: scan line was not calibrated because of bad or insufficient PRT data bit 12: scan line was calibrated but with marginal PRT data bit 11: some uncalibrated channels of this scan. See channel indicators. bit 10: uncalibrated due to instrument mode bits 9 and 8: spare <b>Earth location problem code</b> (all bits set to 0 implies the Earth location was normal) bit 7: not Earth located because of bad time bit 6: Earth location questionable because of questionable time code (see time problem flags above) bit 5: Earth location questionable. Only marginal agreement with reasonableness check. bit 4: Earth location questionable. Fails

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				reasonableness check bit 3-0: spare
hrs1c_chanqual	I4	4	20	quality flag for each channel with the channels in the order 1,2,3,...,20. (all bits off implies a good calibration) bit 31-6: spare bit 5-0: TBD (to be defined)
hrs1c_instrtemp	I4	4	1	HIRS baseplate temperature (K*100)
hrs1c_spare1	I4	4	2	spare
hrs1c_latlon	I4	4	2*56	lat/lon in degrees for Hnfovs first : 10 <sup>4</sup> x (latitude) second : 10 <sup>4</sup> x (longitude)
hrs1c_angles	I4	4	4*56	scan angles for Hnfovs first: 10 <sup>2</sup> x (local zenith angle) second: 10 <sup>2</sup> x (local azimuth angle) third: 10 <sup>2</sup> x (solar zenith angle) fourth: 10 <sup>2</sup> x (solar azimuth angle)
hrs1c_scalti	I4	4	1	sat altitude above reference ellipsoid, km*10
hrs1c_spare2	I4	4	2	spare
hrs1c_btemps	I4	4	20*56	BT data for Hnfovs 10 <sup>2</sup> x scene brightness temperature (K) for channels 1-19 10 <sup>2</sup> x radiance Wm <sup>-2</sup> sr <sup>-1</sup> (cm <sup>-1</sup> )-1 for channel 20
hrs1c_dataqual	I4	4	56	quality control word for the data in each field of view: (all bits off implies acceptable data) bit 31: spare <zero fill> bit 30: set if secondary calibration used bit 29-21: spare <zero fill> bit 20-1: bit n set to 1 if brightness temperature in channel n is physically unreasonable or has not been calculated due to calibration problems. bit 0: set if all channels missing
hrs1c_filler	I4	4	119	zero fill



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## 17. FORMAT OF THE AMSUA.L1C FILE

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

### Header and record length

Header length = record length

768\*4 bytes

### Type

C = character

I2 = integer\*2

I4 = integer\*4

### Header Record

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>General information</b>				
amalc_h_site	C	3	1	dataset creation site ID
amalc_h_cfill1	C	1	1	filler
amalc_h_1bsite	C	3	1	creation site for original 1B data
amalc_h_cfill2	C	1	1	filler
amalc_h_versnb	I4	4	1	level 1c format version number
amalc_h_versyr	I4	4	1	level 1c format version year
amalc_h_versdy	I4	4	1	level 1c format version day of year
amalc_h_hdrcnt	I4	4	1	count of header records in this data set
amalc_h_satid	I4	4	1	satellite identification: .15=NOAA-15 (NOAA-K) 16=NOAA-16 (NOAA-L) 17=NOAA-17 (NOAA-M) 18=NOAA-18 (NOAA-N) 19=NOAA-19 (NOAA-N') 1=Metop-B (Metop-1) 2=Metop-A (Metop-2) 3=Metop-C (Metop-3) 4=Metop simulator
amalc_h_instrument	I4	4	1	instrument code (10=AMSU-A)
amalc_h_satht	I4	4	1	nominal satellite altitude, km*10
amalc_h_period	I4	4	1	nominal orbit period (seconds)
amalc_h_startorbit	I4	4	1	orbit number (at start of file)
amalc_h_startdatayr	I4	4	1	start of data set year
amalc_h_startdatady	I4	4	1	start of data set day of the year

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amalc_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
amalc_h_endorbit	I4	4	1	orbit number (at end of file)
amalc_h_enddatayr	I4	4	1	end of data set year
amalc_h_enddatady	I4	4	1	end of data set day of the year
amalc_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
amalc_h_sclin	I4	4	1	count of scan lines in this data set
amalc_h_missclin	I4	4	1	count of missing scan lines
amalc_h_vnantennacorr	I4	4	1	version number, antenna corrections
amalc_h_spare	I4	4	1	spare
<b>TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS</b>				
amalc_h_tempradcnv	I4	4	3*15	order of channels = 1,2,3,4,...,15 for nochannel = 1 to 15 : 10 <sup>6</sup> x (nochannel central wavenumber) 10 <sup>6</sup> x (nochannel constant 1) 10 <sup>6</sup> x (nochannel constant 2)
amalc_h_wmosatid	I4	4	1	WMO satellite id (e.g. 3 for METOP-1)
amalc_h_filler	I4	4	700	filler

**One Data Record for one AMSU-A scan line**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
amalc_sclin	I4	4	1	scan line number
amalc_sclinyr	I4	4	1	scan line year
amalc_sclindy	I4	4	1	scan line day of year
amalc_sclintime	I4	4	1	scan line UTC time of day in milliseconds
amalc_qualind	I4	4	1	quality indicator bit field In all of the following, if the bit is on (= is set to 1) then the statement is true. Otherwise it is false. <b>general</b> bit 31: do not use scan for product generation bit 30: time sequence error detected with this scan bit 29: data gap precedes this scan bit 28: no calibration bit 27: no Earth location bit 26: first good time following a clock update bit 25: instrument status changed with this scan bit 24-0: spare <zero fill>
amalc_scanqual	I4	4	1	scan line quality flags <b>time problem code</b>

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			<p>(all bits off implies the scan time is as expected)</p> <ul style="list-style-type: none"> <li>bit 31-24: spare &lt;zero fill&gt;</li> <li>bit 23: time field is bad but can probably be inferred from the previous good time</li> <li>bit 22: time field is bad and can't be inferred from the previous good time</li> <li>bit 21: this record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity). This may or may not be associated with a spacecraft clock update. (see bit 26 above)</li> <li>bit 20: start of a sequence that apparently repeats scan times that have been previously accepted.</li> </ul> <p><b>moon problem code</b></p> <ul style="list-style-type: none"> <li>bit 19: Moon in AMSU-A2 space view corrected</li> <li>bit 18: Moon in AMSU-A1 space view corrected</li> <li>bit 17: Moon in AMSU-A2 space view uncorrected</li> <li>bit 16: Moon in AMSU-A1 space view uncorrected</li> </ul> <p><b>calibration problem code</b> (all bits set to 0 indicates normal calibration)</p> <ul style="list-style-type: none"> <li>bit 15: scan line was not calibrated because of bad time</li> <li>bit 14: scan line was calibrated using fewer than the preferred number of scan lines because of proximity to start or end of data set or to a data gap.</li> <li>bit 13: scan line was not calibrated because of bad or insufficient PRT data</li> <li>bit 12: scan line was calibrated but with marginal PRT data</li> <li>bit 11: some uncalibrated channels of this scan. See channel indicators.</li> <li>bit 10: uncalibrated due to instrument mode</li> <li>bits 9 and 8: spare</li> </ul> <p><b>Earth location problem code</b> (all bits set to 0 implies the Earth location was normal)</p> <ul style="list-style-type: none"> <li>bit 7: not Earth located because of bad time</li> <li>bit 6: Earth location questionable because of</li> </ul>
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				questionable time code (see time problem flags above) bit 5: Earth location questionable. Only marginal agreement with reasonableness check. bit 4: Earth location questionable. Fails reasonableness check bit 3: Earth location questionable because of antenna position check bit 2-0: spare
ama1c_chanqual	I4	4	15	quality flag for each channel with the channels in the order 1,2,3,...,15. (all bits off implies a good calibration) bit 31-6: spare bit 5: No good blackbody counts for scan line bit 4: No good space view counts for scan line bit 3: No good PRTs for this line bit 2: Some bad blackbody view counts for this line bit 1: Some bad space view counts for this line bit 0: Some bad PRT temps on this line
ama1c_insttemp1	I4	4	1	AMSU-A1 RF shelf temp (K*100)
ama1c_insttemp2	I4	4	1	AMSU-A2 RF shelf temp (K*100)
ama1c_spare1	I4	4	2	spare
ama1c_latlon	I4	4	2*30	lat/lon in degrees for Anfovs first : 10 <sup>4</sup> x (latitude) second : 10 <sup>4</sup> x (longitude)
ama1c_angles	I4	4	4*30	scan angles for Anfovs first: 10 <sup>2</sup> x (local zenith angle) second: 10 <sup>2</sup> x (local azimuth angle) third: 10 <sup>2</sup> x (solar zenith angle) fourth: 10 <sup>2</sup> x (solar azimuth angle)
ama1c_scalti	I4	4	1	sat altitude above reference ellipsoid, km*10
ama1c_spare2	I4	4	2	spare
ama1c_btemps	I4	4	15*30	BT data for Anfovs 10 <sup>2</sup> x scene brightness temperature (K), channels 1-15
ama1c_dataqual	I4	4	30	quality control word for the data in each field of view: (all bits off implies acceptable data) bit 31: spare <zero fill> bit 30: set if secondary calibration used bit 29-16: spare <zero fill> bit 15-1: bit n set to 1 if brightness temperature in channel n is physically

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				unreasonable or has not been calculated due to calibration problems. bit 0: set if all channels missing
ama1c_filler	I4	4	80	filler

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## 18. FORMAT OF THE AMSUB.L1C AND MHS.L1C FILE

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

### Header and record length

Header length = record length

1152\*4 bytes

### Type

C = character

I2 = integer\*2

I4 = integer\*4

### Header Record

Name in AAPP code	Name	Word Size in byte	Number of words	Meaning
<b>GENERAL INFORMATION</b>				
amb1c_h_site	C	3	1	dataset creation site ID
amb1c_h_cfill1	C	1	1	filler
amb1c_h_1bsite	C	3	1	creation site for original 1B data
amb1c_h_cfill2	C	1	1	filler
amb1c_h_versnb	I4	4	1	level 1c format version number
amb1c_h_versyr	I4	4	1	level 1c format version year
amb1c_h_versdy	I4	4	1	level 1c format version day of year
amb1c_h_hdrcnt	I4	4	1	count of header records in this data set
amb1c_h_satid	I4	4	1	satellite identification: .15=NOAA-15 (NOAA-K) 16=NOAA-16 (NOAA-L) 17=NOAA-17 (NOAA-M) 18=NOAA-18 (NOAA-N) 19=NOAA-19 (NOAA-N') 1=Metop-B (Metop-1) 2=Metop-A (Metop-2) 3=Metop-C (Metop-3) 4=Metop simulator
amb1c_h_instrument	I4	4	1	instrument code (11=AMSU-B; 12=MHS)
amb1c_h_satht	I4	4	1	nominal satellite altitude, km*10
amb1c_h_period	I4	4	1	nominal orbit period (seconds)
amb1c_h_startorbit	I4	4	1	orbit number (at start of file)
amb1c_h_startdatayr	I4	4	1	start of data set year
amb1c_h_startdatady	I4	4	1	start of data set day of the year
amb1c_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)

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amb1c_h_endorbit	I4	4	1	orbit number (at end of file)
amb1c_h_enddatayr	I4	4	1	end of data set year
amb1c_h_enddatady	I4	4	1	end of data set day of the year
amb1c_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
amb1c_h_sclin	I4	4	1	count of scan lines in this data set
amb1c_h_missclin	I4	4	1	count of missing scan lines
amb1c_h_vnantennacorr	I4	4	1	version number, antenna corrections
amb1c_h_spare	I4	4	1	spare
<b>TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS</b>				
amb1c_h_tempradcnv	I4	4	3*5	order of channels = 1,2,3,4,5 for nochannel = 1 to 5 : 10 <sup>6</sup> x (nochannel central wavenumber) 10 <sup>6</sup> x (nochannel constant 1) 10 <sup>6</sup> x (nochannel constant 2)
amb1c_h_wmosatid	I4	4	1	WMO satellite id (e.g. 3 for METOP-1)
amb1c_h_filler	I4	4	1114	filler

**One Data Record for one AMSU-B/MHS scan line**

Name in AAPP code	Name	Word Size in byte	Number of words	Meaning
amb1c_sclin	I4	4	1	scan line number
amb1c_sclinyr	I4	4	1	scan line year
amb1c_sclindy	I4	4	1	scan line day of year
amb1c_sclintime	I4	4	1	scan line UTC time of day in milliseconds
amb1c_qualind	I4	4	1	quality indicator bit field In all of the following, if the bit is on (= is set to 1) then the statement is true. Otherwise it is false. <b>general</b> bit 31: do not use scan for product generation bit 30: time sequence error detected with this scan bit 29: data gap precedes this scan bit 28: no calibration bit 27: no Earth location bit 26: first good time following a clock update bit 25: instrument status changed with this scan bit 24-0: spare <zero fill>
amb1c_scanqual	I4	4	1	scan line quality flags <b>time problem code</b> (all bits off implies the scan time is as

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				<p>expected)</p> <ul style="list-style-type: none"> <li>bit 31-24: spare &lt;zero fill&gt;</li> <li>bit 23: time field is bad but can probably be inferred from the previous good time</li> <li>bit 22: time field is bad and can't be inferred from the previous good time</li> <li>bit 21: this record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity). This may or may not be associated with a spacecraft clock update. (see bit 26 above)</li> <li>bit 20: start of a sequence that apparently repeats scan times that have been previously accepted.</li> <li>bits 19-16: spare</li> </ul> <p><b>calibration problem code</b> (all bits set to 0 indicates normal calibration)</p> <ul style="list-style-type: none"> <li>bit 15: scan line was not calibrated because of bad time</li> <li>bit 14: scan line was calibrated using fewer than the preferred number of scan lines because of proximity to start or end of data set or to a data gap.</li> <li>bit 13: scan line was not calibrated because of bad or insufficient PRT data</li> <li>bit 12: scan line was calibrated but with marginal PRT data</li> <li>bit 11: some uncalibrated channels of this scan. See channel indicators.</li> <li>bit 10: uncalibrated due to instrument mode</li> <li>bits 9 and 8: spare</li> </ul> <p><b>Earth location problem code</b> (all bits set to 0 implies the Earth location was normal)</p> <ul style="list-style-type: none"> <li>bit 7: not Earth located because of bad time</li> <li>bit 6: Earth location questionable because of questionable time code (see time problem flags above)</li> <li>bit 5: Earth location questionable. Only marginal agreement with reasonableness check.</li> <li>bit 4: Earth location questionable. Fails reasonableness check</li> <li>bit 3: Earth location questionable because of antenna position check</li> <li>bit 2-0: spare</li> </ul>
amb1c_chanqual	14	4	5	quality flag for each channel with the channels in the order 1,2,3,4,5.



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				(all bits off implies a good calibration) bit 31-6: spare bit 5: No good blackbody counts for scan line bit 4: No good space view counts for scan line bit 3: No good PRTs for this line bit 2: Some bad blackbody view counts for this line bit 1: Some bad space view counts for this line bit 0: Some bad PRT temps on this line
amb1c_insttemp	I4	4	1	AMSU-B Mixer chan 18-20 temp (K*100)
amb1c_spare1	I4	4	2	spare
amb1c_latlon	I4	4	2*90	lat/lon in degrees for Bnfovs first : 10 <sup>4</sup> x (latitude) second : 10 <sup>4</sup> x (longitude)
amb1c_angles	I4	4	4*90	scan angles for Bnfovs first: 10 <sup>2</sup> x (local zenith angle) second: 10 <sup>2</sup> x (local azimuth angle) third: 10 <sup>2</sup> x (solar zenith angle) fourth: 10 <sup>2</sup> x (solar azimuth angle)
amb1c_scalti	I4	4	1	sat altitude above reference ellipsoid, km*10
amb1c_spare2	I4	4	2	spare
amb1c_btemps	I4	4	5*90	BT data for Bnfovs 10 <sup>2</sup> x scene brightness temperature (K), channels 1-5
amb1c_dataqual	I4	4	90	quality control word for the data in each field of view: (all bits off implies acceptable data) bit 31: spare <zero fill> bit 30: set if secondary calibration used bit 29-6: spare <zero fill> bit 5-1: bit n set to 1 if brightness temperature in channel n is physically unreasonable or has not been calculated due to calibration problems. bit 0: set if all channels missing
amb1c_filler	I4	4	55	spare

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## 19. FORMAT OF THE MSU.L1C FILE

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

### Header and record length

Header length = record length

128\*4 bytes

### Type

C = character

I2 = integer\*2

I4 = integer\*4

### Header Record

Name in AAPP code	Name	Word Size in byte	Number of words	Meaning
<b>GENERAL INFORMATION</b>				
msulc_h_site	C	3	1	dataset creation site ID
msulc_h_cfill1	C	1	1	filler
msulc_h_1bsite	C	3	1	creation site for original 1B data
msulc_h_cfill2	C	1	1	filler
msulc_h_versnb	I4	4	1	level 1c format version number
msulc_h_versyr	I4	4	1	level 1c format version year
msulc_h_versdy	I4	4	1	level 1c format version day of year
msulc_h_hdrcnt	I4	4	1	count of header records in this data set
msulc_h_satid	I4	4	1	satellite identification (e.g. 14 for NOAA-14)
msulc_h_instrument	I4	4	1	instrument code (6=MSU)
msulc_h_satht	I4	4	1	nominal satellite altitude, km*10
msulc_h_period	I4	4	1	nominal orbit period (seconds)
msulc_h_startorbit	I4	4	1	orbit number (at start of file)
msulc_h_startdatayr	I4	4	1	start of data set year
msulc_h_startdatady	I4	4	1	start of data set day of the year
msulc_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
msulc_h_endorbit	I4	4	1	orbit number (at end of file)
msulc_h_enddatayr	I4	4	1	end of data set year
msulc_h_enddatady	I4	4	1	end of data set day of the year
msulc_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
msulc_h_scnlin	I4	4	1	count of scan lines in this data set
msulc_h_missenlin	I4	4	1	count of missing scan lines
msulc_h_spare1	I4	4	1	spare
msulc_h_spare2	I4	4	1	spare

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<b>TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS</b>				
msulc_h_tempradenv	I4	4	3*4	order of channels = 1,2,3,4 for nochannel = 1 to 4 : 10 <sup>6</sup> x (nochannel central wavenumber) 10 <sup>6</sup> x (nochannel constant 1) 10 <sup>6</sup> x (nochannel constant 2)
msulc_h_filler	I4	4	94	filler

**One Data Record for one MSU scan line**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
msulc_sclin	I4	4	1	scan line number
msulc_sclinyr	I4	4	1	scan line year
msulc_sclindy	I4	4	1	scan line day of year
msulc_sclintime	I4	4	1	scan line UTC time of day in milliseconds
msulc_mjfrnt	I4	4	1	major frame count
msulc_qualind	I4	4	1	quality indicator bit field In all of the following, if the bit is on (= is set to 1) then the statement is true. Otherwise it is false. <b>general</b> bit 31: do not use scan for product generation bit 30: time sequence error detected with this scan bit 29: data gap precedes this scan bit 28: no calibration bit 27: no Earth location bit 26: first good time following a clock update bit 25: instrument status changed with this scan bit 24-0: spare <zero fill>
msulc_scanqual	I4	4	1	scan line quality flags <b>time problem code</b> (all bits off implies the scan time is as expected) bit 31-24: spare <zero fill> bit 23: time field is bad but can probably be inferred from the previous good time bit 22: time field is bad and can't be inferred from the previous good time bit 21: this record starts a sequence that is inconsistent with previous times (i.e., there is a

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				<p>time discontinuity). This may or may not be associated with a spacecraft clock update. (see bit 26 above)</p> <p>bit 20: start of a sequence that apparently repeats scan times that have been previously accepted.</p> <p><b>TIP Problem Code</b> (All bits off implies no errors.)</p> <p>bit 19: TIP synch error</p> <p>bit 18: TIP minor or major frame sequence error</p> <p>bit 17: TIP status error</p> <p>bit 16: TIP parity error</p> <p><b>calibration problem code</b> (all bits set to 0 indicates normal calibration)</p> <p>bit 15: scan line was not calibrated because of bad time</p> <p>bit 14: scan line was calibrated using fewer than the preferred number of scan lines because of proximity to start or end of data set or to a data gap.</p> <p>bit 13: scan line was not calibrated because of bad or insufficient PRT data</p> <p>bit 12: scan line was calibrated but with marginal PRT data</p> <p>bit 11: some uncalibrated channels of this scan. See channel indicators.</p> <p>bit 10: uncalibrated due to instrument mode</p> <p>bits 9 and 8: spare</p> <p><b>Earth location problem code</b> (all bits set to 0 implies the Earth location was normal)</p> <p>bit 7: not Earth located because of bad time</p> <p>bit 6: Earth location questionable because of questionable time code (see time problem flags above)</p> <p>bit 5: Earth location questionable. Only marginal agreement with reasonableness check.</p> <p>bit 4: Earth location questionable. Fails reasonableness check</p> <p>bit 3-0: spare</p>
msulc_chanqual	I4	4	4	<p>quality flag for each channel with the channels in the order 1,2,3,4 (all bits off implies a good calibration)</p> <p>bit 31-6: spare</p> <p>bit 5: No good blackbody counts for scan line</p>

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				bit 4: No good space view counts for scan line bit 3: No good PRTs for this line bit 2: Some bad blackbody view counts for this line bit 1: Some bad space view counts for this line bit 0: Some bad PRT temps on this line
msulc_spare1	I4	4	3	spare
msulc_latlon	I4	4	2*11	lat/lon in degrees for Mnfovs(11) first : 10 <sup>4</sup> x (latitude) second : 10 <sup>4</sup> x (longitude)
msulc_angles	I4	4	2*11	scan angles for Mnfovs(11) first: 10 <sup>2</sup> x (local zenith angle) second: 10 <sup>2</sup> x (local azimuth angle)
msulc_scalti	I4	4	1	sat altitude above reference ellipsoid, km*10
msulc_spare2	I4	4	1	spare
msulc_btemps	I4	4	4*11	BT data for Mnfovs(11) 10 <sup>2</sup> x scene brightness temperature (K) for channels 1-4
msulc_dataqual	I4	4	11	quality control word for the data in each field of view: !(all bits off implies acceptable data) bit 31: spare <zero fill> bit 30: set if secondary calibration used bit 29-5: spare <zero fill> bit 4-1: bit n set to 1 if brightness temperature in channel n is physically unreasonable or has not been calculated due to calibration problems. bit 0: set if all channels missing
msulc_filler	I4	4	34	filler

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## 20. FORMAT OF THE IASI L1C FILE

### Header and record length

Header length = record length

545981\*4 bytes

### Type

C = character

I2 = integer\*2

I4 = integer\*4

### Header Record

Name in AAPP code	Name	Word Size in byte	Number of words	Meaning
<b>GENERAL INFORMATION</b>				
ias1c_h_site	C	3	1	dataset creation site ID
ias1c_h_cfill1	C	1	1	filler
ias1c_h_1bsite	C	3	1	creation site for original 1B data
ias1c_h_cfill2	C	1	1	filler
ias1c_h_versnb	I4	4	1	level 1c format version number
ias1c_h_versyr	I4	4	1	level 1c format version year
ias1c_h_versdy	I4	4	1	level 1c format version day of year
ias1c_h_hdrcnt	I4	4	1	count of header records in this data set
ias1c_h_satid	I4	4	1	satellite identification: 1=Metop-1 2=Metop-2 3=Metop-3 4=Metop simulator
ias1c_h_instrument	I4	4	1	instrument code (13=IASI)
ias1c_h_satht	I4	4	1	nominal satellite altitude, km*10
ias1c_h_period	I4	4	1	nominal orbit period (seconds)
ias1c_h_startorbit	I4	4	1	orbit number (at start of file)
ias1c_h_startdatayr	I4	4	1	start of data set year
ias1c_h_startdatady	I4	4	1	start of data set day of the year
ias1c_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
ias1c_h_endorbit	I4	4	1	orbit number (at end of file)
ias1c_h_enddatayr	I4	4	1	end of data set year
ias1c_h_enddatady	I4	4	1	end of data set day of the year
ias1c_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
ias1c_h_scnlin	I4	4	1	count of scan lines in this data set
ias1c_h_misscnlin	I4	4	1	count of missing scan lines
ias1c_h_spare	I4	4	2	spare
ias1c_h_wmosatid	I4	4	1	WMO satellite id (e.g. 3 for METOP-1)

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ias1c_h_startchan	I4	4	10	Start channel for scaling definition
ias1c_h_endchan	I4	4	10	End channel for scaling definition
ias1c_h_scalefactor	I4	4	10	Radiance = scalrad*10 <sup>-scalefactor</sup>
ias1c_h_filler	I4	4	545508	filler

**One Data Record for one IASI scan line**

Name in AAPP code	Name	Word Size in byte	Number of words	Meaning
ias1c_scnlin	I4	4	1	scan line number
ias1c_granule	I4	4	1	Granule number
ias1c_scnlinyr	I4	4	1	scan line year
ias1c_scnlindy	I4	4	1	scan line day of year
ias1c_scnlintime	I4	4	30	scan line UTC time of day in milliseconds
ias1c_GQisFlagQual	I4	4	4*30	Bit 0: GQisFlagQual summary flag for all bands (1=anomaly) Bit 1: anomaly in band 1 Bit 2: anomaly in band 2 Bit 3: anomaly in band 3 Bit 4: hardware Bit 5: Band 1 affected by spikes Bit 6: Band 2 affected by spikes Bit 7: Band 3 affected by spikes Bit 8: NZPD and complex calibration error Bit 9: On-board general quality flag Bit 10: Overflow/underflow Bit 11: Spectral calibration error Bit 12: Radiometric post-calibration error Bit 13: GQisFlagQual summary flag for all bands (same as bit 0) Bit 14: Missing sounder data Bit 15: Missing IIS data Bit 16: Missing AVHRR data
ias1c_GQisQualIndex	I4	4	1	NEDT estimated/expected
ias1c_GQisQualIndexLoc	I4	4	1	IIS/AVHRR co-registration uncertainty
ias1c_GQisQualIndexRad	I4	4	1	NEDT estimated/expected radiometric
ias1c_GQisQualIndexSpectral	I4	4	1	NEDT estimated/expected spectral
ias1c_GQisSysTecSondQual	I4	4	1	
ias1c_latlon	I4	4	2*4*30	lat/lon in degrees first : 10 <sup>4</sup> x (latitude)

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				second : 10 <sup>4</sup> x (longitude)
ias1c_angles	I4	4	4*4*30	scan angles first: 10 <sup>2</sup> x (local zenith angle) second: 10 <sup>2</sup> x (local azimuth angle) third: 10 <sup>2</sup> x (solar zenith angle) fourth: 10 <sup>2</sup> x (solar azimuth angle)
ias1c_scalti	I4	4	1	sat altitude above reference ellipsoid, km*10
ias1c_scalrad	I2	2	8700*4*3 0	Scaled radiance
ias1c_avhcombination	I4	4	1	1 bit for each channel
ias1c_avhrrmean	I4	4	6*7*4*30	Mean radiance for 6 channels, 7 classes
ias1c_avhmeanscalefactor	I4	4	6*7*4*30	Factor scales
ias1c_avhrrsdev	I4	4	6*7*4*30	Std dev radiance for 6 channels, 7 classes
ias1c_avhsdevscalefactor	I4	4	6*7*4*30	Factor scales
ias1c_avhrrfrac	I4	4	7*4*30	10 <sup>6</sup> x Fraction in each class
ias1c_avhrrCGy	I4	4	7*4*30	10 <sup>6</sup> x Y angular position of centre of gravity
ias1c_avhrrCGz	I4	4	7*4*30	10 <sup>6</sup> x Z angular position of centre of gravity
V2.0: New variables from IASI 1C EPS format version 8.0 (420 words)				
ias1c_GIacVarImagIIS	I4	4	30	10 <sup>6</sup> x Variance of IIS image W/(m <sup>2</sup> sr m <sup>-1</sup> )
ias1c_GIacAvgImagIIS	I4	4	30	10 <sup>6</sup> x Average of IIS image W/(m <sup>2</sup> sr m <sup>-1</sup> )
ias1c_GEUMAvhrr1BCldFrac	I4	4	4*30	Cloud fraction
ias1c_GEUMAvhrr1BLandFrac	I4	4	4*30	Land fraction
ias1c_GEUMAvhrr1BQual	I4	4	4*30	Bits 0-6: percentage snow/ice Bit 7: 0 if AVHRR is OK 1 then bits 0-6 show the number of bad AVHRR pixels (0-126)

## 21. FORMAT OF THE CRIS L1C FILE

### Header and record length

Header length = record length

array\_size\_cris1c = ( 11 + cris\_1cnfor + cris\_1cnband\*cris\_1cnfov +  
(13 + 2\*cris\_1cnband + cris\_1cnchan + cris\_1cnpc)\*cris\_1cnfov\*cris\_1cnfor ) \* 4 bytes  
361058\*4 bytes by default

with

cris\_1cnfor = 30 ! Number of fields of regard (scan pos)  
cris\_1cnband = 3 ! Number of bands  
cris\_1cnfov = 9 ! Number of fields of view  
cris\_1cnchan = 1317! Max number of channels in format  
cris\_1cnpc = 1 ! Number of PCs in format (at least 1)



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array\_size\_cris1cspare =  
& array\_size\_cris1c - 36 - cris\_1nchan - 4\*cris\_1cnband

### Type

C = character  
I2 = integer\*2  
I4 = integer\*4

### Header Record

Name in AAPP code	Name	Word Size in byte	Number of words	Meaning
<b>GENERAL INFORMATION</b>				
cris1c_h_site	C	3	1	dataset creation site ID
cris1c_h_cfill1	C	1	1	filler
cris1c_h_1bsite	C	3	1	creation site for original 1B data
cris1c_h_cfill2	C	1	1	filler
cris1c_h_versnb	I4	4	1	level 1c format version number
cris1c_h_versyr	I4	4	1	level 1c format version year
cris1c_h_versdy	I4	4	1	level 1c format version day of year
cris1c_h_hdrcnt	I4	4	1	count of header records in this data set
cris1c_h_satid	I4	4	1	satellite id in series (1 for NPP)
cris1c_h_instrument	I4	4	1	WMO instrument identifier: 620=CrIS
cris1c_h_satht	I4	4	1	nominal satellite altitude, km*10
cris1c_h_period	I4	4	1	nominal orbit period (seconds)
cris1c_h_startorbit	I4	4	1	orbit number (at start of file)
cris1c_h_startdatayr	I4	4	1	start of data set year
cris1c_h_startdatady	I4	4	1	start of data set day of the year
cris1c_h_startdatatime	I4	4	1	start of data set UTC time of day(ms)
cris1c_h_endorbit	I4	4	1	orbit number (at end of file)
cris1c_h_enddatayr	I4	4	1	end of data set year
cris1c_h_enddatady	I4	4	1	end of data set day of the year
cris1c_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
cris1c_h_scnlin	I4	4	1	count of scan lines in this data set
cris1c_h_missenlin	I4	4	1	count of missing scan lines
cris1c_h_spare	I4	4	2	Spare
cris1c_h_wmosatid	I4	4	1	WMO satellite id (224 for NPP)
cris1c_h_spare1	I4	4	1	spare
cris1c_h_centre	I4	4	1	WMO id of reception centre
cris1c_h_subcentre	I4	4	1	WMO id of reception subcentre
<b>CrIS variables</b>				
cris1c_h_recwords	I4	4	1	Size of record in integer*4 words
cris1c_h_nfov	I4	4	1	Number of FOVs
cris1c_h_nfor	I4	4	1	Number of FORs

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cris1c_h_nband	I4	4	1	Number of bands
cris1c_h_startw	I4	4	cris_1cnband	First wavenumber *1E2
cris1c_h_endw	I4	4	cris_1cnband	Last wavenumber *1E2
cris1c_h_startchan	I4	4	cris_1cnband	First channel in band
cris1c_h_endchan	I4	4	cris_1cnband	Last channel in band
cris1c_h_eigvn	I4	4	1	Version number of eigenvectors
cris1c_h_npc	I4	4	1	Number of PCs in format
cris1c_h_npcused	I4	4	1	Number of PCs used
cris1c_h_chanvn	I4	4	1	Version number of channel selection
cris1c_h_nchan	I4	4	1	Number of channels in format
cris1c_h_nchanused	I4	4	1	Number of channels used
cris1c_h_channels	I4	4	cris_1cnchan	List of CRIS channels range 1 to 1317
cris1c_h_spare2	I4	4	cris_1cnchan	spare

**One Data Record for one CRIS scan line**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
cris1c_sclin	I4	4	1	scan line number
cris1c_sclinyr	I4	4	1	scan line year
cris1c_sclindy	I4	4	1	scan line day of year
cris1c_sclintime	I4	4	cris_1cnfor	scan line UTC time of day (ms)
cris1c_latlon	I4	4	2*cris_1cnfov*cris_1cnfor	first : 10 <sup>4</sup> x (latitude) second : 10 <sup>4</sup> x (longitude)
cris1c_angles	I4	4	4*cris_1cnfov*cris_1cnfor	first: 10 <sup>2</sup> x (local zenith angle) second: 10 <sup>2</sup> x (local azimuth angle) third: 10 <sup>2</sup> x (solar zenith angle) fourth: 10 <sup>2</sup> x (solar azimuth angle)
cris1c_satxyz	I4	4	3	x,y,z of satellite at mid-scan
cris1c_ascdesc	I4	4	1	ascending / descending orbit qualifier
cris1c_orbit	I4	4	1	orbit number
cris1c_scalti	I4	4	1	satellite altitude
cris1c_surfht	I4	4	cris_1cnfov*cris_1cnfor	surface height
cris1c_landfrac	I4	4	cris_1cnfov*cris_1cnfor	land fraction

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			for	
cris1c_landsea	I4	4	cris_1cnfov*cris_1cnfor	land/sea qualifier
cris1c_cloudcover	I4	4	cris_1cnfov*cris_1cnfor	cloud cover (percent)
cris1c_cloudtopht	I4	4	cris_1cnfov*cris_1cnfor	height of top of cloud (m)
cris1c_radianceflgs	I4	4	cris_1cnfov*cris_1cnfor	radiance flags !Bit(1=MS) 1 Clear path 2 Partly cloudy path 3 Cloudy path 4 Apodized 5 Unapodized 6 Reconstructed 7 Cloud cleared 8-14 Reserved All 15 Missing value
cris1c_scanqualflgs	I4	4	1	Bit(1=MS) 1 Gap in Raw Data Record (RDR) data detected (i.e., missing scan(s) preceding the current scan) 2 Recorded time is not in sequence (i.e., the scan start time is out of sequence) 3 Lamda monitored calculation cannot be updated 4 The measured temperatures of any instrument components (e.g., beam-splitter, scan mirror, scan baffle, etc.) are outside the allowable ranges 5 At least one of the monitored instrument temperatures has drifted more than a specified tolerance value 6-12 Reserved All 13 Missing value
cris1c_calqualflgs	I4	4	cris_1cnband*cris_1cnfov	Bit(1=MS) 1 Lunar intrusion on first deep space view (see Note) 2 Lunar intrusion on second deep space view (see Note) 3-8 Reserved All 9 Missing value
cris1c_fovqualflgs	I4	4	cris_1cnband*cris_1cnfov*cris_	Bit(1=MS) 1 Degraded SDR quality 2 Invalid SDR quality

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			1cnfor	3 Invalid SDR geolocation information 4 Degraded radiometric calibration 5 Invalid radiometric calibration 6 Degraded spectral calibration 7 Invalid spectral calibration 8 Fringe count error detected and corrected 9 Day/night indicator 10 Invalid RDR data 11 Significant fringe count error detected 12 Bit trim failed 13-18 Reserved All 19 Missing value
cris1c_geolocqual	I4	4	1	Nominal 1 Missing at most a small gap of altitude and Ephemeris data 2 Missing more than a small gap of altitude and Ephemeris data, but no more than a granule boundary 3 Missing more than a granule boundary of altitude and Ephemeris data 4-14 Reserved 15 Missing
cris1c_quality	I4	4	cris_1cnfov*cris_1cnfor	0 Not suspect 1 Suspect 2 Very suspect 3 Unusable
cris1c_scores	I4	4	cris_1cnpc*cris_1cnfov*cris_1cnfor	PC scores
cris1c_logfit	I4	4	cris_1cnband*cris_1cnfov*cris_1cnfor	Log Reconstruction Scores
cris1c_radiance	I4	4	cris_1cnfov*cris_1cnfor*cris_1cnchan	Radiance Wm-2sr-1cm *1E7

## 22. FORMAT OF THE ATMS.L1C FILE

### Header and record length

Header length = record length

array\_size\_atms1c = (8 + 3\*atms\_1cnchan + 7\*atms\_1cnfov + 2\*atms\_1cnchan\*atms\_1cnfov)\*4 bytes

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= 4970\*4 bytes by default

with

atms\_1cnchan = 22  
atms\_1cnfov = 96

array\_size\_atms1cspare = array\_size\_atms1c - 30 - 8\*atms\_1cnchan

Type

C = character  
I2 = integer\*2  
I4 = integer\*4

**Header Record**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>GENERAL INFORMATION</b>				
atms1c_h_site	C	3	1	1D dataset creation site ID
atms1c_h_cfill1	C	1	1	filler
atms1c_h_1bsite	C	3	1	creation site for original 1B data
atms1c_h_cfill2	C	1	1	filler
atms1c_h_versnb	I4	4	1	level 1c format version number
atms1c_h_versyr	I4	4	1	level 1c format version year
atms1c_h_versdy	I4	4	1	level 1c format version day of year
atms1c_h_hdrcnt	I4	4	1	level 1c format version day of year
atms1c_h_satid	I4	4	1	satellite id (1 for NPP)
atms1c_h_instrument	I4	4	1	WMO instrument identifier: 621=ATMS
atms1c_h_satht	I4	4	1	nominal satellite altitude, km*10
atms1c_h_period	I4	4	1	nominal orbit period (seconds)
atms1c_h_startorbit	I4	4	1	orbit number (at start of file)
atms1c_h_startdatayr	I4	4	1	start of data set year
atms1c_h_startdatady	I4	4	1	start of data set day of the year
atms1c_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
atms1c_h_endorbit	I4	4	1	orbit number (at end of file)
atms1c_h_enddatayr	I4	4	1	end of data set year
atms1c_h_enddatady	I4	4	1	end of data set day of the year
atms1c_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
atms1c_h_scnlin	I4	4	1	count of scan lines in this data set
atms1c_h_misscnlin	I4	4	1	count of missing scan lines
atms1c_h_vnantennacorr	I4	4	1	version number, antenna corrections
atms1c_h_spare	I4	4	1	Spare
<b>temperature-radiance conversion coefficients</b>				
atms1c_h_tempradcnv	I4	4	3*atms_1cnchan	order of channels = 1,2,3,4,...,22 for nochannel = 1 to 22 :

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				10 <sup>6</sup> x (nochannel central wavenumber) 10 <sup>6</sup> x (nochannel constant 1) 10 <sup>6</sup> x (nochannel constant 2)
atmslc_h_bandwidth	I4	4	atms_1cnc han	
atmslc_h_nchan	I4	4	1	
atmslc_h_nfov	I4	4	1	
atmslc_h_nchanused	I4	4	1	
atmslc_h_recwords	I4	4	1	Words in record
atmslc_h_wmosatid	I4	4	1	WMO satellite id (224 for NPP)
atmslc_h_centre	I4	4	1	WMO id of reception centre
atmslc_h_subcentre	I4	4	1	WMO id of reception subcentre
<b>The following variables characterise any image processing</b>				
atmslc_h_beamversion	I4	4	1	User defined (see atms_beamwidth.dat)
atmslc_h_beamwidth	I4	4	atms_1cnc han	FFT manipulation: deg*1E3
atmslc_h_cutoff	I4	4	atms_1cnc han	FFT manipulation: fraction*1E3
atmslc_h_nxaverage	I4	4	atms_1cnc han	Simple averaging
atmslc_h_nyaverage	I4	4	atms_1cnc han	Simple averaging
atmslc_h_filler	I4	4	array_size _atms1csp are	filler

### One Data Record for one ATMS scan line

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
atmslc_scnlin	I4	4	1	scan line number
atmslc_scnlinyr	I4	4	1	scan line year
atmslc_scnlindy	I4	4	1	scan line day of year
atmslc_scnlintime	I4	4	atms_1cnf ov	scan line UTC time of day in milliseconds
atmslc_orbit	I4	4	1	
atmslc_granulequal	I4	4	1	granule quality flags Bit(1=MS of 16 bits) 1-5 Reserved 6 The No. 1-No.7 health checks failed 7 The No. 8-No.15 health checks failed 8 The No. 16-No.23 health checks failed 9 The No. 24-No.31 health checks failed 10 The No. 32-No.39 health checks failed 11 The No. 40-No.47 health checks failed

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				<p>12 The No. 48-No.55 health checks failed</p> <p>13 The No. 56-No.63 health checks failed</p> <p>14 The No. 64-No.70 health checks failed</p> <p>15 Quadratic correction applied to the radiometric transfer function for non-linearity correction</p> <p>All 16 Missing value</p>
atms1c_scanqual	I4	4	1	<p>scan line quality flags</p> <p>Bit(1=MS of 20 bits)</p> <p>1-6 Reserved</p> <p>7 Divide-by-zero condition or computation loop failed to converge in the K/Ka and V (KAV) Band PRT</p> <p>8 Divide-by-zero condition or computation loop failed to converge in the WG Band PRT</p> <p>9 Divide-by-zero condition or computation loop failed to converge in the K/Ka, V, W, G Band Receiver Shelf PRT K temperature computation</p> <p>10 Out of range condition for the K/Ka and V Band PRT</p> <p>11 Out of range condition for the WG Band PRT</p> <p>12 KAV PRT temperature inconsistency</p> <p>13 WG PRT temperature inconsistency</p> <p>14 Time Sequence Error</p> <p>15 Data Gap - Missing scan(s) preceding the current scan</p> <p>16 KAV PRT Sufficiency - Insufficient KAV PRT data are available</p> <p>17 WG PRT Sufficiency - Insufficient WG PRT data are available</p> <p>18 Space View antenna position error</p> <p>19 Blackbody antenna position error</p> <p>All 20 Missing value</p>
atms1c_geolocqual	I4	4	1	<p>geolocation quality</p> <p>Value</p> <p>0 Nominal - altitude and Ephemeris data available</p> <p>1 Missing at most a small gap of altitude and Ephemeris data</p> <p>2 Missing more than a small gap of altitude and Ephemeris data, but no more than a granule boundary</p> <p>3 Missing more than a granule boundary of altitude and Ephemeris data</p> <p>4-14 Reserved</p> <p>15 Missing</p>

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atms1c_chanqual	I4	4	atms_1cnc han	quality flag for each channel Bit(1=MS of 12 bits) 1-2 Reserved 3 Moon in Space View 4 Gain Error - The lowest blackbody count is smaller than or equal to the highest space view count in a scan 5 Calibration With Fewer Than Preferred Samples 6 Space View Data Sufficiency Check - Insufficient space view samples are available 7 Blackbody View Data Sufficiency Check - Insufficient blackbody view samples are available 8 Out of range condition for the Space View 9 Out of range condition for the BlackBody View 10 Space view inconsistency 11 BlackBody view inconsistency All 12 Missing value
atms1c_latlon	I4	4	2*atms_1c nfov	lat/lon in degrees for atms_1cnfov first : 10 <sup>4</sup> x (latitude) second : 10 <sup>4</sup> x (longitude)
atms1c_angles	I4	4	4*atms_1c nfov	scan angles for atms_1cnfov first: 10 <sup>2</sup> x (local zenith angle) second: 10 <sup>2</sup> x (local azimuth angle) third: 10 <sup>2</sup> x (solar zenith angle) fourth: 10 <sup>2</sup> x (solar azimuth angle)
atms1c_scalti	I4	4	1	sat altitude above reference ellipsoid, km*10
atms1c_nedtcold	I4	4	atms_1cnc han	Cold view NEDT K*100
atms1c_nedtwarm	I4	4	atms_1cnc han	Warm view NEDT K*100
atms1c_anttemps	I4	4	atms_1cnc han*atms_ 1cnfov	Antenna temps *100
atms1c_btemps	I4	4	atms_1cnc han*atms_ 1cnfov	BT *100

### **23. FORMAT OF THE AVH.L1C FILE AND AVH.L1D FILE**

The same format for a AVH level 1c file and the AVH level 1d file



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Header and record length

Header length = record length

29808 bytes

Type

C = character

I2 = integer\*2

I4 = integer\*4

**Header Record**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>GENERAL INFORMATION</b>				
avh1c_h_site	C	3	1	dataset creation site ID
avh1c_h_cfill1	C	1	1	filler
avh1c_h_1bsite	C	3	1	creation site for original 1B data
avh1c_h_cfill2	C	1	1	filler
avh1c_h_versnb	I4	4	1	level 1c format version number
avh1c_h_versyr	I4	4	1	level 1c format version year
avh1c_h_versdy	I4	4	1	level 1c format version day of year
avh1c_h_hdrcnt	I4	4	1	count of header records in this data set
avh1c_h_satid	I4	4	1	satellite id (e.g. 14 for NOAA-14)
avh1c_h_instrument	I4	4	1	instrument identification (1=AVHRR)
avh1c_h_satht	I4	4	1	nominal satellite altitude, km*10
avh1c_h_period	I4	4	1	nominal orbit period (seconds)
avh1c_h_startorbit	I4	4	1	orbit number (at start of file)
avh1c_h_startdatayr	I4	4	1	avh1c_h_startdatayr
avh1c_h_startdatady	I4	4	1	start of data set day of the year
avh1c_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
avh1c_h_endorbit	I4	4	1	orbit number (at end of file)
avh1c_h_enddatayr	I4	4	1	end of data set year
avh1c_h_enddatady	I4	4	1	end of data set year
avh1c_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
avh1c_h_scnlin	I4	4	1	count of scan lines in this data set
avh1c_h_missenlin	I4	4	1	count of missing scan lines
avh1c_h_calloccnlin	I4	4	1	count of calibrated, earth located scan lines in this data set
avh1c_h_datagaps	I4	4	1	count of data gaps in this data set
avh1c_h_datatyp	I4	4	1	data type code (1 = LAC; 2 = GAC; 3 = HRPT)
avh1c_h_infilename	C	68	1	input file name (allow pfs name)
avh1c_h_wmosatid	I4	4	1	WMO satellite id (3 for METOP-1)
<b>CALIBRATION INFORMATION</b>				
avh1c_h_cpidsyr	I4	4	1	year of Last CPIDS Update

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avh1c_h_cpidsdy	I4	4	1	Day of Year of Last CPIDS Update
<b>NAVIGATION INFORMATION</b>				
avh1c_h_rollerr	I4	4	1	10 <sup>3</sup> x (constant roll attitude error in degrees)
avh1c_h_pitcherr	I4	4	1	10 <sup>3</sup> x (constant pitch attitude error in degrees)
avh1c_h_yawerr	I4	4	1	10 <sup>3</sup> x (constant yaw attitude error in degrees)
<b>RADIANCE TO TEMPERATURE CONVERSION</b>				
avh1c_h_albcnv	I4	4	2*avh1c_mxvischn	albedo conversion order of channels : 1, 2, 3A. for nochannel = 1 to 3A : 10 <sup>1</sup> x (albedo-radiance nochannel solar filtered irradiance in wavelength) 10 <sup>3</sup> x (albedo-radiance nochannel equivalent filter width in wavelength)
avh1c_h_radtempcnv	I4	4	3*avh1c_mxirchn	radiance to temperature conversion order of channels : 3B, 4, 5. for nochannel = 3B to 5: 10 <sup>2</sup> x (temperature-radiance nochannel central wavenumber Ch3b) or 10 <sup>3</sup> x (temperature-radiance nochannel central wavenumber Ch4,5) 10 <sup>5</sup> x (temperature-radiance nochannel constant 1) 10 <sup>6</sup> x (temperature-radiance nochannel constant 2)
avh1c_h_filler(7391)	I4	4	7391	Filler <Zero Fill>

**One Data Record for one AVHRR scan line**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
avh1c_scnlin	I4	4	1	scan line number
avh1c_scnlinyr	I4	4	1	scan line year
avh1c_scnlindy	I4	4	1	scan line day of year
avh1c_scnlintime	I4	4	1	scan line UTC time of day in milliseconds
avh1c_clockdrift	I4	4	1	satellite clock drift delta in milliseconds
avh1c_scnlinbit	I4	4	1	scan line bit field bit 15 : (0 = ascending data; 1 = descending data) bit 14 : (1 = scan time corrected for clock drift) bit 13 : (1 = earth location corrected for TIP attitude) bit 0 : channel 3 select (0 = 3A; 1 = 3B)
avh1c_spare0	I4	4	2	<Zero Fill>
<b>QUALITY INDICATORS</b>				
avh1c_qualind	I4	4	1	quality indicator bit field

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				bit 31 : (1 = do not use data for product generation) bit 30 : (1 = time sequence error detected in this frame) bit 29 : (1 = data gap precedes this frame) bit 28 : (1 = insufficient data for calibration) bit 27 : (1 = earth location data not available) bit 26 : (1 = sync lock dropped during this frame) bit 25 : (1 = frame sync word error greater than zero) bit 24 : (1 = frame sync previously dropped lock) bit 23 : (1 = flywheeling detected during this frame) bit 22 : (1 = bit slippage detected during this frame) bit 9 : tip parity in first minor frame bit 8 : tip parity in second minor frame bit 7 : tip parity in third minor frame bit 6 : tip parity in fourth minor frame bit 5 : tip parity in fifth minor frame bit 4 : (1 = reflected sunlight detected channel 3B) bit 3 : (1 = reflected sunlight detected channel 4) bit 2 : (1 = reflected sunlight detected channel 5) bit 1 : (1 = resync occurred on this frame) bit 0 : (1 = pseudo noise occurred on this frame)
avh1c_scnlinqual	I4	I4	1	scan line quality flags  Time Problem Code  bit 31-24 : spare bit 23 : time field is bad but can probably be inferred from the previous good time bit 22 : time field is bad and can't be inferred from the previous good time bit 21 : this record starts a sequence that is inconsistent with previous time (i.e., there is a time discontinuity).this may or may not associated with a spacecraft clock update.(see bit 26 above) bit 20 : start of a sequence that apparently repeats scan times that have been previously accepted.

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				bit 19-16 : spare  <p style="text-align: center;">Calibration Problem Code</p> (all bits set to 0 indicates normal calibration) bit 15 : scan line was not calibrated because of bad time bit 14 : scan line was calibrated using fewer than the preferred number of scan lines because of proximity to start or end of data set or to a data gap bit 13 : scan line was not calibrated because of bad or insufficient PRT data bit 12 : scan line was calibrated but with marginal PRT data bit 11 : some uncalibrated channels on this scan (see channel indicators) bit 10 : spare bit 09 : spare bit 08 : spare  <p style="text-align: center;">Earth location Problem Code</p> (all bits set to 0 implies the earth location was normal) bit 07 : not earth located because of bad time bit 06 : earth location questionable because of questionable time code (see time problem flags above) bit 05 : earth location questionable -- only marginal agreement with reasonableness check bit 04 : earth location questionable -- fails reasonableness check bit 03-00 : spare
avh1c_calqual	I4	4	avh1c_mx irchn	calibration quality flags  order of channels : 3B, 4, 5. (all bits off implies a good calibration) bit 7 : this channel is not calibrated bit 6 : this channel is calibrated but questionable bit 5 : not good blackbody count for scan line bit 4 : not good space view counts for scan line bit 3 : insufficient PRT data bit 2 : some bad blackbody view counts for this line bit 1 : some bad space view counts for this line

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				bit 0 : some bad PRT data
avh1c_spare1	I4	4	2	<Zero Fill>
<b>NAVIGATION</b>				
avh1c_scalti	I4	4	1	10 x Spacecraft Altitude (MSL) in km in this scan line
avh1c_ang	I4	4	3*51	set of 3 angles in degrees for point 25 to point 2025 every 40 points first angle : 10 <sup>2</sup> x (solar zenith angle ) second angle : 10 <sup>2</sup> x (satellite zenith angle ) third angle : 10 <sup>2</sup> x (relative azimuth angle )
avh1c_pos	I4	4	2*51	lat/lon pair in degrees for point 25 to point 2025 every 40 points first : 10 <sup>4</sup> x (latitude ) second : 10 <sup>4</sup> x (longitude ) (North latitude and East longitude are positive)
avh1c_spare2	I4	4	2	<Zero Fill>
<b>AVHRR SENSOR DATA</b>				
avh1c_btemps	I2	2	avh1c_mx hrpchn*av h1c_mxpi x	avh1c_mxpix = 2048 for pixel in line avh1c_mxhrpchn = 5 for channels every pixel albedo ! 100*% IRchannels ! 100*K
<b>AVHRR CLOUD MASK</b>				
avh1c_maskind	I4	4	1	cloud mask done =1
avh1c_mask	I2	2	avh1c_mx pix	avh1c_mxpix = 2048 for pixel in line avh1c_mxhrpchn = 5 for channels every pixel  bits 15-14: 0 Night 1 Twilight 2 Day 3 Sunlint bit 13 : 1 sea 0 land or coast bit 12 : 1 cloudy 0 clear bit 11 : 1 blackbody (only filled if bit12 =1) bits 10-6: 0 non-processed: containing no data or corrupted data 1 cloud free land no contamination by snow/ice covered surface, no contamination by clouds ; but contamination by thin dust/volcanic clouds not checked 2 cloud free sea no contamination by snow/ice covered surface, no contamination by clouds ; but contamination by thin dust/volcanic clouds not checked 3 land contaminated by snow

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				<p>4 sea contaminated by snow/ice</p> <p>5 very low and cumuliform clouds</p> <p>6 very low and stratiform clouds</p> <p>7 low and cumuliform clouds</p> <p>8 low and stratiform clouds</p> <p>9 medium and cumuliform clouds</p> <p>10 medium and stratiform clouds</p> <p>11 high opaque and cumuliform clouds</p> <p>12 high opaque and stratiform clouds</p> <p>13 very high opaque and cumuliform clouds</p> <p>14 very high opaque and stratiform clouds</p> <p>15 high semitransparent thin clouds</p> <p>16 high semitransparent meanly thick clouds</p> <p>17 high semitransparent thick clouds</p> <p>18 high semitransparent above low or medium clouds</p> <p>19 fractional clouds (sub-pixel water clouds)</p> <p>20 undefined (undefined by CMA)</p> <p>bit 5: 0 Ts background : climatology used</p> <p>1 Ts background : forecast used</p> <p>bits 4-3: 0 WV content : AMSU used</p> <p>1 WV content : forecast used</p> <p>2 WV content : climatology used</p> <p>bit 2-1:quality flag: 0= same CMA, 1= bad data, 2= different CMA, 3= coast</p> <p>bit 0 : for marine cloudy = 1 , clear = 0</p>
avh1c_tsurf	I2	2	avh1c_mx pix	retrieved temperature in C*100 if clear: retrieved SST (sea) or Tsurf(land) if cloudy and blackbody: cloud top temperature 0=missing values
avh1c_spare3	I4	4	10	<Zero Fill>

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## 24. FORMAT OF THE MWTS.L1C FILE

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

### Header and record length

Header length = record length

300\*4 bytes

### Type

C = character

I2 = integer\*2

I4 = integer\*4

### Header Record

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>General information</b>				
mwts1c_h_site	C	3	1	dataset creation site ID
mwts1c_h_cfill1	C	1	1	filler
mwts1c_h_1bsite	C	3	1	creation site for original 1B data
mwts1c_h_cfill2	C	1	1	filler
mwts1c_h_versnb	I4	4	1	level 1c format version number
mwts1c_h_versyr	I4	4	1	level 1c format version year
mwts1c_h_versdy	I4	4	1	level 1c format version day of year
mwts1c_h_hdrent	I4	4	1	count of header records in this data set
mwts1c_h_satid	I4	4	1	satellite identification: 1=FY3A 2=FY3B
mwts1c_h_instrument	I4	4	1	instrument code 15=MWTS
mwts1c_h_satht	I4	4	1	nominal satellite altitude, km*10
mwts1c_h_period	I4	4	1	nominal orbit period (seconds)
mwts1c_h_startorbit	I4	4	1	orbit number (at start of file)
mwts1c_h_startdatayr	I4	4	1	start of data set year
mwts1c_h_startdatady	I4	4	1	start of data set day of the year
mwts1c_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
mwts1c_h_endorbit	I4	4	1	orbit number (at end of file)
mwts1c_h_enddatayr	I4	4	1	end of data set year
mwts1c_h_enddatady	I4	4	1	end of data set day of the year
mwts1c_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
mwts1c_h_scnlin	I4	4	1	count of scan lines in this data set
mwts1c_h_missnlin	I4	4	1	count of missing scan lines
mwts1c_h_vnantennacor r	I4	4	1	version number, antenna corrections

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mwts1c_h_spare	I4	4	1	spare
<b>TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS</b>				
mwts1c_h_tempradcnv	I4	4	3*4	order of channels = 1,2,3,4 for nochannel = 1 to 4: 10 <sup>6</sup> x (nochannel central wavenumber) 10 <sup>6</sup> x (nochannel constant 1) 10 <sup>6</sup> x (nochannel constant 2)
mwts1c_h_wmosatid	I4	4	1	WMO satellite id (e.g. 520 for FY-3A)
mwts1c_h_filler	I4	4	265	filler

**One Data Record for one MWTS scan line**

Name in AAPP code	Name	Word Size in byte	Number of words	Meaning
mwts1c_sclin	I4	4	1	scan line number
mwts1c_sclinyr	I4	4	1	scan line year
mwts1c_sclindy	I4	4	1	scan line day of year
mwts1c_sclintime	I4	4	1	scan line UTC time of day in milliseconds
mwts1c_qualind	I4	4	1	quality indicator bit field In all of the following, if the bit is on (= is set to 1) then the statement is true. Otherwise it is false. <b>general</b> bit 31: do not use scan for product generation bit 30: time sequence error detected with this scan bit 29: data gap precedes this scan bit 28: no calibration bit 27: no Earth location bit 26: first good time following a clock update bit 25: instrument status changed with this scan bit 24-0: spare <zero fill>
mwts1c_scanqual	I4	4	1	scan line quality flags <b>time problem code</b> (all bits off implies the scan time is as expected) bit 31-24: spare <zero fill> bit 23: time field is bad but can probably be inferred from the previous good time bit 22: time field is bad and can't be inferred from the previous good time bit 21: this record starts a sequence that is inconsistent with previous times (i.e., there is a



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				<p>time discontinuity). This may or may not be associated with a spacecraft clock update. (see bit 26 above)</p> <p>bit 20: start of a sequence that apparently repeats scan times that have been previously accepted.</p> <p><b>moon problem code</b></p> <p>bit 19: spare</p> <p>bit 18: Moon in MWTS space view, corrected</p> <p>bit 17: spare</p> <p>bit 16: Moon in MWTS space view, uncorrected</p> <p><b>calibration problem code</b> (all bits set to 0 indicates normal calibration)</p> <p>bit 15: scan line was not calibrated because of bad time</p> <p>bit 14: scan line was calibrated using fewer than the preferred number of scan lines because of proximity to start or end of data set or to a data gap.</p> <p>bit 13: scan line was not calibrated because of bad or insufficient PRT data</p> <p>bit 12: scan line was calibrated but with marginal PRT data</p> <p>bit 11: some uncalibrated channels of this scan. See channel indicators.</p> <p>bit 10: uncalibrated due to instrument mode</p> <p>bits 9 and 8: spare</p> <p><b>Earth location problem code</b> (all bits set to 0 implies the Earth location was normal)</p> <p>bit 7: not Earth located because of bad time</p> <p>bit 6: Earth location questionable because of questionable time code (see time problem flags above)</p> <p>bit 5: Earth location questionable. Only marginal agreement with reasonableness check.</p> <p>bit 4: Earth location questionable. Fails reasonableness check</p> <p>bit 3: Earth location questionable because of antenna position check</p> <p>bit 2-0: spare</p>
mwts1c_chanqual	I4	4	4	<p>quality flag for each channel with the channels in the order 1,2,3,4. (all bits off implies a good calibration)</p> <p>bit 31-6: spare</p> <p>bit 5: No good blackbody counts for scan</p>

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				line bit 4: No good space view counts for scan line bit 3: No good PRTs for this line bit 2: Some bad blackbody view counts for this line bit 1: Some bad space view counts for this line bit 0: Some bad PRT temps on this line
mwts1c_instrtemp1	I4	4	1	MWTS1 RF shelf temp (K*100)
mwts1c_instrtemp2	I4	4	1	MWTS2 RF shelf temp (K*100)
mwts1c_spare1	I4	4	2	spare
mwts1c_latlon	I4	4	2*15	lat/lon in degrees for fovs first : 10 <sup>4</sup> x (latitude) second : 10 <sup>4</sup> x (longitude)
mwts1c_surface	I4	4	2*15	Height/type first : surface height (metres) second : surface type (0=sea, 1=mixed, 2=land)
mwts1c_angles	I4	4	4*90	scan angles for fovs first: 10 <sup>2</sup> x (local zenith angle) second: 10 <sup>2</sup> x (local azimuth angle) third: 10 <sup>2</sup> x (solar zenith angle) fourth: 10 <sup>2</sup> x (solar azimuth angle)
mwts1c_scalti	I4	4	1	sat altitude above reference ellipsoid, km*10
mwts1c_spare2	I4	4	2	spare
mwts1c_btemps	I4	4	4*15	BT data for fovs 10 <sup>2</sup> x scene brightness temperature (K), channels 1-4
mwts1c_btmap	I4	4	5*15	Mapped BT data (MWHS) 10 <sup>2</sup> x scene brightness temperature (K), channels 1-4
mwts1c_dataqual	I4	4	15	quality control word for the data in each field of view: (all bits off implies acceptable data) bit 31: spare <zero fill> bit 30: set if secondary calibration used bit 29-4: spare <zero fill> bit 4-1: bit n set to 1 if brightness temperature in channel n is physically unreasonable or has not been calculated due to calibration problems. bit 0: set if all channels missing
mwts1c_filler	I4	4	13	spare

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## 25. FORMAT OF THE MWTS2.L1C FILE

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

### Header and record length

Header length = record length  
3370\*4 bytes

### Type

C = character  
I2 = integer\*2  
I4 = integer\*4

### Header Record

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>General information</b>				
mwts21c_h_site	C	3	1	dataset creation site ID
mwts21c_h_cfill1	C	1	1	filler
mwts21c_h_1bsite	C	3	1	creation site for original 1B data
mwts21c_h_cfill2	C	1	1	filler
mwts21c_h_versnb	I4	4	1	level 1c format version number
mwts21c_h_versyr	I4	4	1	level 1c format version year
mwts21c_h_versdy	I4	4	1	level 1c format version day of year
mwts21c_h_hdrent	I4	4	1	count of header records in this data set
mwts21c_h_satid	I4	4	1	satellite identification: 3=FY3C
mwts21c_h_instrument	I4	4	1	instrument code 18=MWTS2
mwts21c_h_satht	I4	4	1	nominal satellite altitude, km*10
mwts21c_h_period	I4	4	1	nominal orbit period (seconds)
mwts21c_h_startorbit	I4	4	1	orbit number (at start of file)
mwts21c_h_startdatayr	I4	4	1	start of data set year
mwts21c_h_startdatady	I4	4	1	start of data set day of the year
mwts21c_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
mwts21c_h_endorbit	I4	4	1	orbit number (at end of file)
mwts21c_h_enddatayr	I4	4	1	end of data set year
mwts21c_h_enddatady	I4	4	1	end of data set day of the year
mwts21c_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
mwts21c_h_scnlin	I4	4	1	count of scan lines in this data set
mwts21c_h_misscnlin	I4	4	1	count of missing scan lines
mwts21c_h_vnantennacorr	I4	4	1	version number, antenna corrections

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mwts21c_h_spare	I4	4	1	spare
<b>TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS</b>				
mwts21c_h_tempradcnv	I4	4	3*13	for nochannel = 1 to 13: 10 <sup>6</sup> x (nochannel central wavenumber) 10 <sup>6</sup> x (nochannel constant 1) 10 <sup>6</sup> x (nochannel constant 2)
mwts21c_h_wmosatid	I4	4	1	WMO satellite id (e.g. 522 for FY-3C)
mwts21c_h_bandwidth	I4	4	13	Bwndwidth in GHz*1E6
<b>Beam width manipulation</b>				
mwts21c_h_nchan	I4	4	1	Number of MWTS channels in format
mwts21c_h_nmapchan	I4	4	1	Number of mapped channels in format
mwts21c_h_nmapchanused	I4	4	1	Number of mapped channels used
mwts21c_h_beamversion	I4	4	1	User defined (see mwts2_beamwidth.dat)
mwts21c_h_beamwidth	I4	4	13	deg*1E3
mwts21c_h_cutoff	I4	4	13	fraction*1E3
mwts21c_h_nxaverage	I4	4	13	number of spots averaged in x
mwts21c_h_nyaverage	I4	4	13	number of spots averaged in y
mwts21c_h_filler	I4	4	3239	filler

**One Data Record for one MWTS scan line**

Name in AAPP code	Name	Word Size in byte	Number of words	Meaning
mwts21c_sclin	I4	4	1	scan line number
mwts21c_sclinyr	I4	4	1	scan line year
mwts21c_sclindy	I4	4	1	scan line day of year
mwts21c_sclintime	I4	4	1	scan line UTC time of day in milliseconds
mwts21c_qualind	I4	4	1	quality indicator bit field
mwts21c_scanqual	I4	4	1	scan line quality flags
mwts21c_chanqual	I4	4	4	channel quality flag
mwts21c_instrtemp1	I4	4	1	Instrument temp 1 (K*100)
mwts21c_instrtemp2	I4	4	1	Instrument temp 2 (K*100)
mwts21c_spare1	I4	4	2	spare
mwts21c_latlon	I4	4	2*90	lat/lon in degrees for fovs first : 10 <sup>4</sup> x (latitude) second : 10 <sup>4</sup> x (longitude)
mwts21c_surface	I4	4	2*90	Height/type first : surface height (metres) second : surface type (0=sea, 1=mixed, 2=land)
mwts21c_angles	I4	4	4*90	scan angles for fovs first: 10 <sup>2</sup> x (local zenith angle) second: 10 <sup>2</sup> x (local azimuth angle) third: 10 <sup>2</sup> x (solar zenith angle)

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				fourth: 10 <sup>2</sup> x (solar azimuth angle)
mwts21c_scalti	I4	4	1	sat altitude above reference ellipsoid, km*10
mwts21c_satposition	I4	4	3	x,y,z in metres
mwts21c_satvelocity	I4	4	3	vx,vy,vz in m/s
mwts21c_orbitangle	I4	4	1	angle round orbit relative to solar plane, deg*100
mwts21c_spare2	I4	4	5	spare
mwts21c_btemps	I4	4	13*90	BT data for fovs 10 <sup>2</sup> x scene brightness temperature (K), channels 1-13
mwts21c_btmap	I4	4	15*90	Mapped BT data (MWHS) 10 <sup>2</sup> x scene brightness temperature (K), channels 1-15
mwts21c_dataqual	I4	4	15	quality control word for the data in each field of view
mwts21c_filler	I4	4	4	spare

## 26. FORMAT OF THE MWHS.L1C FILE

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

### Header and record length

Header length = record length  
1396\*4 bytes

### Type

C = character  
I2 = integer\*2  
I4 = integer\*4

### Header Record

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>General information</b>				
mwhs1c_h_site	C	3	1	dataset creation site ID
mwhs1c_h_cfill1	C	1	1	filler
mwhs1c_h_1bsite	C	3	1	creation site for original 1B data
mwhs1c_h_cfill2	C	1	1	filler
mwhs1c_h_versnb	I4	4	1	level 1c format version number
mwhs1c_h_versyr	I4	4	1	level 1c format version year
mwhs1c_h_versdy	I4	4	1	level 1c format version day of year
mwhs1c_h_hdrcnt	I4	4	1	count of header records in this data set
mwhs1c_h_satid	I4	4	1	satellite identification: 1=FY3A

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				2=FY3B
mwhslc_h_instrument	I4	4	1	instrument code 16=MWHS
mwhslc_h_satht	I4	4	1	nominal satellite altitude, km*10
mwhslc_h_period	I4	4	1	nominal orbit period (seconds)
mwhslc_h_startorbit	I4	4	1	orbit number (at start of file)
mwhslc_h_startdatayr	I4	4	1	start of data set year
mwhslc_h_startdatady	I4	4	1	start of data set day of the year
mwhslc_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
mwhslc_h_endorbit	I4	4	1	orbit number (at end of file)
mwhslc_h_enddatayr	I4	4	1	end of data set year
mwhslc_h_enddatady	I4	4	1	end of data set day of the year
mwhslc_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
mwhslc_h_scnlin	I4	4	1	count of scan lines in this data set
mwhslc_h_misscnlin	I4	4	1	count of missing scan lines
mwhslc_h_vnantennacor r	I4	4	1	version number, antenna corrections
mwhslc_h_spare	I4	4	1	spare
<b>TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS</b>				
mwhslc_h_tempradcnv	I4	4	3*5	order of channels = 1,2,3,4,5 for nochannel = 1 to 5: 10 <sup>6</sup> x (nochannel central wavenumber) 10 <sup>6</sup> x (nochannel constant 1) 10 <sup>6</sup> x (nochannel constant 2)
mwhslc_h_wmosatid	I4	4	1	WMO satellite id (e.g. 520 for FY-3A)
mwhslc_h_filler	I4	4	1162	filler

**One Data Record for one MWHS scan line**

Name in AAPP code	Name	Word Size in byte	Number of words	Meaning
mwhslc_scnlin	I4	4	1	scan line number
mwhslc_scnlinyr	I4	4	1	scan line year
mwhslc_scnlindy	I4	4	1	scan line day of year
mwhslc_scnlintime	I4	4	1	scan line UTC time of day in milliseconds
mwhslc_qualind	I4	4	1	quality indicator bit field In all of the following, if the bit is on (= is set to 1) then the statement is true. Otherwise it is false. <b>general</b> bit 31: do not use scan for product generation bit 30: time sequence error detected with this scan bit 29: data gap precedes this scan bit 28: no calibration bit 27: no Earth location

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				bit 26: first good time following a clock update bit 25: instrument status changed with this scan bit 24-0: spare <zero fill>
mwhs1c_scanqual	I4	4	1	scan line quality flags <b>time problem code</b> (all bits off implies the scan time is as expected) bit 31-24: spare <zero fill> bit 23: time field is bad but can probably be inferred from the previous good time bit 22: time field is bad and can't be inferred from the previous good time bit 21: this record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity). This may or may not be associated with a spacecraft clock update. (see bit 26 above) bit 20: start of a sequence that apparently repeats scan times that have been previously accepted. <b>moon problem code</b> bit 19: spare bit 18: Moon in MWHS space view, corrected bit 17: spare bit 16: Moon in MWHS space view, uncorrected <b>calibration problem code</b> (all bits set to 0 indicates normal calibration) bit 15: scan line was not calibrated because of bad time bit 14: scan line was calibrated using fewer than the preferred number of scan lines because of proximity to start or end of data set or to a data gap. bit 13: scan line was not calibrated because of bad or insufficient PRT data bit 12: scan line was calibrated but with marginal PRT data bit 11: some uncalibrated channels of this scan. See channel indicators. bit 10: uncalibrated due to instrument mode bits 9 and 8: spare <b>Earth location problem code</b> (all bits set to 0 implies the Earth location was normal) bit 7: not Earth located because of bad time

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				<p>bit 6: Earth location questionable because of questionable time code (see time problem flags above)</p> <p>bit 5: Earth location questionable. Only marginal agreement with reasonableness check.</p> <p>bit 4: Earth location questionable. Fails reasonableness check</p> <p>bit 3: Earth location questionable because of antenna position check</p> <p>bit 2-0: spare</p>
mwhs1c_chanqual	I4	4	5	<p>quality flag for each channel with the channels in the order 1,2,3,4,5. (all bits off implies a good calibration)</p> <p>bit 31-6: spare</p> <p>bit 5: No good blackbody counts for scan line</p> <p>bit 4: No good space view counts for scan line</p> <p>bit 3: No good PRTs for this line</p> <p>bit 2: Some bad blackbody view counts for this line</p> <p>bit 1: Some bad space view counts for this line</p> <p>bit 0: Some bad PRT temps on this line</p>
mwhs1c_insttemp	I4	4	1	MWHS instrument temp (K*100)
mwhs1c_spare1	I4	4	2	spare
mwhs1c_latlon	I4	4	2*90	<p>lat/lon in degrees for fovs</p> <p>first : 10<sup>4</sup> x (latitude)</p> <p>second : 10<sup>4</sup> x (longitude)</p>
mwhs1c_angles	I4	4	4*90	<p>scan angles for fovs</p> <p>first: 10<sup>2</sup> x (local zenith angle)</p> <p>second: 10<sup>2</sup> x (local azimuth angle)</p> <p>third: 10<sup>2</sup> x (solar zenith angle)</p> <p>fourth: 10<sup>2</sup> x (solar azimuth angle)</p>
mwhs1c_scalti	I4	4	1	sat altitude above reference ellipsoid, km*10
mwhs1c_spare2	I4	4	2	spare
mwhs1c_btemps	I4	4	5*90	<p>BT data for fovs</p> <p>10<sup>2</sup> x scene brightness temperature (K), channels 1-5</p>
mwhs1c_dataqual	I4	4	90	<p>quality control word for the data in each field of view: (all bits off implies acceptable data)</p> <p>bit 31: spare &lt;zero fill&gt;</p> <p>bit 30: set if secondary calibration used</p> <p>bit 29-4: spare &lt;zero fill&gt;</p> <p>bit 5-1: bit n set to 1 if brightness temperature in channel n is physically unreasonable or has</p>



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				not been calculated due to calibration problems. bit 0: set if all channels missing
mwhs1c_filler	I4	4	7	spare

## 27. FORMAT OF THE MWHS2.L1C FILE

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

### Header and record length

Header length = record length

3668\*4 bytes

### Type

C = character

I2 = integer\*2

I4 = integer\*4

### Header Record

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>General information</b>				
mwhs21c_h_site	C	3	1	dataset creation site ID
mwhs21c_h_cfill1	C	1	1	filler
mwhs21c_h_1bsite	C	3	1	creation site for original 1B data
mwhs21c_h_cfill2	C	1	1	filler
mwhs21c_h_versnb	I4	4	1	level 1c format version number
mwhs21c_h_versyr	I4	4	1	level 1c format version year
mwhs21c_h_versdy	I4	4	1	level 1c format version day of year
mwhs21c_h_hdrcnt	I4	4	1	count of header records in this data set
mwhs21c_h_satid	I4	4	1	satellite identification: 3=FY3C
mwhs21c_h_instrument	I4	4	1	instrument code 19=MWHS2
mwhs21c_h_satht	I4	4	1	nominal satellite altitude, km*10
mwhs21c_h_period	I4	4	1	nominal orbit period (seconds)
mwhs21c_h_startorbit	I4	4	1	orbit number (at start of file)
mwhs21c_h_startdatayr	I4	4	1	start of data set year
mwhs21c_h_startdatady	I4	4	1	start of data set day of the year
mwhs21c_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
mwhs21c_h_endorbit	I4	4	1	orbit number (at end of file)
mwhs21c_h_enddatayr	I4	4	1	end of data set year
mwhs21c_h_enddatady	I4	4	1	end of data set day of the year

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mwhs21c_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
mwhs21c_h_scnlin	I4	4	1	count of scan lines in this data set
mwhs21c_h_misscnlin	I4	4	1	count of missing scan lines
mwhs21c_h_vnantennac orr	I4	4	1	version number, antenna corrections
mwhs21c_h_spare	I4	4	1	spare
<b>TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS</b>				
mwhs21c_h_tempradcnv	I4	4	3*15	for nochannel = 1 to 15: 10 <sup>6</sup> x (nochannel central wavenumber) 10 <sup>6</sup> x (nochannel constant 1) 10 <sup>6</sup> x (nochannel constant 2)
mwhs21c_h_wmosatid	I4	4	1	WMO satellite id (e.g. 520 for FY-3A)
mwhs21c_h_bandwidth	I4	4	15	Bandwidth in GHz*1E6
mwhs21c_h_nchan	I4	4	15	Number of MWHS channels in format
mwhs21c_h_nmapchan	I4	4	15	Number of mapped channels in format
mwhs21c_h_nmapchanu sed	I4	4	15	Number of mapped channels used
<b>Beam width manipulation</b>				
mwhs21c_h_beamversio n	I4	4	1	User defined (see mwhs2_beamwidth.dat)
mwhs21c_h_beamwidth	I4	4	15	deg*1E3
mwhs21c_h_cutoff	I4	4	15	fraction*1E3
mwhs21c_h_nxaverage	I4	4	15	number of spots averaged in x
mwhs21c_h_nyaverage	I4	4	15	number of spots averaged in y
mwhs21c_h_filler	I4	4	3521	filler

**One Data Record for one MWHS2 scan line**

Name in AAPP code	Name	Word Size in byte	Number of words	Meaning
mwhs21c_scnlin	I4	4	1	scan line number
mwhs21c_scnlinyr	I4	4	1	scan line year
mwhs21c_scnlindy	I4	4	1	scan line day of year
mwhs21c_scnlintime	I4	4	1	scan line UTC time of day in milliseconds
mwhs21c_qualind	I4	4	1	quality indicator bit field
mwhs21c_scanqual	I4	4	1	scan line quality flags
mwhs21c_chanqual	I4	4	5	channel quality flag
mwhs21c_insttemp1	I4	4	1	MWHS2 instrument temp 1 (K*100)
mwhs21c_insttemp2	I4	4	1	MWHS2 instrument temp 2 (K*100)
mwhs21c_spare1	I4	4	2	spare
mwhs21c_latlon	I4	4	2*98	lat/lon in degrees for fovs first : 10 <sup>4</sup> x (latitude) second : 10 <sup>4</sup> x (longitude)
mwhs21c_angles	I4	4	4*98	scan angles for fovs first: 10 <sup>2</sup> x (local zenith angle) second: 10 <sup>2</sup> x (local azimuth angle)

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				third: 10 <sup>2</sup> x (solar zenith angle) fourth: 10 <sup>2</sup> x (solar azimuth angle)
mwhs21c_scalti	I4	4	1	sat altitude above reference ellipsoid, km*10
mwhs21c_satposition	I4	4	3	x,y,z in metres
mwhs21c_satvelocity	I4	4	3	vx,vy,vz in m/s
mwhs21c_orbitangle	I4	4	1	angle round orbit relative to solar plane, deg*100
mwhs21c_spare2	I4	4	5	spare
mwhs21c_btemps	I4	4	15*98	BT data for fovs 10 <sup>2</sup> x scene brightness temperature (K), channels 1-15
mwhs21c_dataqual	I4	4	98	quality control word for the data in each field of view
mwhs21c_filler	I4	4	4	spare

## 28. FORMAT OF THE IRAS.L1C FILE

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

### Header and record length

Header length = record length  
3611\*4 bytes

### Type

C = character  
I2 = integer\*2  
I4 = integer\*4

### Header Record

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>General information</b>				
iras1c_h_site	C	3	1	dataset creation site ID
iras1c_h_cfill1	C	1	1	filler
iras1c_h_1bsite	C	3	1	creation site for original 1B data
iras1c_h_cfill2	C	1	1	filler
iras1c_h_versnb	I4	4	1	level 1c format version number
iras1c_h_versyr	I4	4	1	level 1c format version year
iras1c_h_versdy	I4	4	1	level 1c format version day of year
iras1c_h_hdrent	I4	4	1	count of header records in this data set
iras1c_h_satid	I4	4	1	satellite identification: 1=FY3A 2=FY3B 3=FY3C

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iraslc_h_instrument	I4	4	1	instrument code 17=IRAS
iraslc_h_satht	I4	4	1	nominal satellite altitude, km*10
iraslc_h_period	I4	4	1	nominal orbit period (seconds)
iraslc_h_startorbit	I4	4	1	orbit number (at start of file)
iraslc_h_startdatayr	I4	4	1	start of data set year
iraslc_h_startdatady	I4	4	1	start of data set day of the year
iraslc_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
iraslc_h_endorbit	I4	4	1	orbit number (at end of file)
iraslc_h_enddatayr	I4	4	1	end of data set year
iraslc_h_enddatady	I4	4	1	end of data set day of the year
iraslc_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
iraslc_h_scnlin	I4	4	1	count of scan lines in this data set
iraslc_h_missenlin	I4	4	1	count of missing scan lines
iraslc_h_spare	I4	4	2	spare
<b>TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS</b>				
iraslc_h_tempradcnv	I4	4	3*26	for nochannel = 1 to 26: 10 <sup>4</sup> x (nochannel central wavenumber) 10 <sup>6</sup> x (nochannel constant 1) 10 <sup>6</sup> x (nochannel constant 2)
iraslc_h_wmosatid	I4	4	1	WMO satellite id (e.g. 520 for FY-3A)
iraslc_h_nchan	I4	4	1	Number of IRAS channels in format
iraslc_h_nmapchan	I4	4	1	Number of mapped channels in format
iraslc_h_nmapchanused _mwts	I4	4	1	Number of MWTS channels used
iraslc_h_nmapchanused _mwhs	I4	4	1	Number of MWHS channels used
iraslc_h_filler	I4	4	3506	filler

**One Data Record for one IRAS scan line**

Name in AAPP code	Name	Word Size in byte	Number of words	Meaning
iraslc_scnlin	I4	4	1	scan line number
iraslc_scnliny	I4	4	1	scan line year
iraslc_scnliny	I4	4	1	scan line day of year
iraslc_scnlintime	I4	4	1	scan line UTC time of day in milliseconds
iraslc_geo_qc	I4	4	1	quality indicator
iraslc_scnlin_qc	I4	4	1	scan line quality flags
iraslc_cal_qc	I4	4	5	calibration quality flag
iraslc_pixel_qc	I4	4	56	pixel quality flag
iraslc_insttemp	I4	4	9	IRAS instrument temps (K*100)
iraslc_latlon	I4	4	2*56	lat/lon in degrees for fovs first : 10 <sup>4</sup> x (latitude) second : 10 <sup>4</sup> x (longitude)

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iras1c_surface	I4	4	2*56	height/type for iras_fovs first : surface height (metres) second : surface type (0=sea, 1=mixed, 2=land)
iras1c_angles	I4	4	4*56	scan angles for fovs first: 10 <sup>2</sup> x (local zenith angle) second: 10 <sup>2</sup> x (local azimuth angle) third: 10 <sup>2</sup> x (solar zenith angle) fourth: 10 <sup>2</sup> x (solar azimuth angle)
iras1c_scalti	I4	4	1	sat altitude above reference ellipsoid, km*10
iras1c_satposition	I4	4	3	x,y,z in metres
iras1c_satvelocity	I4	4	3	vx,vy,vz in m/s
iras1c_orbitangle	I4	4	1	angle round orbit relative to solar plane, deg*100
iras1c_btemps	I4	4	26*56	BT data for fovs 10 <sup>2</sup> x scene brightness temperature (K), channels 1-26, or reflectivity *100 for visible channels
iras1c_btmap	I4	4	28*56	Mapped MWTS/MWHS BTs
iras1c_dataqual	I4	4	56	quality control word for the data in each field of view
iras1c_filler	I4	4	3	spare

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## 29. FORMAT OF THE HIRS.L1D FILE

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

### Header and record length

Header length = record length

3968\*4 bytes

### Type

C = character

I2 = integer\*2

I4 = integer\*4

### Header Record

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>GENERAL INFORMATION</b>				
hrs1d_h_site	C	3	1	1D dataset creation site ID
hrs1d_h_cfill1	C	1	1	filler
hrs1d_h_1bsite	C	3	1	creation site for original 1B data
hrs1d_h_cfill2	C	1	1	filler
hrs1d_h_versnb	I4	4	1	level 1d format version number
hrs1d_h_versyr	I4	4	1	level 1d format version year
hrs1d_h_versdy	I4	4	1	level 1d format version day of year
hrs1d_h_hdrcnt	I4	4	1	count of header records in this data set
hrs1d_h_satid	I4	4	1	satellite identification: .15=NOAA-15 (NOAA-K) 16=NOAA-16 (NOAA-L) 17=NOAA-17 (NOAA-M) 18=NOAA-18 (NOAA-N) 19=NOAA-19 (NOAA-N') 1=Metop-B (Metop-1) 2=Metop-A (Metop-2) 3=Metop-C (Metop-3) 4=Metop simulator
hrs1d_h_grid	I4	4	1	code for instrument grid (5=HIRS)
hrs1d_h_satht	I4	4	1	nominal satellite altitude, km*10
hrs1d_h_period	I4	4	1	nominal orbit period (seconds)
hrs1d_h_startorbit	I4	4	1	orbit number (at start of dataset)
hrs1d_h_startdatayr	I4	4	1	start of data set year
hrs1d_h_startdatady	I4	4	1	start of data set day of the year

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hrs1d_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
hrs1d_h_endorbit	I4	4	1	orbit number (at end of dataset)
hrs1d_h_enddatayr	I4	4	1	end of data set year
hrs1d_h_enddatady	I4	4	1	end of data set day of the year
hrs1d_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
hrs1d_h_scnlin	I4	4	1	count of scan lines in this data set
hrs1d_h_misscnlin	I4	4	1	count of missing scan lines
hrs1d_h_atovppvn	I4	4	1	ATOVPP version number (test vns = 9000+)
hrs1d_h_instruments	I4	4	1	instruments present (bit0=HIRS, bit1=MSU, bit3=AMSU-A, bit4=AMSU-B or MHS, bit5=AVHRR)
hrs1d_h_wmosatid	I4	4	1	WMO satellite id (e.g. 3 for METOP-1)
hrs1d_h_spare1	I4	4	1	spare
<b>HIRS TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS (Planck function)</b>				
hrs1d_h_hrsPlanck	I4	4	3*19	order of channels = HIRS 1,2,3,4,...,18,19 (1,*) = 10 <sup>6</sup> x (central wavenumber) (scaling factor for wavenumber changes to 10 <sup>5</sup> for channels 13-19 inclusive) (2,*) = 10 <sup>6</sup> x (constant 1) (3,*) = 10 <sup>6</sup> x (constant 2)
hrs1d_h_20solfiltirrad	I4	4	1	10 <sup>6</sup> x (albedo-radiance ch20 solar filtered irradiance W/m2)
hrs1d_h_20equifiltwidth	I4	4	1	10 <sup>6</sup> x (albedo-radiance ch 20 equivalent filter width cm <sup>-1</sup> )
hrs1d_h_spare2	I4	4	1	spare
<b>AMSU(-A&amp;B) TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS (Planck function)</b>				
hrs1d_h_amsPlanck	I4	4	3*20	order of channels = AMSU-A 1-15, AMSU-B 1-5 (1,*) = 10 <sup>6</sup> x (central wavenumber) (2,*) = 10 <sup>6</sup> x (constant 1) (3,*) = 10 <sup>6</sup> x (constant 2)
<b>PRE-PROCESSING INFORMATION</b>				
hrs1d_h_dT	I4	4	1	size of data batches processed within ATOVPP (seconds - see ATOVPP documentation)
hrs1d_h_mapBTmode	I4	4	1	mapping method used for BTs (1=nearest neighbour, 2=bilinear interpolation, 3=spatial averaging)
hrs1d_h_Hcorrvn	I4	4	1	vn no HIRS limb/emiss correction (=0 if data not corrected)
hrs1d_h_Hcloudvn	I4	4	1	vn no HIRS cloud detection/correction (=0 if not done)
hrs1d_h_Acorrvn	I4	4	1	vn no AMSU-A limb/emiss correction (=0 if data not corrected)
hrs1d_h_Apcpvvn	I4	4	1	vn no AMSU-A precip/scatter detection (=0 if not done)
hrs1d_h_Aantenna	I4	4	1	vn no, AMSU-A antenna corrections

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				(from ATOVIN)
hrs1d_h_Bcorrvn	I4	4	1	vn no AMSU-B/MHS limb/emiss correction (=0 if data not corrected)
hrs1d_h_Bpcpvn	I4	4	1	vn no AMSU-B/MHS precip/scatter detection (=0 if not done)
hrs1d_h_Bantenna	I4	4	1	vn no, AMSU-B/MHS antenna corrections (from ATOVIN)
hrs1d_h_Ascat	I4	4	1	threshold value for AMSU-A scattering index
hrs1d_h_ACrosby	I4	4	1	threshold value for AMSU-A logistic precip
hrs1d_h_AB89	I4	4	1	threshold value for AMSU-A/AMSU-B or MHS 89GHz differences
hrs1d_h_spare3	I4	4	3809	spare

**One Data Record for one HIRS scan line**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
hrs1d_scnlin	I4	4	1	scan line number
hrs1d_scnlinyr	I4	4	1	scan line year
hrs1d_scnlindy	I4	4	1	scan line day of year
hrs1d_scnlintime	I4	4	1	scan line UTC time of day in milliseconds
hrs1d_qualind	I4	4	1	quality indicator bit field In all of the following, if the bit is on (= is set to 1) then the statement is true. Otherwise it is false. <b>general</b> bit 31: do not use scan for product generation bit 30: time sequence error detected with this scan bit 29: data gap precedes this scan bit 28: no HIRS calibration bit 27: no Earth location bit 26: first good time following a clock update bit 25: instrument status changed with this scan bit 24-0: spare <zero fill>
hrs1d_scanqual	I4	4	1	scan line quality flags <b>time problem code</b> (all bits off implies the scan time is as expected) bit 31-24: spare <zero fill> bit 23: time field is bad but can probably be inferred from the previous good time



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				<p>bit 22: time field is bad and can't be inferred from the previous good time</p> <p>bit 21: this record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity). This may or may not be associated with a spacecraft clock update. (see bit 26 above)</p> <p>bit 20: start of a sequence that apparently repeats scan times that have been previously accepted.</p> <p>bits 19-16: spare</p> <p><b>calibration problem code</b> (all bits set to 0 indicates normal calibration)</p> <p>bit 15: scan line was not calibrated because of bad time</p> <p>bit 14: scan line was calibrated using fewer than the preferred number of scan lines because of proximity to start or end of data set or to a data gap.</p> <p>bit 13: scan line was not calibrated because of bad or insufficient PRT data</p> <p>bit 12: scan line was calibrated but with marginal PRT data</p> <p>bit 11: some uncalibrated channels of this scan. See channel indicators.</p> <p>bit 10: uncalibrated due to instrument mode</p> <p>bits 9 and 8: spare</p> <p><b>Earth location problem code</b> (all bits set to 0 implies the Earth location was normal)</p> <p>bit 7: not Earth located because of bad time</p> <p>bit 6: Earth location questionable because of questionable time code (see time problem flags above)</p> <p>bit 5: Earth location questionable. Only marginal agreement with reasonableness check.</p> <p>bit 4: Earth location questionable. Fails reasonableness check</p> <p>bit 3-0: spare</p>
hrs1d_instrtemp	I4	4	1	HIRS baseplate temperature (K*100)
hrs1d_instrtempa1	I4	4	1	AMSU-A1 RF shelf temp (K*100)
hrs1d_instrtempa2	I4	4	1	AMSU-A2 RF shelf temp (K*100)
hrs1d_instrtempb	I4	4	1	AMSU-B/MHS mixer ch 18-20 temp (K*100) (all from the nearest scanlines)
hrs1d_spare1	I4	4	2	spare
hrs1d_latlon	I4	4	2*56	lat/lon in degrees for Hnfovs first : 10 <sup>4</sup> x (latitude)

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				second : 10 <sup>4</sup> x (longitude)
hrs1d_surface	I4	4	2*56	height/type for Hnfovs first : surface height (metres) second : surface type (0=sea, 1=mixed, 2=land)
hrs1d_angles	I4	4	4*56	scan angles for Hnfovs first: 10 <sup>2</sup> x (local zenith angle) second: 10 <sup>2</sup> x (local azimuth angle) third: 10 <sup>2</sup> x (solar zenith angle) fourth: 10 <sup>2</sup> x (solar azimuth angle)
hrs1d_scalti	I4	4	1	sat altitude above reference ellipsoid, km*10
hrs1d_spare2	I4	4	2	spare
hrs1d_btemps	I4	4	(20+15+5) *56	10 <sup>2</sup> x scene brightness temperature (K) for channels HIRS 1-20, AMSU-A 1-15, AMSU-B 1-5 10 <sup>2</sup> x radiance Wm <sup>-2</sup> sr <sup>-1</sup> (cm <sup>-1</sup> )-1 for channel HIRS 20
hrs1d_avhrr	I4	4	13*56	AVHRR parameters in HIRS fov. For mode=1 in avh2hirs_atovs.F: Word 1: percentage of clear AVHRR pixels Words 2-6: mean albedo (%*100) or brightness temperature (K*100), AVHRR channels 1-5 Words 7-11: mean clear albedo (%*100) or brightness temperature (K*100), channels 1-5 Word 12: std dev chan 4, all pixels (K*100) Word 13: std dev chan 4, clear pixels (K*100) For mode=2 in avh2hirs_atovs.F: Word 1: percentage of clear AVHRR pixels Word 2: surface temperature (K*100) Word 3: climatological temperature or t2m (K*100) Words 4-6: mean brightness temperature channels 3-5 (K*100) Word 7: percentage of pixels that are black body Word 8: cloud top temperature (K*100) Word 9: standard deviation of cloud top T (K*100) Word 10: mean chan 4, clear pixels (K*100) Word 11: mean chan 5, clear pixels (K*100) Word 12: std dev chan 4, all pixels (K*100) Word 13: std dev chan 4, clear pixels (K*100)

**PRE-PROCESSING OUTPUTS**

hrs1d_hirsqual	I4	4	56	HIRS quality control word for each field of view: (all bits off implies acceptable data) [user-defined: bit 31: spare <zero fill> bit 30: set if secondary calibration used (..see calflg) bit 29-22: spare <zero fill> bit 21: HIRS cloud test (TBD) ... ] bit 20-1: bit n set to 1 if brightness
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				temperature in HIRS channel n is physically unreasonable or has not been calculated due to calibration problems. bit 0: bad or missing data (in any or all channels)
hrsId_prepro	I4	4	7*56	values from pre-processing  <b>(1,*) pre-processing quality control word with flags</b> all bits off implies acceptable data) bit 31: set if AMSU-A surface types not all the same bit 30: set if AMSU-A used secondary calibration bit 29: set if AMSU-B/MHS used secondary calibration bit 28: set if AMSU-B/MHS data missing bit 27: flag for cloud cost set for any mapped AMSU-A bit 26: scattering flag set for any mapped AMSU-A (only set over the sea) bit 25: logistic precipitation probability test calculated from AMSU-A data mapped to HIRS grid bit 24: Grody light rainfall test calculated on HIRS grid bit 23: mismatch between AMSU-A/AMSU-B or MHS 89GHz values (any AMSU-A) bit 22: mismatch between surface type from topography dataset and from pre-processing (any AMSU-A) bit 21: fewer AMSU mapping co-locations than expected bit 20-4: spare <zero fill> bit 3: set when AVHRR channel 3 is albedo not brightness temp bit 2: flag for cloud cost (recalculated on HIRS grid) bit 1: flag for scattering index (recalculated on HIRS grid) bit 0: set if AMSU-A & AMSU-B/MHS data missing  <b>(2,*) estimated surface type from the pre-processing:</b> 1 = Bare young ice (i.e. new ice, no snow) 2 = Dry land (i.e. dry with or without significant vegetation)

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				<p>3 = Dry snow (i.e. snow with water less than 2%, over land)  4 = Multi-year ice (i.e. old ice with snow [assumed dry] cover)  5 = Sea (i.e. open water, no islands, ice-free, WS=0 to 14m/s)  6 = Wet forest (i.e. established forest with wet canopy)  7 = Wet land (i.e. non-forested land with a wet surface)  8 = Wet snow (i.e. snow with water content &gt; 2%, over land or ice)  9 = Desert</p> <p><b>(3,*) cost fn from PPASURF surface identification (*100)</b></p> <p><b>(4,*) scattering index (*100)</b></p> <p><b>(5,*) logistic precipitation probability (*100)</b></p> <p><b>(6,*) spare</b></p> <p><b>(7,*) spare</b></p>
hrs1d_filler	I4	4	89	filler

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### 30. FORMAT OF THE AMSU-B.L1D FILE

#### Header and record length

Header length = record length

3072\*4 bytes

#### Type

C = character

I2 = integer\*2

I4 = integer\*4

#### Header Record

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>GENERAL INFORMATION</b>				
amb1d_h_site	C	3	1	1D dataset creation site ID
amb1d_h_cfill1	C	1	1	filler
amb1d_h_1bsite	C	3	1	creation site for original 1B data
amb1d_h_cfill2	C	1	1	filler
amb1d_h_versnb	I4	4	1	level 1d format version number
amb1d_h_versyr	I4	4	1	level 1d format version year
amb1d_h_versdy	I4	4	1	level 1d format version day of year
amb1d_h_hdrcnt	I4	4	1	count of header records in this data set
amb1d_h_satid	I4	4	1	satellite identification: .15=NOAA-15 (NOAA-K) 16=NOAA-16 (NOAA-L) 17=NOAA-17 (NOAA-M) 18=NOAA-18 (NOAA-N) 19=NOAA-19 (NOAA-N') 1=Metop-B (Metop-1) 2=Metop-A (Metop-2) 3=Metop-C (Metop-3) 4=Metop simulator
amb1d_h_grid	I4	4	1	code for instrument grid (5=HIRS; 6=MSU; 10=AMSU-A; 11=AMSU-B)
amb1d_h_satht	I4	4	1	nominal satellite altitude, km*10
amb1d_h_period	I4	4	1	nominal orbit period (seconds)
amb1d_h_startorbit	I4	4	1	orbit number (at start of dataset)
amb1d_h_startdatayr	I4	4	1	start of data set year
amb1d_h_startdatady	I4	4	1	start of data set day of the year
amb1d_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
amb1d_h_endorbit	I4	4	1	orbit number (at end of dataset)

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amb1d_h_enddatayr	I4	4	1	end of data set year
amb1d_h_enddatady	I4	4	1	end of data set day of the year
amb1d_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
amb1d_h_scnlin	I4	4	1	count of scan lines in this data set
amb1d_h_misscnlin	I4	4	1	count of missing scan lines
amb1d_h_atovppvn	I4	4	1	ATOVPP version number (test vns = 9000+)
amb1d_h_instruments	I4	4	1	instruments present (bit0=HIRS, bit1=MSU, bit3=AMSU-A, bit4=AMSU-B or MHS, bit5=AVHRR)
amb1d_h_wmosatid	I4	4	1	WMO satellite id (e.g. 3 for METOP-1)
amb1d_h_spare1	I4	4	1	spare
<b>AMSU(-A&amp;B) TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS (Planck function)</b>				
amb1d_h_amsPlanck	I4	4	3*20	order of channels = AMSU-A 1-15, AMSU-B 1-5 (1,*) = 10 <sup>6</sup> x (central wavenumber) (2,*) = 10 <sup>6</sup> x (constant 1) (3,*) = 10 <sup>6</sup> x (constant 2)
<b>PRE-PROCESSING INFORMATION</b>				
amb1d_h_Bcorrvn	I4	4	1	vn no AMSU-B/MHS limb/emiss correction (=0 if data not corrected)
amb1d_h_Bpcpvvn	I4	4	1	vn no AMSU-B/MHS precip/scatter detection (=0 if not done)
amb1d_h_spare2	I4	4	2218	spare

**One Data Record for one AMSU-B/MHS scan line**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
amb1d_scnlin	I4	4	1	scan line number
amb1d_scnlinyr	I4	4	1	scan line year
amb1d_scnlindy	I4	4	1	scan line day of year
amb1d_scnlintime	I4	4	1	scan line UTC time of day in milliseconds
amb1d_qualind	I4	4	1	quality indicator bit field In all of the following, if the bit is on (= is set to 1) then the statement is true. Otherwise it is false. <b>general</b> bit 31: do not use scan for product generation bit 30: time sequence error detected with this scan bit 29: data gap precedes this scan bit 28: no AMSU-B calibration bit 27: no Earth location

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				bit 26: first good time following a clock update bit 25: instrument status changed with this scan bit 24-0: spare <zero fill>
amb1d_scanqual	I4	4	1	scan line quality flags <b>time problem code</b> (all bits off implies the scan time is as expected) bit 31-24: spare <zero fill> bit 23: time field is bad but can probably be inferred from the previous good time bit 22: time field is bad and can't be inferred from the previous good time bit 21: this record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity). This may or may not be associated with a spacecraft clock update. (see bit 26 above) bit 20: start of a sequence that apparently repeats scan times that have been previously accepted. bits 19-16: spare <b>calibration problem code</b> (all bits set to 0 indicates normal calibration) bit 15: scan line was not calibrated because of bad time bit 14: scan line was calibrated using fewer than the preferred number of scan lines because of proximity to start or end of data set or to a data gap. bit 13: scan line was not calibrated because of bad or insufficient PRT data bit 12: scan line was calibrated but with marginal PRT data bit 11: some uncalibrated channels of this scan. See channel indicators. bit 10: uncalibrated due to instrument mode bits 9 and 8: spare <b>Earth location problem code</b> (all bits set to 0 implies the Earth location was normal) bit 7: not Earth located because of bad time bit 6: Earth location questionable because of questionable time code (see time problem flags above) bit 5: Earth location questionable. Only marginal agreement with reasonableness

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				check. bit 4: Earth location questionable. Fails reasonableness check bit 3-0: spare
amb1d_instrtempb	I4	4	1	AMSU-B/MHS instrument temp (K*100)
amb1d_spare1	I4	4	2	spare
amb1d_latlon	I4	4	2*90	lat/lon in degrees for Hnfovs first : 10 <sup>4</sup> x (latitude) second : 10 <sup>4</sup> x (longitude)
amb1d_surface	I4	4	2*90	height/type for Hnfovs first : surface height (metres) second : surface type (0=sea, 1=mixed, 2=land)
amb1d_angles	I4	4	4*90	scan angles for Hnfovs first: 10 <sup>2</sup> x (local zenith angle) second: 10 <sup>2</sup> x (local azimuth angle) third: 10 <sup>2</sup> x (solar zenith angle) fourth: 10 <sup>2</sup> x (solar azimuth angle)
amb1d_scalti	I4	4	1	sat altitude above reference ellipsoid, km*10
amb1d_spare2	I4	4	2	spare
amb1d_btemps	I4	4	20*90	10 <sup>2</sup> x scene brightness temperature (K) for channels AMSU-A 1-15, AMSU-B 1-5
<b>PRE-PROCESSING OUTPUTS</b>				
amb1d_prepro	I4	4	6*90	values from nearest AMSU-A  <b>(1,*): pre-processing quality control word with flags</b> all bits off implies acceptable data) bit 31: spare bit 30: set if AMSU-B/MHS used secondary calibration bit 29: set if AMSU-A used secondary calibration bit 28: set if AMSU-A data missing bit 27: maximum probability scheme cloud flag bit 26: scattering test (only set over the sea) bit 25: logistic precipitation probability test bit 24: Grody light rainfall test bit 23: mismatch between AMSU-A/AMSU-B or MHS 89GHz values bit 22: mismatch between surface type from topography dataset and from pre-processing bit 21: spare  values from the AMSU-B or MHS:  bit 20: set if 89GHz channel greatly different



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			<p>from that in surrounding fovs (PPMEDIAN)          bit 19: scattering test (only set over the sea) - using AMSU-B 89GHz channel          bit 18: mismatch between AMSU-A/B 89GHz values          bit 17: AMSU-B quality control flag 1          bit 16: AMSU-B quality control flag 2          bit 15: AMSU-B quality control flag 3          bit 14: AMSU-B quality control flag 4          bit 13-1: spare          bit 0: bad or missing data (in any or all AMSU-B channels)</p> <p><b>(2,*) estimated AMSU-A surface type:</b>          1 = Bare young ice (i.e. new ice, no snow)          2 = Dry land (i.e. dry with or without significant vegetation)          3 = Dry snow (i.e. snow with water less than 2%, over land)          4 = Multi-year ice (i.e. old ice with snow [assumed dry] cover)          5 = Sea (i.e. open water, no islands, ice-free, WS=0 to 14m/s)          6 = Wet forest (i.e. established forest with wet canopy)          7 = Wet land (i.e. non-forested land with a wet surface)          8 = Wet snow (i.e. snow with water content &gt; 2%, over land or ice)          9 = Desert</p> <p><b>(3,*) cost fn from PPASURF surface identification (*100)</b></p> <p><b>(4,*) scattering index (*100) (recalculated with AMSU-B 89GHz)</b></p> <p><b>(5,*) microwave cirrus index (*1000) (range is +/-200)</b></p> <p><b>(6,*) NWC-SAF scattering index and precipitation probabilities:</b>          bit 16-31: scattering index * 100 (K), (range -327.78 K to +327.67 K)          Precipitation probabilities are scaled to 4 bits:          15 = probability of 1.0.          bit 0-3: Prob 0-0.1mm/h          bit 4-7: Prob 0.1-0.5mm/h</p>
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			bit 8-11: Prob 0.5-5.0 mm/h bit 12-15: Prob >5mm/h Note: if all four probabilities are zero, they could not be calculated.
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### 31. FORMAT OF THE IASIL1D FILE

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

#### Header and record length

Header length = record length

$(6377 + 15 \cdot \text{iasi\_1dnchan} + 30 \cdot \text{iasi\_1dnpc}) \cdot 4$  bytes (default  $19587 \cdot 4$  bytes)

where *iasi\_1dnchan* is the number of channels required (default 366), and *iasi\_1dnpc* is the number of Principal Component scores required (default 300).

#### Type

C = character

I2 = integer\*2

I4 = integer\*4

#### Header Record

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>GENERAL INFORMATION</b>				
iasild_h_site	C	3	1	1D dataset creation site ID
iasild_h_cfill1	C	1	1	filler
iasild_h_1bsite	C	3	1	creation site for original 1B data
iasild_h_cfill2	C	1	1	filler
iasild_h_versnb	I4	4	1	level 1d format version number
iasild_h_versyr	I4	4	1	level 1d format version year
iasild_h_versdy	I4	4	1	level 1d format version day of year
iasild_h_hdrent	I4	4	1	count of header records in this data set
iasild_h_satid	I4	4	1	satellite identification: 1=Metop-1 2=Metop-2 3=Metop-3 4=Metop simulator
iasild_h_grid	I4	4	1	code for instrument grid (12=IASI)
iasild_h_satht	I4	4	1	nominal satellite altitude, km*10
iasild_h_period	I4	4	1	nominal orbit period (seconds)
iasild_h_startorbit	I4	4	1	orbit number (at start of dataset)
iasild_h_startdatayr	I4	4	1	start of data set year
iasild_h_startdatady	I4	4	1	start of data set day of the year
iasild_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
iasild_h_endorbit	I4	4	1	orbit number (at end of dataset)
iasild_h_enddatayr	I4	4	1	end of data set year
iasild_h_enddatady	I4	4	1	end of data set day of the year

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iasild_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
iasild_h_scnlin	I4	4	1	count of scan lines in this data set
iasild_h_misscnlin	I4	4	1	count of missing scan lines
iasild_h_atovppvn	I4	4	1	ATOVPP version number (test vns = 9000+)
iasild_h_instruments	I4	4	1	instruments present (bit0=HIRS, bit1=MSU, bit3=AMSU-A, bit4=AMSU-B or MHS, bit5=AVHRR, bit6=IASI)
iasild_h_wmosatid	I4	4	1	WMO satellite id (3 for METOP-1, 4 for METOP-2, 5 for METOP-3))
iasild_h_spare1	I4	4	1	spare
<b>IASI VARIABLES)</b>				
iasild_h_startchan	I4	4	10	Start channel for scaling definition
iasild_h_endchan	I4	4	10	End channel for scaling definition
iasild_h_scalefactor	I4	4	10	Radiance = scalrad*10 <sup>-scalefactor</sup>
iasild_h_eigvn	I4	4	1	Version number of eigenvectors
iasild_h_npc	I4	4	1	Number of PCs in format
iasild_h_npcused	I4	4	1	Number of PCs used
iasild_h_chanvn	I4	4	1	Version number of channel selection
iasild_h_nchan	I4	4	1	Number of channels in format
iasild_h_nchanused	I4	4	1	Number of channels used
iasild_h_channels	I4	4	300	List of IASI channels range 1 to 8461
<b>AMSU(-A&amp;B) TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS (Planck function)</b>				
iasild_h_amsPlanck	I4	4	3*20	order of channels = AMSU-A 1-15, MHS 1-5 (1,*) = 10 <sup>6</sup> x (central wavenumber) (2,*) = 10 <sup>6</sup> x (constant 1) (3,*) = 10 <sup>6</sup> x (constant 2)
<b>PRE-PROCESSING INFORMATION</b>				
iasild_h_dT	I4	4	1	size of data batches processed within ATOVPP (seconds - see ATOVPP documentation)
iasild_h_mapBTmode	I4	4	1	mapping method used for BTs (1=nearest neighbour, 2=bilinear interpolation, 3=spatial averaging)
iasild_h_Acorrvn	I4	4	1	vn no AMSU-A limb/emiss correction (=0 if data not corrected)
iasild_h_Apcpvvn	I4	4	1	vn no AMSU-A precip/scatter detection (=0 if not done)
iasild_h_Aantenna	I4	4	1	vn no, AMSU-A antenna corrections (from ATOVIN)
iasild_h_Bcorrvn	I4	4	1	vn no MHS limb/emiss correction (=0 if data not corrected)
iasild_h_Bpcpvvn	I4	4	1	vn no.MHS precip/scatter detection (=0 if not done)
iasild_h_Bantenna	I4	4	1	vn no, MHS antenna corrections (from ATOVIN)
iasild_h_Ascat	I4	4	1	threshold value for AMSU-A scattering index

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ias1d_h_ACrosby	I4	4	1	threshold value for AMSU-A logistic precip
ias1d_h_AB89	I4	4	1	threshold value for AMSU-A/AMSU-B or MHS 89GHz differences
ias1d_h_cloudtests	I4	4	1	Cloud tests used (0 if none)
ias1d_h_recperscan	I4	4	1	Records per scan: 1 or 4
ias1d_h_fovmode	I4	4	1	0 = full resolution 1 to 4 = fixed detector 5+ = other methods (TBD)
ias1d_h_spare2	I4	4	[19153]	spare: size depends on number of chans/scores

**One Data Record for one IASI scan line**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
ias1d_scnlin	I4	4	1	scan line number
ias1d_scnlinyr	I4	4	1	scan line year
ias1d_scnlindy	I4	4	1	scan line day of year
ias1d_scnlintime	I4	4	30	scan line UTC time of day in milliseconds
ias1d_insttrtempa1	I4	4	1	AMSU-A1 RF shelf temp (K*100)
ias1d_insttrtempa2	I4	4	1	AMSU-A2 RF shelf temp (K*100)
ias1d_insttrtempb	I4	4	1	AMSU-B mixer ch 18-20 temp (K*100) (all from the nearest scanlines)
ias1d_spare1	I4	4	2	spare
ias1d_latlon	I4	4	2*30	lat/lon in degrees first : 10 <sup>4</sup> x (latitude) second : 10 <sup>4</sup> x (longitude)
ias1d_surface	I4	4	2*30	height/type first : surface height (metres) second : surface type (0=sea, 1=mixed, 2=land)
ias1d_angles	I4	4	4*30	scan angles first: 10 <sup>2</sup> x (local zenith angle) second: 10 <sup>2</sup> x (local azimuth angle) third: 10 <sup>2</sup> x (solar zenith angle) fourth: 10 <sup>2</sup> x (solar azimuth angle)
ias1d_scalti	I4	4	1	sat altitude above reference ellipsoid, km*10
ias1d_spare2	I4	4	2	spare
<b>AMSU-A+MHS MAPPED TO IASI</b>				
ias1d_btemps	I4	4	(15+5)*30	10 <sup>2</sup> x scene brightness temperature (K) for AMSU-A 1-15, MHS 1-5 10 <sup>2</sup> x radiance Wm <sup>-2</sup> sr <sup>-1</sup> (cm <sup>-1</sup> )-1 for channel HIRS 20
ias1d_iasiqal	I4	4	30	Quality control word for each field of view: (all bits off implies acceptable data)

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				[user-defined: bit 23-4: bit n set to 1 if brightness temperature in AMSU-A+MHS channel n-3 is physically unreasonable or has not been calculated due to calibration problems. bit 3-1: bit n set to 1 if data for IASI detector n are bad bit 0: bad or missing data (in any or all channels)
iasild_prepro	I4	4	7*30	values from pre-processing  <b>(1,*) pre-processing quality control word with flags</b> all bits off implies acceptable data) bit 31: set if AMSU-A surface types not all the same bit 30: set if AMSU-A used secondary calibration bit 29: set if MHS used secondary calibration bit 28: set if MHS data missing bit 27: flag for cloud cost set for any mapped AMSU-A bit 26: scattering flag set for any mapped AMSU-A (only set over the sea) bit 25: logistic precipitation probability test calculated from AMSU-A data mapped to HIRS grid bit 24: Grody light rainfall test calculated on HIRS grid bit 23: mismatch between AMSU-A/MHS 89GHz values (any AMSU-A) bit 22: mismatch between surface type from topography dataset and from pre-processing (any AMSU-A) bit 21: fewer AMSU mapping co-locations than expected bit 20-4: spare <zero fill> bit 3: set when AVHRR channel 3 is albedo not brightness temp bit 2: flag for cloud cost (recalculated on HIRS grid) bit 1: flag for scattering index (recalculated on HIRS grid) bit 0: set if AMSU-A & MHSdata missing  <b>(2,*) estimated surface type from the pre-processing:</b> 1 = Bare young ice (i.e. new ice, no snow)

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				<p>2 = Dry land (i.e. dry with or without significant vegetation)</p> <p>3 = Dry snow (i.e. snow with water less than 2%, over land)</p> <p>4 = Multi-year ice (i.e. old ice with snow [assumed dry] cover)</p> <p>5 = Sea (i.e. open water, no islands, ice-free, WS=0 to 14m/s)</p> <p>6 = Wet forest (i.e. established forest with wet canopy)</p> <p>7 = Wet land (i.e. non-forested land with a wet surface)</p> <p>8 = Wet snow (i.e. snow with water content &gt; 2%, over land or ice)</p> <p>9 = Desert</p> <p><b>(3,*) cost fn from PPASURF surface identification (*100)</b></p> <p><b>(4,*) scattering index (*100)</b></p> <p><b>(5,*) logistic precipitation probability (*100)</b></p> <p><b>(6,*) spare</b></p> <p><b>(7,*) spare</b></p>
iasild_emiss	I4	4	13*30	13 emissivity parameters
<b>IASI DATA</b>				
iasild_GQisFlagQual	I4	4	30	1=some anomaly
iasild_GQisQualIndex	I4	4	1	NEDT estimated/expected
iasild_GQisQualIndexLoc	I4	4	1	IIS/AVHRR co-registration uncertainty
iasild_GQisQualIndexRad	I4	4	1	NEDT estimated/expected radiometric
iasild_GQisQualIndexSpect	I4	4	1	NEDT estimated/expected spectral
iasild_GQisSysTecSondQual	I4	4	1	
iasild_scalrad	I4	4	[300]*30	Scaled radiance (default 300 channels)
iasild_scores	I4	4	[300]*30	PC scores (default 300 scores)
iasild_logfit	I4	4	3*30	Reconstruction Scores for 3 bands
iasild_FOV	I4	4	30	30 values in range 1 to 120
<b>AVHRR DATA</b>				
iasild_avhcombination	I4	4	1	1 bit for each channel
iasild_avhrrmean	I4	4	6*7*30	Scaled mean radiance for 6 channels, 7 classes
iasild_avhrrsdev	I4	4	6*7*30	Scaled Std Dev for 6 channels, 7 classes
iasild_avhmeanscalefactor	I2	2	6*7*30	

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iasild_avhsdevscalefactor	I2	2	6*7*30	
iasild_avhrrfrac	I4	4	7*30	10 <sup>6</sup> x Fraction in each class
iasild_avhrrCGy	I4	4	7*30	10 <sup>6</sup> x Y angular position of centre of gravity (deg)
iasild_avhrrCGz	I4	4	7*30	10 <sup>6</sup> x Z angular position of centre of gravity (deg)
<b>CLOUD FLAG (user defined)</b>				
iasild_cloudflag	I4	4	10*30	

## 32. FORMAT OF THE CRIS.L1D FILE

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

### Header and record length

Header length = record length

array\_size\_cris1d = (11 + cris\_1dnfor\*(53 + cris\_1dnchanatms + cris\_1dnchan +  
& cris\_1dnpc + 2\*cris\_1dnband + 2\*cris\_1dnchanviirs)  
& + 2\*cris\_1dnchanatms) \*4 bytes (default 12835\*4 bytes)

where

cris\_1dnfor = 30            Number of FORs present in 1d  
cris\_1dnchanatms = 22    Number of ATMS channels  
cris\_1dnchan = 300       Number of channel slots present in 1d  
cris\_1dnpc = 1            Number of Principal Components present  
cris\_1dnband = 3          Number of bands  
cris\_1dnchanviirs = 22   Number of VIIRS channels in format  
cris\_1dnchanatms = 22    Number of ATMS channels

array\_size\_cris1dspare =  
& array\_size\_cris1d - 49 - cris\_1dnchan - 7\*cris\_1dnchanatms  
& - 4\*cris\_1dnband - 2\*cris\_1dnchanviirs)

### Type

C = character  
I2 = integer\*2  
I4 = integer\*4

### Header Record

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
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<b>GENERAL INFORMATION</b>				
cris1d_h_site	C	3	1	1D dataset creation site ID
cris1d_h_cfill1	C	1	1	filler
cris1d_h_1bsite	C	3	1	creation site for original 1B data
cris1d_h_cfill2	C	1	1	filler
cris1d_h_versnb	I4	4	1	level 1d format version number
cris1d_h_versyr	I4	4	1	level 1d format version year
cris1d_h_versdy	I4	4	1	level 1d format version day of year
cris1d_h_hdrent	I4	4	1	count of header records in this data set
cris1d_h_satid	I4	4	1	satellite id in series (1 for NPP)
cris1d_h_grid	I4	4	1	code for instrument grid (5=HIRS; 6=MSU; 10=AMSU-A; 11=AMSU-B; 12=IASI; 13=ATMS; 14=CrIS)
cris1d_h_satht	I4	4	1	nominal satellite altitude, km*10
cris1d_h_period	I4	4	1	nominal orbit period (seconds)
cris1d_h_startorbit	I4	4	1	orbit number (at start of file)
cris1d_h_startdatayr	I4	4	1	start of data set year
cris1d_h_startdatady	I4	4	1	start of data set day of the year
cris1d_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
cris1d_h_endorbit	I4	4	1	orbit number (at end of file)
cris1d_h_enddatayr	I4	4	1	end of data set year
cris1d_h_enddatady	I4	4	1	end of data set day of the year
cris1d_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
cris1d_h_scnlin	I4	4	1	count of scan lines in this data set
cris1d_h_misscnlin	I4	4	1	count of missing scan lines
cris1d_h_atovppvn	I4	4	1	ATOVPP version number (test vns = 9000+)
cris1d_h_instruments	I4	4	1	instruments present (bit0=HIRS, bit1=MSU, bit3=AMSU-A, bit4=AMSU-B, bit5=AVHRR, bit 6=IASI, bit7=ATMS, bit8=CrIS)
cris1d_h_wmosatid	I4	4	1	WMO satellite id (224 for NPP)
cris1d_h_spare1	I4	4	1	spare
cris1d_h_centre	I4	4	1	WMO id of reception centre
cris1d_h_subcentre	I4	4	1	WMO id of reception subcentre
<b>CrIS variables</b>				
cris1d_h_recwords	I4	4	1	Size of record in integer*4 words
cris1d_h_nfov	I4	4	1	Number of FOVs
cris1d_h_nfor	I4	4	1	Number of FORs
cris1d_h_nband	I4	4	1	Number of bands
cris1d_h_startw	I4	4	cris_1dnband	First wavenumber *1E2
cris1d_h_endw	I4	4	cris_1dnband	Last wavenumber *1E2
cris1d_h_startchan	I4	4	cris_1dnband	First channel in band
cris1d_h_endchan	I4	4	cris_1dnband	Last channel in band

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cris1d_h_eigvn	I4	4	1	Version number of eigenvectors
cris1d_h_npc	I4	4	1	Number of PCs in format
cris1d_h_npcused	I4	4	1	Number of PCs used
cris1d_h_chanvn	I4	4	1	Version number of channel selection
cris1d_h_nchan	I4	4	1	Number of channels in format
cris1d_h_nchanused	I4	4	1	Number of channels used
cris1d_h_channels	I4	4	cris_1dnband	List of cris channels range 1 to 8461
<b>ATMS variables</b>				
cris1d_h_atmsbeamversion	I4	4	1	User defined (see atms_beamwidth.dat)
cris1d_h_atmsbeamwidth	I4	4	cris_1dnchanatms	FFT manipulation: deg*1E3
cris1d_h_atmscutoff	I4	4	cris_1dnchanatms	FFT manipulation: fraction*1E3
cris1d_h_atmsnxaverage	I4	4	cris_1dnchanatms	Simple averaging:
cris1d_h_atmsnyaverage	I4	4	cris_1dnchanatms	Simple averaging:
<b>ATMS temperature-radiance conversion coefficients (Planck function)</b>				
cris1d_h_atmsPlanck	I4	4	3* Simple averaging:	(1,*) = 10 <sup>6</sup> x (central wavenumber) (2,*) = 10 <sup>6</sup> x (constant 1) (3,*) = 10 <sup>6</sup> x (constant 2)
<b>Pre-processing information</b>				
cris1d_h_dT	I4	4	1	size of data batches processed within ATOVPP
cris1d_h_mapBTmode	I4	4	1	mapping method used for BTs (1=nearest neighbour, 2=bilinear interpolation)
cris1d_h_Acorrvn	I4	4	1	vn no ATMS limb/emiss correction (=0 if data not corrected)
cris1d_h_Apcpvn	I4	4	1	vn no ATMS precip/scatter detection (=0 if not done)
cris1d_h_Aantenna	I4	4	1	vn no, ATMS antenna corrections
cris1d_h_Ascat	I4	4	1	threshold value for ATMS scattering index
cris1d_h_ACrosby	I4	4	1	threshold value for ATMS logistic precip
cris1d_h_cloudtests	I4	4	1	Cloud tests used (0 if none)
cris1d_h_recperscan	I4	4	1	Records per scan: 1 to 9
cris1d_h_fovmode	I4	4	1	0 = full resolution Others TBD
<b>VIIRS</b>				
cris1d_h_nviirschan	I4	4	1	number of VIIRS channels in format
cris1d_h_nviirschanused	I4	4	1	number of channels used
cris1d_h_viirschans(cris_1dnchanviirs)	I4	4	cris_1dnchanviirs	Channel numbers
cris1d_h_viirsbands	I4	4	cris_1dnchanviirs	Band numbers 5=M, 6=I, 7-DN
cris1d_h_spare2	I4	4	array_size_cris1dspa	spare

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**One Data Record for one CRIS scan line**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>General information</b>				
cris1d_scnlin	I4	4	1	scan line number
cris1d_scnlinyr	I4	4	1	scan line year
cris1d_scnlindy	I4	4	1	scan line day of year
cris1d_scnlintime	I4	4	cris_1dnfor	scan line UTC time of day (ms)
cris1d_latlon	I4	4	2*cris_1dnf or	lat/lon in degrees first : 10 <sup>4</sup> x (latitude) second : 10 <sup>4</sup> x (longitude)
cris1d_angles	I4	4	4*cris_1dnf or	scan angles first: 10 <sup>2</sup> x (local zenith angle) second: 10 <sup>2</sup> x (local azimuth angle) third: 10 <sup>2</sup> x (solar zenith angle) fourth: 10 <sup>2</sup> x (solar azimuth angle)
cris1d_satxyz	I4	4	3	x,y,z of satellite at mid-scan
cris1d_ascdesc	I4	4	1	ascending / descending orbit qualifier
cris1d_orbit	I4	4	1	orbit number
cris1d_scalti	I4	4	1	satellite altitude
cris1d_surfht	I4	4	cris_1dnfor	surface height
cris1d_landfrac	I4	4	cris_1dnfor	land fraction
cris1d_landsea	I4	4	cris_1dnfor	land/sea qualifier
cris1d_cloudcover	I4	4	cris_1dnfor	cloud cover (percent)
cris1d_cloudtopht	I4	4	cris_1dnfor	height of top of cloud (m)
cris1d_surface	I4	4	3* cris_1dnfor	Surfelev output first : surface height (metres) second : surface type (0=sea, 1=mixed, 2=land) third : land fraction (percent)
<b>ATMS mapped to CrIS</b>				
cris1d_nedtcoldatms	I4	4	cris_1dncha natms	
cris1d_nedtwarmatms	I4	4	cris_1dncha natms	
cris1d_btemps	I4	4	cris_1dncha natms*cris_1dnfor	10 <sup>2</sup> x scene brightness temperature (K) for ATMS channels
cris1d_crisqual	I4	4	cris_1dnfor	Quality control word for each field of view: (all bits off implies acceptable data) ! bit 27-4: bit n set to 1 if brightness

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				temperature in ATMS channel n-3 is physically unreasonable or has not been calculated due to calibration problems. bit 3-1: bit n set to 1 if data for CrIS detector n are bad bit 0: bad or missing data (in any or all channels)
cris1d_prepro	I4	4	8* cris_1dnfor	values from pre-processing (1,*): pre-processing quality control word with flags(all bits off implies acceptable data) bit 31: set if ATMS surface types not all the same bit 30-28: spare bit 27: flag for cloud cost set for any mapped ATMS bit 26: scattering flag set for any mapped ATMS(only set over the sea) bit 25: logistic precipitation probability test calculated from ATMS data mapped to CrIS grid bit 24: Grody light rainfall test calculated on CrIS grid bit 23: spare bit 22: mismatch between surface type from topography dataset and from pre-processing (any ATMS) bit 21: fewer ATMS mapping co-locations than expected bit 20-4: spare <zero fill> bit 3: spare bit 2: flag for cloud cost (recalculated on CrIS grid) bit 1: flag for scattering index (recalculated on CrIS grid) bit 0: set if ATMS data missing  (2,*) estimated surface type from the pre-processing: 1 = Bare young ice (i.e. new ice, no snow) 2 = Dry land (i.e. dry with or without significant vegetation) 3 = Dry snow (i.e. snow with water less than 2%, over land) 4 = Multi-year ice (i.e. old ice with snow [assumed dry] cover) 5 = Sea (i.e. open water, no islands, ice-free, WS=0 to 14m/s)

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				6 = Wet forest (i.e. established forest with wet canopy) 7 = Wet land (i.e. non-forested land with a wet surface) 8 = Wet snow (i.e. snow with water content > 2%, over land or ice) 9 = Desert (3,*) cost fn from PPASURF surface identification (*100) (4,*) scattering index (*100) (5,*) cirrus index (*100) (6,*) logistic precipitation probability (*100) (7,*) NWC-SAF (Bennartz) scattering index (K) (8,*) NWC-SAF (Bennartz) precipitation probabilities
cris1d_emiss	I4	4	13* cris_1dnfor	13 emissivity parameters
<b>CrIS data</b>				
cris1d_radianceflgs	I4	4	cris_1dnfor	radiance flags Bit(1=MS) 1 Clear path 2 Partly cloudy path 3 Cloudy path 4 Apodized 5 Unapodized 6 Reconstructed 7 Cloud cleared 8-14 Reserved All 15 Missing value
cris1d_scanqualflgs	I4	4	1	scan quality flags Bit(1=MS) 1 Gap in Raw Data Record (RDR) data detected (i.e., missing scan(s) preceding the current scan) 2 Recorded time is not in sequence (i.e., the scan start time is out of sequence) 3 Lamda monitored calculation cannot be updated 4 The measured temperatures of any instrument components (e.g., beam-splitter, scan mirror, scan baffle, etc.) are outside the allowable ranges 5 At least one of the monitored instrument temperatures has drifted more than a specified tolerance value 6-12 Reserved All 13 Missing value

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cris1d_calqualflgs	I4	4	cris_1dnband*cris_1dnfor	cal. quality Same for all FOVS 1 to 9, but thinned data may have different FOVs within a record Bit(1=MS of 9 bits) 1Lunar intrusion on first deep space view 2Lunar intrusion on second deep space view 3-8 Reserved All 9 Missing value
cris1d_fovqualflgs	I4	4	cris_1dnband*cris_1dnfor	FOV quality Bit(1=MS of 19 bits) 1Degraded SDR quality 2Invalid SDR quality 3Invalid SDR geolocation information 4Degraded radiometric calibration 5Invalid radiometric calibration 6Degraded spectral calibration 7Invalid spectral calibration 8Fringe count error detected and corrected 9Day/night indicator 10Invalid RDR data 11Significant fringe count error detected 12Bit trim failed 13-18 Reserved All 19 Missing value
cris1d_geolocqual	I4	4	1	Geolocation quality Value 0 Nominal 1 Missing at most a small gap of altitude and Ephemeris data 2 Missing more than a small gap of altitude and Ephemeris data, but no more than a granule boundary 3 Missing more than a granule boundary of altitude and Ephemeris data 4-14 Reserved 15 Missing
cris1d_quality	I4	4	cris_1dnband,cris_1dnfor	Value 0 Not suspect 1 Suspect 2 Very suspect 3 Unusable
cris1d_cloudflag	I4	4	10*cris_1dnfor	CrIS cloud flag (user defined)
<b>CrIS radiance and PC scores</b>				
cris1d_FOV	I4	4	cris_1dnfor	30 values in range 1 to 270
cris1d_scores	I4	4	cris_1dnpc*cris_1dnfo	PC scores

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cris1d_logfit	I4	4	3*cris_1dnfor)	Reconstruction Scores for 3 bands
cris1d_radiance	I4	4	cris_1dnfor *cris_1dnchan	Radiance Wm-2sr-1cm *1E7
<b>VIIRS</b>				
cris1d_viirsradiance	I4	4	cris_1dnchan nviirs * cris_1dnfor	
cris1d_viirsreflectance	I4	4	cris_1dnchan nviirs * cris_1dnfor	

**One Data Record for one ATMS scan line**

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>General information</b>				
atms1d_scnlin	I4	4	1	scan line number
atms1d_scnlinyr	I4	4	1	scan line year
atms1d_scnlindy			1	scan line day of year
atms1d_scnlintime			atms_1dnfov	UTC time of day in milliseconds
atms1d_orbit				
atms1d_granulequal				granule quality flags
atms1d_scanqual				scan line quality flags
atms1d_geolocqual				geolocation quality
atms1d_chanqual			atms_1dnchan	quality flag for each channel
atms1d_latlon			2*atms_1dnfov	lat/lon in degrees first : 10 <sup>4</sup> x (latitude) second : 10 <sup>4</sup> x (longitude)
atms1d_surface			2*atms_1dnfov	height/type first : surface height (metres) second : surface type (0=sea, 1=mixed, 2=land)
atms1d_landfrac			2*atms_1dnfov	first : AMSU-A-like channels (percent) second : AMSU-B-like channels (percent)
atms1d_angles			4*atms_1dnfov	scan angles first: 10 <sup>2</sup> x (local zenith angle) second: 10 <sup>2</sup> x (local azimuth angle) third: 10 <sup>2</sup> x (solar zenith angle) fourth: 10 <sup>2</sup> x (solar azimuth angle)

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atms1d_scalti				sat altitude above reference ellipsoid, km*10
<b>Data</b>				
atms1d_nedtcold			atms_1dnchan	Cold view NEDT K*100
atms1d_nedtwarm			atms_1dnchan	Warm view NEDT K*100
atms1d_btemps			atms_1dnchan*atms_1dnfov	10 <sup>2</sup> x scene brightness temperature (K)
atms1d_atmsqual			atms_1dnfov	Quality control word for each field of view: (all bits off implies acceptable data) bit 27-4: bit n set to 1 if brightness temperature in ATMS channel n-3 is physically unreasonable or has not been calculated due to calibration problems. bit 3-1: reserved bit 0: bad or missing data (in any or all channels)
<b>Pre-processing output</b>				
atms1d_prepro			8*atms_1dnfov	(1,*) pre-processing quality control word, atmsqc(all bits off implies acceptable data) bit 31: set if ATMS BTs considered contaminated due e.g. to precip or surface type bit 30: spare bit 29: spare bit 28: spare bit 27: maximum probability scheme cloud flag bit 26: scattering test (only set over the sea) bit 25: Crosby logistic precipitation probability test bit 24: Grody light rainfall test bit 23: spare bit 22: mismatch between surface type from topography dataset and from pre-processing bit 21: spare <zero fill> bit 20: spare bit 19: scattering test (only set over the sea) - using ATMS 89GHz channel bit 18: spare bit 17: spare bit 16: spare bit 15: spare bit 14: spare bit 13-1: spare <zero fill> bit 0: bad or missing data (in any or all ATMS channels) (2,*) estimated AMSU-A surface type:



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			1 = Bare young ice (i.e. new ice, no snow) 2 = Dry land (i.e. dry with or without significant vegetation) 3 = Dry snow (i.e. snow with water less than 2%, over land) 4 = Multi-year ice (i.e. old ice with snow [assumed dry] cover) 5 = Sea (i.e. open water, no islands, ice-free, WS=0 to 14m/s) 6 = Wet forest (i.e. established forest with wet canopy) 7 = Wet land (i.e. non-forested land with a wet surface) 8 = Wet snow (i.e. snow with water content > 2%, over land or ice) 9 = Desert (3,*) cost fn from PPASURF surface identification (4,*) scattering index (89GHz) (5,*) cirrus index (*100) (6,*) logistic precipitation probability (*100) (7,*) NWC-SAF (Bennartz) scattering index (K) (8,*) NWC-SAF (Bennartz) precipitation probabilities
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### **33. FORMAT OF THE ATMS.L1D FILE**

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

#### Header and record length

Header length = record length

array\_size\_atms1d = 8 + 3\*atms\_1dnchan + atms\_1dnfov\*(20 + atms\_1dnchan) \*4 bytes (default 12104\*4 bytes)

where

atms\_1dnchan = 22

atms\_1dnfov = 96

array\_size\_atms1dspare = array\_size\_atms1d - 37 - 8\*atms\_1dnchan

#### Type

C = character

I2 = integer\*2

I4 = integer\*4

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### Header Record

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
<b>GENERAL INFORMATION</b>				
atms1d_h_site	C	3	1	1D dataset creation site ID
atms1d_h_cfill1	C	1	1	filler
atms1d_h_1bsite	C	3	1	creation site for original 1B data
atms1d_h_cfill2	C	1	1	filler
atms1d_h_versnb	I4	4	1	level 1d format version number
atms1d_h_versyr	I4	4	1	level 1d format version year
atms1d_h_versdy	I4	4	1	level 1d format version day of year
atms1d_h_hdrcnt	I4	4	1	count of header records in this data set
atms1d_h_satid	I4	4	1	satellite id (e.g. 14 for NOAA-14)
atms1d_h_grid	I4	4	1	code for instrument grid (5=HIRS; 6=MSU; 10=AMSU-A; 11=ATMS)
atms1d_h_satht	I4	4	1	nominal satellite altitude, km*10
atms1d_h_period	I4	4	1	nominal orbit period (seconds)
atms1d_h_startorbit	I4	4	1	orbit number (at start of dataset)
atms1d_h_startdatayr	I4	4	1	start of data set year
atms1d_h_startdatady	I4	4	1	start of data set day of the year
atms1d_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
atms1d_h_endorbit	I4	4	1	orbit number (at end of dataset)
atms1d_h_enddatayr	I4	4	1	end of data set year
atms1d_h_enddatady	I4	4	1	end of data set day of the year
atms1d_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
atms1d_h_scnlin	I4	4	1	count of scan lines in this data set
atms1d_h_misscnlin	I4	4	1	count of missing scan lines
atms1d_h_atovppv	I4	4	1	ATOVPP version number (test vns = 9000+)
atms1d_h_instruments	I4	4	1	instruments present (bit0=HIRS, bit1=MSU, bit3=AMSU-A, bit4=ATMS, bit5=AVHRR, bit6=IASI, bit7=ATMS, bit8=CrIS)
atms1d_h_Aantenna	I4	4	1	vn no, ATMS antenna corrections
atms1d_h_planck	I4	4	3*atms_1d nchan	ATMS temperature-radiance conversion coefficients (Planck function) (1,*) = 10 <sup>6</sup> x (central wavenumber) (2,*) = 10 <sup>6</sup> x (constant 1) (3,*) = 10 <sup>6</sup> x (constant 2)
atms1d_h_bandwidth	I4	4	atms_1dnc han	
atms1d_h_nchan	I4	4	1	
atms1d_h_nfov	I4	4	1	
atms1d_h_nchanused	I4	4	1	
atms1d_h_recwords	I4	4	1	Words in record

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atms1d_h_wmosatid	I4	4	1	WMO sat ID (224 for NPP)
atms1d_h_centre	I4	4	1	WMO id of reception centre
atms1d_h_subcentre	I4	4	1	WMO id of reception subcentre
The following variables characterise any image processing (see atms_beamwidth)				
atms1d_h_beamversion	I4	4	1	User defined (see atms_beamwidth.dat)
atms1d_h_beamwidth	I4	4	atms_1dnc han	FFT manipulation: deg*1E3
atms1d_h_cutoff	I4	4	atms_1dnc han	FFT manipulation: fraction*1E3
atms1d_h_nxaverage	I4	4	atms_1dnc han	simple averaging:
atms1d_h_nyaverage	I4	4	atms_1dnc han	simple averaging:
Pre-processing information [user-defined:				
atms1d_h_dT	I4	4	1	size of data batches processed within ATOVPP (seconds - see ATOVPP documentation)
atms1d_h_Acorrvn	I4	4	1	vn no ATMS limb/emiss correction (=0 if data not corrected)
atms1d_h_Apcpvn	I4	4	1	vn no ATMS precip/scatter detection (=0 if not done)
atms1d_h_Ascat	I4	4	1	threshold value for ATMS scattering index
atms1d_h_Acirr	I4	4	1	threshold value for cirrus index
atms1d_h_ACrosby	I4	4	1	threshold value for ATMS logistic precip
atms1d_h_spare2	I4	4	array_size _atms1dsp are	spare

### **34. FORMAT OF THE TBUS\_NOAAXX.INDEX FILE**

Summary information taken in *tbus.5* (directory *AAPP/man/man5*)  
(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

Named *tbus\_noaaxx.index* where *xx* is the number of the satellite  
(Historical index file one for each satellite)

Format:

First line: character # in the first column,  
a blank in the second column,  
the satellite name in columns 3 to 8 (format a6).  
Second line: character % in the first column,  
the name of the fields present in the following lines  
Following lines: contains several fields:

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epoch\_time f orbit fwerr bkerr time\_string argos  
 format f15.9,1x,i1,1x,i5,2f7.2,1x,a22,1x,a

with:

epoch\_time : TBUS Part IV epoch time in CNES julian days (day 0=01/01/50 0h)  
 f : quality flag (0 = OK)  
 orbit : orbit number  
 fwer : forward extrapolation error (km/day)  
 bwer : backward extrapolation error (km/day)  
 time\_string : character string corresponding to epoch\_time  
 tbus : TBUS bulletin filename relative to DIR\_DATA\_TBUS

Notes: For a good use of the navigation software the tbus index files must be sorted after each new tbus ingest. Example of the sort command:

```
sort -u -o TBUS_INDEX.sort +0b -3b TBUS_INDEX
```

### **35. FORMAT OF THE TLE SSSXX.INDEX FILE**

Resume information taken in *tle.5* (directory *AAPP/man/man5*)

(See also general information in the paragraph 3.3.2 of the *AAPP software description document*)

Named *tle\_sssxx.index* where *xx* is the number of the sss satellite  
 (Historical index file one for each satellite)

Format:

First line: character # in first column  
 a blank in second column  
 the satellite name in columns 3 to 8  
 (format a6).

Second line: character % in first column  
 the name of the fields present in the following lines

Following lines: contains several fields:  
 epoch\_time f orbit fwerr bkerr time\_string tle  
 format f15.9,1x,i1,1x,i5,2f7.2,1x,a22,1x,a

with:

epoch\_time epoch time in CNES julian days (day 0=01/01/50 0h)  
 f quality flag (0 = OK)  
 orbit orbit number  
 fwer forward extrapolation error (km/day)  
 bwer backward extrapolation error (km/day)  
 time\_string character string corresponding to epoch\_time  
 tle TLE bulletin filename relative

Notes: For a good use of the navigation software the tle index files must be sorted after each new tle ingest. Example of the sort command:

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sort -u -o TLE\_INDEX.sort +0b -3b TLE\_INDEX

### 36. FORMAT OF THE SPM\_SSSXX.INDEX FILE

Named spm\_ sssxx.index where xx is the number of the sss satellite  
(Historical index file one for each satellite)

Format:

First line: character # in first column  
a blank in second column  
the satellite name in columns 3 to 8  
(format a6).

Second line: character % in first column  
the name of the fields present in the following lines

Following lines: contains several fields:

epoch\_time order f orbit fwerr bkerr time\_string spm  
format f15.9,1x,i1,1x,i1,1x,i5,2f7.2,1x,a22,1x,a

with:

epoch\_time epoch time in CNES julian days (day 0=01/01/50 0h)  
order order number of bulletin in file [1,2,3]  
f quality flag (0 = OK)  
orbit orbit number  
fwer forward extrapolation error (km/day)  
bwer backward extrapolation error (km/day)  
time\_string character string corresponding to epoch\_time  
spm SPM bulletin filename relative

Notes: For a good use of the navigation software the spm index files must be sorted after each new spm ingest. Example of the sort command:

sort -u -o SPM\_INDEX.sort +0b -3b SPM\_INDEX

### 37. FORMAT OF THE CLKERR\_NOAAXX.TXT FILE

Resume information taken in *clockerror.5* (directory *AAPP/man/man5*)

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

A clock error file is an historical file relative to one satellite which contains the TBUS part IV clock information: clock error, clock error rate, clock error after last correction and next clock correction.

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Only the parameters which have been considered as valid by the command tbusing are stored in the file.

Each clock error file is named clerr\_noaaxx.txt where xx is the number of the satellite.

First line: character # in the first column,  
 a blank in the second column,  
 the satellite name in columns 3 to 8 (format a6).

Several comment lines: character % in the first column,  
 a blank or several blanks  
 comments

Following lines: contains several fields:  
 type date value date\_string  
 format a4,i6,f8.3,2x,a8

with:

type : one of the following: bias = bias of clock  
 cerr for clock error  
 last for last clock correction  
 next for next clock correction  
 rate for error rate  
 null for clock error assigned to 0

date : CNES julian day for the measure (day 0 =01/01/50 0h)  
 value : measured value  
 date\_string: character string corresponding to date

Notes: For a good use of the files they must be sorted after each new tbus ingest. Example of the sort command:

```
sort -u -o CLOCK_ERROR.sort +0b -2b CLOCK_ERROR
```

The "null" parameter can be introduced manually in the clock error file. All orbits following that date will have a null clock error and ierr =0.

null must be used when the tbus values are dubious and removed when tbus values are considered valid.

All the tbus values are stored during the dubious period (but not used)

For correct use off line, the erroneous values must be eliminated when removing the null parameter.

The "bias" parameter can be introduced manually in the clock error file when the TBUS values present a systematic error (which has been true for Noaa16 in 2001). The bias is applied starting at a given date. To suppress it, introduce a 0 bias at a new date. For a correct use off-line do not remove the bias lines.

### **38. FORMAT OF THE SATPOS\_NOAAXX\_YYMMDD.TXT FILE**

Summary information taken in *satpos.5* (directory *AAPP/man/man5*)

(See also general information in the paragraph named "interfaces" of the *AAPP software description document*)

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The satpos file contains the satellite position and velocity vectors on a limited duration (typically one day) with a time step of about 2 mn. The file is relative to one satellite and one station.

The satpos file "normalized" name is: satpos\_ssssxx\_yyyymmdd.txt

where:

ssss is the platform name and xx the satellite number

yyymmdd year month day of the first position velocity vector in the file

Some dummy lines can exist at the beginning of the file.

A line with the string #SATPOS indicates the actual beginning of the file.

Real first line: #SATPOS

21 header lines:

line	format	meaning
1 <sup>st</sup> header line	('satellite ',a6)	NOAA name of the satellite
2 <sup>nd</sup> header line	('ground station ',a)	Ground station name
3 <sup>rd</sup> header line	('start date ',a22)	Start date
4 <sup>th</sup> header line	('number of days ',f6.2)	Number of days (real value)
5 <sup>th</sup> header line	('time step (s) ',f6.2)	Time step (sec)
6 <sup>th</sup> header line	('orbital bulletin ',a)	Type of orbital bulletin (TBUS)
7 <sup>th</sup> header line	('search criteria ',i2)	Bulletin search criteria (0 is normal mode)
8 <sup>th</sup> header line	('orbital elem. file ',a)	Name of the TBUS file used for the calculations
9 <sup>th</sup> header line	('tbus epoch time ',a22)	Epoch time (dd/mm/yy hh:mm:ss.sss)
10 <sup>th</sup> header line	('semi-major axis ',f10.4)	Semi-major axis (km)
11 <sup>th</sup> header line	('eccentricity ',f10.9)	Eccentricity
12 <sup>th</sup> header line	('inclination ',f10.5)	Inclination (deg)
13 <sup>th</sup> header line	('perigee argument ',f10.5)	Perigee argument (deg)
14 <sup>th</sup> header line	('right ascension ',f10.5)	Right ascension (deg)
15 <sup>th</sup> header line	('mean anomaly ',f10.5)	Mean anomaly (deg)
16 <sup>th</sup> header line	('x,y,z ',3(f10.4,1x))	x,y,z (km)
17 <sup>th</sup> header line	('vx,vy,vz ',3(f10.7,1x))	vx,vy,vz (km/sec)
18 <sup>th</sup> header line	('station latitude ',f10.4)	Ground station geographical latitude (deg)
19 <sup>th</sup> header line	('station longitude ',f10.4)	Ground station geographical longitude(deg)
20 <sup>th</sup> header line	('station altitude ',f10.4)	Ground station altitude (km)
21 <sup>th</sup> header line	('stat. minimum site ',f10.4)	Ground station minimum site (deg)

Field description line:

one line describing the following fields

Several data lines:

format of one data line = (i8,3f10.3,3f10.6,i6,2i4)

Format	Meaning
I8	step number

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f10.3	position vector in Greenwich ref. frame (km): x coordinate
f10.3	position vector in Greenwich ref. frame (km): y coordinate
f10.3	position vector in Greenwich ref. frame (km): z coordinate
f10.6	velocity vector in Greenwich ref. frame (km/sec) vx coordinate
f10.6	velocity vector in Greenwich ref. frame (km/sec) vy coordinate
f10.6	velocity vector in Greenwich ref. frame (km/sec) vz coordinate
i6	orbit number
i4	satellite in daylight or nighttime conditions (-1=non calculated , 0=daylight , 1=nighttime , 2=penombra)
i4	Satellite seen from the station (0=yes , 1=no)

### 39. FORMAT OF THE MONAVHR.TXT FILE

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

One line added at each AAPP run.

format of one data line =

(a5,1x,a1,f11.4,3i5,7f11.7,2f9.2,4f6.1,4f5.1,4f5.1,4f5.1,3f6.1,3f5.1,3f5.1,3f5.1,3f5.1,6f6.1,6f5.1,6f5.1,6f5.1)

#### Type

C : character

I4 : integer 4

R : real

DP : double precision

Name in AAPP code	Type	Format	Meaning
orbnum	C*5	a5	Orbit number.
		1x	Blank
typorb	C*1	a1	Orbit type: ascending 'a' descending 'd'
ij	DP	f11.4	Julian start instant for output
stat_cnt	I4	i5	Total number of values to compute the mean of the thermistor counts
stat_ch3a	I4	i5	Total number of sub-block with 3a channel
stat_ch3b	I4	i5	Total number of sub-block with 3b channel
k1mean(3)	R	3f11.7	Mean of 1 <sup>st</sup> coefficients of each sub-block
k2mean(3)	R	3f11.7	Mean of 2 <sup>nd</sup> coefficients of each sub-



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			block
k3mean(3)	R	1f11.7,2f9.2	Mean of 3 <sup>rd</sup> coefficients of each sub-block
cthmean(4)	R	4f6.1	Mean thermistors counts for each thermistor.
pcthinf(4)	R	4f5.1	Percent of thermistor count values below a min value.
pcthsup(4)	R	4f5.1	Percent of thermistor values above a max value.
pcthrej(4)	R	4f5.1	Percent of thermistor count values rejected
bbmean(3)	R	3f6.1	mean target view counts for the 3 IR channels
bbsig(3)	R	3f5.1	Mean of standard deviation of target view counts for the 3 IR channel.
pbbinf(3)	R	3f5.1	Percent of target view counts values below a min value
pbbsup(3)	R	3f5.1	Percent of target view counts values above a max value
pbbrej(3)	R	3f5.1	Percent of target view counts values rejected.
spmean(6)	R	6f6.1	Mean of standard deviation of space view counts for the 3 IR channel.
spsig(6)	R	6f5.1	Mean of standard deviation of space view counts for the 3 IR channel.
sppinf(6)	R	6f5.1	Percent of space view counts values below a min value
pspsup(6)	R	6f5.1	Percent of space view counts values above a max value
psprej(6)	R	6f5.1	Percent of space view counts values rejected.

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#### **40. FORMAT OF THE MONHIRS.TXT FILE**

(See also general information in the paragraph named “interfaces” of the AAPP software description document)

One line added at each AAPP run.

format of one data line =

(a5,1x,a1,f11.4,i2,20f5.2,20f14.10,20f14.6,20f5.2,20f13.10,20f13.10,4f9.2,4f9.6,4f5.2,19f9.2,19f6.3,19f5.2,19f5.2,19f5.2,19f9.2,19f6.3,19f5.2,19f5.2,19f5.2,19f5.2)

#### Type

C : character

I4 : integer 4

R : real

DP : double precision

<b>Name in AAPP code</b>	<b>Type</b>	<b>Format</b>	<b>Meaning</b>
orbnum	C*5	a5	Orbit number.
		1x	Blank
typorb	C*1	a1	Orbit type : ascending 'a' descending 'd' orbit.
ij		f11.4	Julian start instant.
calib	I4	i2	Number of calibration cycles in the orbit (maximum 4 in AAPP).
calibcoefmn(20,3)	DP	20f5.2,20f14.10,20f14.6	Array of the means of calibration coefficients (intercept,slope and third coef) for all the orbit
calibcoefstd(20,3)	DP	20f5.2,20f13.10,20f13.10	Array of the standard deviations of calibration coefficients (intercept,slope and third coef) for all the orbit.
prtmnstat(4)	DP	4f9.2	Array of the means of PRT readings for each PRT.
prtstdstat(4)	DP	4f9.6	Array of the standard deviations of PRT readings for each PRT.
prtejecstat(4)	DP	4f5.2	100*percentage of ejected PRT readings for each PRT.
spmnstat(19)	DP	19f9.2	Array of the means of filtered radiant signal output counts for all the space lines of the orbit and for each IR channel.
spstdstat(19)	DP	19f6.3	Array of the standard deviations of filtered radiant signal output counts for all the space lines of the orbit and for each IR channel.
spmisstat(19)	R	19f5.2	100*percentage of missing radiant signal output counts for all the space lines of the orbit and for each IR channel.
spinfstat(19)	R	19f5.2	100*percentage of radiant signal output counts inferior to the low limit for all the

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			space lines of the orbit and for each IR channel.
spsupstat(19)	R	19f5.2	100*percentage of radiant signal output counts superior to the high limit for all the space lines of the orbit and for each IR channel.
spejecstat(19)	R	19f5.2	100*percentage of radiant signal output counts exceeding mean+/-coef*standard deviation for all the space lines of the orbit and for each IR channel.
iwtmnstat(19)	DP	19f9.2	Array of the means of filtered radiant signal output counts for all the internal warm target(IWT) lines of the orbit and for each IR channel.
iwtstdstat(19)	DP	19f6.3	Array of the standard deviations of filtered radiant signal output counts for all the internal warm target(IWT) lines of the orbit and for each IR channel.
iwtmisstat(19)	R	19f5.2	100*percentage of missing radiant signal output counts for all the internal warm target(IWT) lines of the orbit and for each IR channel.
iwtinfstat(19)	R	19f5.2	100*percentage of radiant signal output counts inferior to the low limit for all the internal warm target(IWT) lines of the orbit and for each IR channel.
iwtsupstat(19)	R	19f5.2	100*percentage of radiant signal output counts superior to the high limit for all the internal warm target(IWT) lines of the orbit and for each IR channel.
iwtejecstat(19)	R	19f5.2	100*percentage of radiant signal output counts exceeding mean+/-coef*standard deviation for all the internal warm target(IWT) lines of the orbit and for each IR channel.

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## **41. FORMAT OF THE HIRS HISTORIC.TXT FILE**

ASCII file

Contains data about calibration cycles.

One file for several calibration cycles, for several orbits.

The maximum of calibration cycles that is possible to write in the file is defined by the parameter *hrs\_mxcalibhisto* in the include file *hcalibhisto\_algoV4.h*. (*hrs\_mxcalibhisto*=10000 in the initial version of AAPP 5.0).

A script was developed to manage the *hrs\_historic.txt* file: *hrs\_historic\_file\_manage.ksh*

The purpose of the script is :

When the  $\{\text{HIST}\}$  file has a number of lines greater than  $\{\text{HIST\_SIZE\_HIGH}\}$ , it is copied to  $\{\text{HIST}\}.0$  file.

If  $\{\text{HIST}\}.0$  file already exists, it is moved to  $\{\text{HIST}\}.1$ .

$\{\text{HIST}\}.\{\text{HIST\_NMAX}\}$  can be stored.

The final part of  $\{\text{HIST}\}$  is remained in  $\{\text{HIST}\}$ . The final part is defined from the first line with the chain 'HIRS CALIB INFO' after having remained the last  $\{\text{HIST\_SIZE\_LOW}\}$  lines of  $\{\text{HIST}\}$  to the last line of  $\{\text{HIST}\}$ .

At each orbit run, if the calibration cycle is qualified for at least one channel, then the 70 following lines are written in the *hrs\_historic.txt* file:

### Type

C : character

L : logical

I2 : integer 2

I4 : integer 4

R : real

DP : double precision

Line Nb	Name in AAPP code	Type	Format	Meaning
1			'HIRS CALIB INFO'	
2			'!'	
3			'! satellite, date, orbit number'	
4	scname	C*6	Free	NOAA name (ex noaa16)
5	hscnlinyr hscnlindy hscnlintime	I2 I2 I4	'(1x,2i4,i10)'	Year, day of year, time day (milliseconds) of the space view line
6	orbnum	I4	Free	Number of the orbit
7			'! ascending descending (0/1)'	
8	ascdsc	I4	Free	0 if ascending 1 if descending
9			'! solar zenith angle'	
10	(hang(82,spl) +	I2	Free	Value of the solar zenith angle

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	hang(85,spl))/2/100.			at the nadir
11			'! latitude at nadir'	
12	(hpos(55,spl) + hpos(57,spl))/2./10000.	I4	Free	Value of latitude at the nadir
13			'!'	
14			'! calib cycle number, total cycles'	
15	k calib	I4 I4	Free	Value of the number of the calib cycle Value of the total number of the calib cycle
16			'! total path scan lines '	
17	hscnlin	I2	Free	Total number of the scan lines in the orbit
18			'! qualified channels'	
19	qualified	L	'(2012)'	For each of the 20 HIRS channels: T if the calib cycle is qualified F if the calib cycle is not qualified
20			'! space line number '	
21	splintab	I4	Free	Number of the space view line
22			'! warm target line number'	
23	iwtlintab	I4	Free	Number of the IWT view line
24			'! moon contamination flag'	
25	mooncontaflag	L	'(12)'	Value of the moon contamination flag; Always F in this AAPP version 5.0
26			'! telescope temps (prim, sec, ter)'	
27	ptt stt ttt	R R R	Free	Values of the 3 temperatures
28			'! filter wheel temp'	
29	fwt	R	Free	Value of the temperature. =0. in this version of AAPP 5.0
30			'! base plate temp'	
31	bbt	R	Free	Value of the temperature. =0. in this version of AAPP 5.0
32			'!'	
33			'! calibration intercept '	
34	calibcoef0	DP	'(10e15.6)'	BB or raw calibration intercept at this calib cycle For channels 1 to 10
35	calibcoef0	DP	'(10e15.6)'	BB or raw calibration intercept at this calib cycle For channels 11 to 20

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36			'! calibration slope '	
37	calibcoef0	DP	'(10e15.6)'	BB or raw calibration slope at this calib cycle For channels 1 to 10
38	calibcoef0	DP	'(10e15.6)'	BB or raw calibration slope at this calib cycle For channels 11 to 20
39			'! calibration 2snd order '	
40	calibcoef0	DP	'(10e15.6)'	Calibration 2 <sup>nd</sup> order coefficient at this calib cycle For channels 1 to 10 =0. in this version of AAPP 5.0
41	calibcoef0	DP	'(10e15.6)'	Calibration 2 <sup>nd</sup> order coefficient at this calib cycle For channels 11 to 20 =0. in this version of AAPP 5.0
42			'!'	
43			'! space target '	
44			'! mean, stdev, good, missing, lower than limit, higher than limit, rejected'	
45	spcntmn	DP	'(19f7.1)'	For the space view line For each of the 19 IR HIRS channels, - Mean of the output counts
46	spcntstd	DP	'(19f7.2)'	For the space view line For each of the 19 IR HIRS channels, - Standard deviation of the output counts
47	spgoodcnt	I4	'(19i7)'	For the space view line For each of the 19 IR HIRS channels, - Total number of good output counts used to compute the mean (max value 48)
47	spmisscnt	I4	'(19i7)'	For the space view line For each of the 19 IR HIRS channels, - Total number of missing output counts.
48	spinfcnt	I4	'(19i7)'	For the space view line For each of the 19 IR HIRS channels, - Total number of lower output counts than limit
49	spsupcnt	I4	'(19i7)'	For the space view line

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				For each of the 19 IR HIRS channels, - Total number of higher output counts than limit
50	spejeccnt	I4	'(19i7)'	For the space view line For each of the 19 IR HIRS channels, - Total number of rejected output counts
51			'!	
52			'! warm target '	
53			'! mean, stdev, good, missing lower than limit, higher than limit, rejected'	
54	iwtcntmn	DP	'(19f7.1)'	For the IWT view line For each of the 19 IR HIRS channels, - Mean of the output counts
55	iwtcntstd	DP	'(19f7.2)'	For the IWT view line For each of the 19 IR HIRS channels, - Standard deviation of the output counts
56	iwtgoodcnt	I4	'(19i7)'	For the IWT view line For each of the 19 IR HIRS channels, - Total number of good output counts used to compute the mean (max value 48)
57	iwtmisscnt	I4	'(19i7)'	For the IWT view line For each of the 19 IR HIRS channels, - Total number of missing output counts.
58	iwtinfcnt	I4	'(19i7)'	For the IWT view line For each of the 19 IR HIRS channels, - Total number of lower output counts than limit
59	iwtsupcnt	I4	'(19i7)'	For the IWT view line For each of the 19 IR HIRS channels, - Total number of higher output counts than limit
60	iwtejeccnt	I4	'(19i7)'	For the IWT view line For each of the 19 IR HIRS channels,

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				- Total number of rejected output counts
61			'!	
62			'! PRTs '	
63			'! temp, mean, stdev, initial, good, rejected'	
64	tmp	DP	'(5f9.3)'	5 values of the temperatures got from the 5 PRTs.
65	prtmean	DP	'(5f9.2)'	Mean of the output count readings of the 5 PRTs
66	prtstd	DP	'(5f9.2)'	Standard deviation of the output count readings of the 5 PRTs
67	datanb	I4	'(5i9)'	Initial number of the output count readings used for each of the 5 PRTs
68	goodprt	I4	'(5i9)'	Total number of the good output count readings used to compute the means for each of the 5 PRTs
69	ejecprt	I4	'(5i9)'	Total number of the rejected output count readings for each of the 5 PRTs
70			'!	



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## **42. FORMAT OF THE HIRS B1ASLOPE.TXT FILE**

ASCII file of 22 lines

### Type

I4 : integer 4

R : real

<b>Line Nb</b>	<b>Name in AAPP code</b>	<b>Type</b>	<b>Format</b>	<b>Meaning</b>
1	yyyy, mm, dd	I4, I4, I4	'(1x,i4,1x,i2.2,1x,i2.2)' ,	Year, month, day of the reference date
2	hh, mn	I4, I4	'(1x,i2.2,1x,i2.2)'	Time of the reference date
3	nbhour	I4	'(1x,i2.2)'	Number of hours to define the period of the data that will be used
1 line for each of the 19 IR channels	ic, avgslope(ic), stdevavgslope(ic), b1(ic), b1n(ic), b1d(ic)	I4, R, R, R, R, R	Free	Number of the channel Average slope of the channel ic Standard deviation of the average slope B1 values for all conditions B1 values for night conditions B1 values for day light conditions

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### 43. FORMAT OF THE MONMSU.TXT FILE

(See also general information in the paragraph named “interfaces” of the AAPP software description document)

One line added at each AAPP run.

format of one data line =

(a5,1x,a1,f11.4,f10.4,f9.6,i3,3f7.2,f10.4,f9.6,i3,3f7.2,f7.2,f10.4,f9.6,i3,3f7.2,f10.4,f9.6,i3,3f7.2,f7.2,f10.4,f9.6,i3,2f7.2,f10.4,f9.6,i3,2f7.2,f10.4,f9.6,i3,2f7.2,f10.4,f9.6,i3,2f7.2,f10.4,f9.6,i3,3f7.2,f10.4,f9.6,i3,3f7.2,f10.4,f9.6,i3,3f7.2,f10.4,f9.6,i3,3f7.2,f10.4,f9.6,i3,3f7.2,f10.4,f9.6,i3,3f7.2,f10.4,f9.6,i3,3f7.2)

#### Type

C : character

I4 : integer 4

R : real

DP : double precision

Name in AAPP code	Type	Format	Meaning
orbnum	C*5	a5	Orbit number.
		1x	Blank
typorb	C*1	a1	Orbit type : ascending 'a' descending 'd' orbit.
ij	DP	f11.4	Julian start instant.
talomn	DP	f10.4	Mean of the low calibration reference points for electronic system A
talodev	DP	f9.6	Standard deviation of the low calibration reference points for electronic system A
talonb	I4	i3	Total number of values included good ones, bad ones (inf, sup, other ejected values)
gtalopct	R	f7.2	Percent of good values.
inftalopct	R	f7.2	Percent of values inferior to a min limit.
suptalopct	R	f7.2	Percent of values superior to a max. limit
tahimn	DP	f10.4	Mean of the high calibration reference points for electronic system A
tahidev	DP	f9.6	Standard deviation of the high calibration reference points for electronic system A
tahinb	I4	i3	Total number of values included good ones, bad ones (inf, sup, other ejected values)
gtahipct	R	f7.2	Percent of good values
inftahipct	R	f7.2	Percent of values inferior to a min limit.
suptahipct	R	f7.2	Percent of values superior to a max. limit
talohipct	R	f7.2	Percent of cases with the high calibration reference point inferior to the low one.

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tblomn	DP	f10.4	Mean of the low calibration reference points for electronic system B
tblodev	DP	f9.6	Standard deviation of the low calibration reference points for electronic system B
tblonb	I4	i3	Total number of values included good ones, bad ones (inf, sup, other ejected values)
gtblopct	R	f7.2	Percent of good values
inftblopct	R	f7.2	Percent of values inferior to a min limit
suptblopct	R	f7.2	Percent of values superior to a max limit
tbhimn	DP	f10.4	Mean of the high calibration reference points for electronic system B
tbhidev	DP	f9.6	Standard deviation of the high calibration reference points for electronic system B
tbhinb	I4	i3	Total number of values included good ones, bad ones (inf, sup, other ejected values)
gtbhipct	R	f7.2	Percent of good values
inftbhipct	R	f7.2	Percent of values inferior to a min limit
suptbhipct	R	f7.2	Percent of values superior to a max limit
tblohipct	R	f7.2	Percent of cases with the high calibration reference point inferior to the low one.
prt1amn	DP	f10.4	Mean of PRT 1A count values
prt1adev	DP	f9.6	Standard deviation of the PRT 1A count values.
prt1anb	I4	i3	Total number of PRT 1A values included good ones and bad ones (missing).
gprt1apct	R	f7.2	Percent of good PRT 1A values
misprt1apct	R	f7.2	Percent of missing PRT 1A values
prt1bmn	DP	f10.4	Mean of PRT 1B count values
prt1bdev	DP	f9.6	Standard deviation of the PRT 1B count values.
prt1bnb	I4	i3	Total number of PRT 1B values included good ones and bad ones (missing).
gprt1bpct	R	f7.2	Percent of good PRT 1B values
misprt1bpct	R	f7.2	Percent of missing PRT 1B values
prt2amn	DP	f10.4	Mean of PRT 2A count values
prt2adev	DP	f9.6	Standard deviation of the PRT 2A count values
prt2anb	I4	i3	Total number of PRT 2A values included good ones and bad ones (missing).
gprt2apct	R	f7.2	Percent of good PRT 2A values
misprt2apct	R	f7.2	Percent of missing PRT 2A values
prt2bmn	DP	f10.4	Mean of PRT 2B count values
prt2bdev	DP	f9.6	Standard deviation of the PRT 2B count values
prt2bnb	I4	i3	Total number of PRT 2B values included

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			good ones and bad ones (missing)
gprrt2bpct	R	f7.2	Percent of good PRT 2B values
mispr2bpct	R	f7.2	Percent of missing PRT 2B values
spcntmn(1)	DP	f10.4	Mean of the space view counts for channel 1
spcntdev(1)	DP	f9.6	Standard deviation of the space view counts for the channel 1
spnb(1)	I4	i3	Total number of space view counts, good ones and bad ones, channel 1
gspct(1)	R	f7.2	Percent of good space view counts, channel 1
misspct(1)	R	f7.2	Percent of missing space view counts, channel 1
ejectspct(1)	R	f7.2	Percent of rejected space view counts, channel 1
spcntmn(2)	DP	f10.4	Mean of the space view counts for channel 2
spcntdev(2)	DP	f9.6	Standard deviation of the space view counts for the channel 2
spnb(2)	I4	i3	Total number of space view counts, good ones and bad ones, channel 2
gspct(2)	R	f7.2	Percent of good space view counts, channel 2
misspct(2)	R	f7.2	Percent of missing space view counts, channel 2
ejectspct(2)	R	f7.2	Percent of rejected space view counts, channel 2
spcntmn(3)	DP	f10.4	Mean of the space view counts for channel 3
spcntdev(3)	DP	f9.6	Standard deviation of the space view counts for the channel 3
spnb(3)	I4	i3	Total number of space view counts, good ones and bad ones, channel 3
gspct(3)	R	f7.2	Percent of good space view counts, channel 3
misspct(3)	R	f7.2	Percent of missing space view counts, channel 3
ejectspct(3)	R	f7.2	Percent of rejected space view counts, channel 3
spcntmn(4)	DP	f10.4	Mean of the space view counts for channel 4
spcntdev(4)	DP	f9.6	Standard deviation of the space view counts for the channel 4
spnb(4)	I4	i3	Total number of space view counts, good ones and bad ones, channel 4
gspct(4)	R	f7.2	Percent of good space view counts, channel 4

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missppct(4)	R	f7.2	Percent of missing space view counts, channel 4
ejectspct(4)	R	f7.2	Percent of rejected space view counts, channel 4
tgntmn(1)	DP	f10.4	Mean of the target view counts for channel 1
tgntdev(1)	DP	f9.6	Standard deviation of the target view counts for the channel 1
tgnb(1)	I4	i3	Total number of target view counts, good ones and bad ones, channel 1
gtgpct(1)	R	f7.2	Percent of good target view counts, channel 1
mistgpct(1)	R	f7.2	Percent of missing target view counts, channel 1
ejecttgct(1)	R	f7.2	Percent of rejected target view counts, channel 1
tgntmn(2)	DP	f10.4	Mean of the target view counts for channel 2
tgntdev(2)	DP	f9.6	Standard deviation of the target view counts for the channel 2
tgnb(2)	I4	i3	Total number of target view counts, good ones and bad ones, channel 2
gtgpct(2)	R	f7.2	Percent of good target view counts, channel 2
mistgpct(2)	R	f7.2	Percent of missing target view counts, channel 2
ejecttgct(2)	R	f7.2	Percent of rejected target view counts, channel 2
tgntmn(3)	DP	f10.4	Mean of the target view counts for channel 3
tgntdev(3)	DP	f9.6	Standard deviation of the target view counts for the channel 3
tgnb(3)	I4	i3	Total number of target view counts, good ones and bad ones, channel 3
gtgpct(3)	R	f7.2	Percent of good target view counts, channel 3
mistgpct(3)	R	f7.2	Percent of missing target view counts, channel 3
ejecttgct(3)	R	f7.2	Percent of rejected target view counts, channel 3
tgntmn(4)	DP	f10.4	Mean of the target view counts for channel 4
tgntdev(4)	DP	f9.6	Standard deviation of the target view counts for the channel 4
tgnb(4)	I4	i3	Total number of target view counts, good ones and bad ones, channel 4
gtgpct(4)	R	f7.2	Percent of good target view counts,

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			channel 4
mistgpct(4)	R	f7.2	Percent of missing target view counts, channel 4
ejecttgpc(4)	R	f7.2	Percent of rejected target view counts, channel 4

**44. FORMAT OF THE MONAMSUA.TXT FILE**

This file is empty for the version 7 of AAPP and previous versions

**45. FORMAT OF THE MONAMSUB.TXT FILE**

This file is empty for the version 7 of AAPP and previous versions

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## **46. FORECAST IN ASCII FORMAT OR IN GRIB FORMAT**

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

### **For maia2.1**

Two formats are available for the forecast file: ASCII and the standard meteorological format GRIB. To run AAPP with a GRIB forecast file, the ECMWF GRIB API library is needed, and the location of the GRIB library must be specified when AAPP is built (see Installation Guide).

If GRIB file is used:

- Update the variable FORECAST\_FORMAT in ATOVS\_ENV7 to the value “grib”

If ASCII file is used:

- Update the variable FORECAST\_FORMAT in ATOVS\_ENV7 to the value “ascii”

### **For maia3**

Only format GRIB is available for the forecast file:

The ECMWF GRIB API library is needed, and the location of the GRIB library must be specified when AAPP is built (see Installation Guide).

Check you have in ATOVS\_ENV7: MAIA3\_FORECAST\_FORMAT='grib'

## **47. FIELDS DESIRABLE IN THE FORECAST FILE IN GRIB FORMAT FOR MAIA2.1 AND MAIA3**

Necessary ones:

- The air 2m temperature (°K) ,
- The surface pressure (hPa)
- The altitude (m)
- The temperature (°K) and humidity (%) profiles on pressure levels

Better in addition

- The altitude (m)
- The precipitable water vapor (100\*g /cm2)

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**48. FIELDS DESIRABLE AND FORMAT FOR A FORECAST FILE IN ASCII FOR MAIA2.1**

The files contain one header describing the grid for all the fields which are inside, and for all fields 3 sub-header lines and the values in 20i4 or 16i5 format

Header of 7 lines

-line 1	grid_type	ch*12	type of data (analysis or forecast)
-line 2	grid_name	ch*12	reference name of the grid
-line 3	grid_refdate	i4,i2,i2,2x,i2	reference date and time of the fields: year, month, day, hour
-line 4	nb_hours_forecast	i3	number of hours for the forecast the date time of validity of the fields will be grid_refdate + nb_hours_forecast For analysis nb_hours_forecast is 0
-line 5	lat1, lon1	2f10.3	latitude and longitude of the first grid point latitudes north are positive longitudes east are positive
-line 6	step_lat, step_lon	2f10.3	latitude longitude increment between 2 grid nodes step_lat should be negative (North to South) step_lon should be positive (West to East)
-line 7	nbl, nbp	2i10	number of lines and pixels of the grid lines are in the north-south direction pixels are in the west-east direction

For each field:

-line 1	character*12	parameter name, one of the following: T = temperature HU = humidity P = pressure ALTITUDE = altitude over sea level
-line 2	character*12	level type one of the following: ISOBARE SURFACE MER = sea level



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-line 3	integer i8	<p>HAUTEUR = altitude above surface</p> <p>level value with respect to the level type</p> <p>ex: 850 with level type ISOBARE means 850hPa</p> <p>ex: 10 with level type HAUTEUR means 10m above surface</p>
-line 4 to n	integer	<p>values of the field in an array of (pixels,lines)</p> <p>where pixels are on a parallel and lines on a meridian</p> <p>latitude of array(i,j) =lat1 + (step_lat * (j-1))</p> <p>longitude of array(i,j) =lon1 + (step_lon * (i-1))</p> <p>format 20i4 unless format 16i5 for Z and P</p>

storage units are: temperatures are K \* 10  
pressures are hPa\*10  
humidity in percentage \* 10  
land-sea in percentage  
altitude in meters

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#### **49. FORMAT OF THE MAPQUAL NOAAXX.TXT FILE**

(See also general information in the paragraph named “interfaces” of the *AAPP software description document*)

One line added at each AAPP run.

format of one data line = (i4,2i3.2,i6.5,57f5.2)

##### Type

C : character

I4 : integer 4

R : real

DP : double precision

Name in AAPP code	Type	Format	Meaning
dg(1)	I4	i4	Year.
dg(2)	I4	i3.2	Month
dg(3)	I4	i3.2	Day
hrs1d_h_startorbit	I4	i6.5	Orbit number at the start of dataset
sd_all	R	f5.2	Global standard deviation of the differences (HIRS channel 8 – AVHRR channel 4), No difference between pixels
sd(ii),ii=1,56	R	56f5.2	Standard deviation of the differences (HIRS channel 8 – AVHRR channel 4), for each column of pixels.

#### **50. FORMAT OF THE MAIA4 CLOUD TYPE OUTPUT DATASETS**

The maia4 HDF5 files contain two groups: DATA and HEADER. The following list gives the names of the different datasets for these two groups, and their respective dimensions:

/	Group
/DATA	Group
/DATA/Alt_surface	Dataset {768, 3200}
/DATA/CloudMask	Dataset {768, 3200}
/DATA/CloudTopPres	Dataset {768, 3200}
/DATA/CloudTopTemp	Dataset {768, 3200}
/DATA/CloudType	Dataset {768, 3200}
/DATA/IChan_Used	Dataset {5}
/DATA/Latitude	Dataset {768, 3200}
/DATA/Longitude	Dataset {768, 3200}
/DATA/MChan_Used	Dataset {12}
/DATA/Mask_ind	Dataset {768, 3200}
/DATA/Nb_IChan_Used	Dataset {1}
/DATA/Nb_MChan_Used	Dataset {1}
/DATA/Sat_zenith	Dataset {768, 3200}
/DATA/Tsurf	Dataset {768, 3200}

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/DATA/fov\_qual Dataset {768, 3200}  
 /DATA/scnlin\_day Dataset {768}  
 /DATA/scnlin\_time Dataset {768}  
 /DATA/scnlin\_year Dataset {768}  
 /DATA/scnline\_qual Dataset {768}  
 /HEADER Group  
 /HEADER/CMa\_Version Dataset {1}  
 /HEADER/ModScan Dataset {48}  
 /HEADER/N\_Granule\_ID Dataset {1}  
 /HEADER/Nb\_Granules Dataset {1}  
 /HEADER/Nb\_Lines Dataset {1}  
 /HEADER/Nb\_pixels Dataset {1}  
 /HEADER/dataname Dataset {1}  
 /HEADER/dataname\_gmodo Dataset {1}  
 /HEADER/datatyp Dataset {1}  
 /HEADER/end\_day Dataset {1}  
 /HEADER/end\_orbit Dataset {1}  
 /HEADER/end\_time Dataset {1}  
 /HEADER/end\_year Dataset {1}  
 /HEADER/inst\_id Dataset {1}  
 /HEADER/sat\_id Dataset {1}  
 /HEADER/site1b Dataset {1}  
 /HEADER/site1c Dataset {1}  
 /HEADER/start\_day Dataset {1}  
 /HEADER/start\_orbit Dataset {1}  
 /HEADER/start\_time Dataset {1}  
 /HEADER/start\_year Dataset {1}

**Detailed content of the HEADER group:**

DATASET	DATATYPE(DIM)	COMMENT	ATTRIBUTES
CMa_Version	H5T_STD_I32LE ( 1 )	version number of the cloud mask	COMMENT LBOUND UBOUND
ModScan	H5T_STD_I32LE( 48 )	Scan operational mode (0: processed)	COMMENT LBOUND UBOUND
N_Granule_ID	H5T_STRING(1)	Granule identifier of the RDR granule	COMMENT LBOUND UBOUND
Nb_Granules	H5T_STD_I32LE(1)	"number of granules in this dataset	COMMENT
Nb_Lines	H5T_STD_I32LE(1)	count of scan lines in this data set	COMMENT
Nb_pixels	H5T_STD_I32LE(1)	number of pixels in line	COMMENT
dataname	H5T_STRING(1)	dataname of this file	COMMENT LBOUND UBOUND
dataname_gmodo	H5T_STRING(1)	dataname of the SDR Geolocation file	COMMENT

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			LBOUND UBOUND
datatyp	H5T_STD_I32LE(1)	data type code (1 = LAC; 2 = GAC; 3 = HRPT; 4 = global)	COMMENT
end_day	H5T_STD_I32LE(1)	end of dataset: day of year	COMMENT
end_orbit	H5T_STD_I32LE(1)	end of orbit number	COMMENT
end_time	H5T_STD_I32LE(1)	end of dataset: UTC time of day in ms	COMMENT
end_year	H5T_STD_I32LE(1)	end of dataset: year	COMMENT
inst_id	H5T_STD_I32LE(1)	H5instrument identification AVHRR=1	COMMENT
sat_id	H5T_STD_I32LE(1)	satellite id (11=METOP-1/12=METOP-2/13=METOP-3/14=NPP)	COMMENT
site1b	H5T_STRING(1)	creation site of SDR data (CMS, NOA)	COMMENT LBOUND UBOUND
site1c	H5T_STRING(1)	Dataset creation site ID (AAPP_SITE_ID)	COMMENT LBOUND UBOUND
start_day	H5T_STD_I32LE(1)	start of dataset: day of year	COMMENT
start_orbit	H5T_STD_I32LE(1)	start orbit number	COMMENT
start_time	H5T_STD_I32LE(1)	start of dataset: UTC time of day in ms	COMMENT
"start_year	H5T_STD_I32LE(1)	start of dataset: year	COMMENT

### Detailed content of the DATA group:

DATASET	DATATYPE(DIM)	COMMENT	ATTRIBUTES
Alt_surface	H5T_STD_I32LE( 768, 3200 )	surface altitude (meters * 100) Missing value : -999900	COMMENT (COMPRESSED) LBOUND UBOUND UNITS
CloudMask	H5T_STD_I32LE( 768, 3200 )	CLOUD MASK (see below)	CloudMask_Info COMMENT (COMPRESSED) LBOUND UBOUND
CloudTopPres	H5T_STD_I32LE( 768, 3200 )	CLOUD Top Pressure (hPa * 10) Missing value : -9999	COMMENT (COMPRESSED) LBOUND UBOUND UNITS
CloudTopTemp	H5T_STD_I32LE( 768, 3200 )	CLOUD Top Temperature (Celsius * 100) Missing value : -9999	COMMENT (COMPRESSED) LBOUND UBOUND UNITS
CloudType	H5T_STD_I32LE( 768, 3200 )	cloud classification (see below)	COMMENT CloudType Info

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			(COMPRESSED) LBOUND UBOUND
IChan_Used	H5T_STD_I32LE(5)	list of Imaging resolution channels used in process	COMMENT LBOUND UBOUND
Latitude	H5T_STD_I32LE(768,3200)	Latitude (degrees * 10000) (North latitude positive) Missing value : -99990000	COMMENT (COMPRESSED) LBOUND UBOUND UNITS
Longitude	H5T_STD_I32LE(768,3200)	Longitude (degrees * 10000)(East longitude positive) Missing value : -99990000	COMMENT (COMPRESSED) LBOUND UBOUND UNITS
MChan_Used	H5T_STD_I32LE(32)	list of Moderate resolution channels used in process	COMMENT LBOUND UBOUND
Mask_ind	H5T_STD_I32LE(768,3200)	Processes applied on the line (see below)	COMMENT (COMPRESSED) LBOUND UBOUND UNITS cloud mask status
Nb_IChan_Used	H5T_STD_I32LE(1)	Number of Imaging resolution channels used in process	COMMENT
Nb_MChan_Used	H5T_STD_I32LE(1)	Number of Moderate resolution channels used in process	COMMENT
Sat_zenith	H5T_STD_I32LE(768,3200)	satellite zenith angle (degrees * 100)	COMMENT (COMPRESSED) LBOUND UBOUND UNITS
Tsurf	H5T_STD_I32LE(768,3200)	retrieved surface temperature (Celsius * 100) for confident clear: retrieved surface temperature in C*100: over sea : SST Split-Window over land: LST from RTE using forecast and emissivity atlas Missing value : -9999	COMMENT (COMPRESSED) LBOUND UBOUND UNITS
fov_qual	H5T_STD_I32LE(768,3200)	pixel quality flags 0= ok (see below)	COMMENT (COMPRESSED) LBOUND UBOUND UNITS
scnlin_day	H5T_STD_I32LE(768)	scan line day of year	
scnlin_time	H5T_STD_I32LE(768)	scan line UTC time of day in milliseconds	COMMENT (COMPRESSED) LBOUND



<b>NWP SAF</b>	<b>AAPP DOCUMENTATION DATA FORMATS</b>	Doc ID: NWPSAF-MF-UD-003 Version: 7.5 Date: 14 May 2015
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	1=No 2=CloudShadow 3=Heavy Aerosol 4=Fire 5=Dust/Volcanic Ash 0=climatology used 1=forecast used 0=climatology used 1=forecast"
bits 26	Tskin bg source
bits 27	WV content bg source
CloudType	bits 0-3 cloud phase: 0 Not Done 1 Clear: from Confidently Clear pixels 2 Partly Cloudy: from Probably Clear and Cloudy pixels 3 Water Cloud 4 Supercooled Water or MixedPhaseCloud 5 Opaque Ice Cloud 6 Cirrus Non-Opaque Cloud 7 Cloud Overlap bits 4-8 cloud type: 0 no data or corrupted data 1 cloud free land 2 cloud free sea 3 land contaminated by snow 4 sea contaminated by snow/ice 6 very low clouds 8 low clouds 10 medium clouds 12 high opaque clouds 14 very high opaque clouds 15 thin semitransparent clouds 16 meanly thick semitransparent clouds 17 thick semitransparent clouds 18 semitransparent above lower clouds 19 sub-pixel water clouds 20 undefined by CMA bits 9-10 thin cirrus: 0 Not Done 1 Yes 2 No bits 11-15 spares
Mask_ind	bit 0 snow/ice from external data 0 Not Done bit 1 Cloud mask on pixel 0 Not Done bit 2 Thin Cirrus detection 0 Not Done bit 3 cloud type 0 Not done bit 4 cloud phase 0 Not Done bit 5 Cloud Height 0 Not Done bit 6 Active Fire detection 0 Not Done bit 7 Aerosols 0 Not Done bit 8 Cloud Shadow from Neighbors 0 Not Done bit 9 CMA update from Neighbors 0 Not Done bit 10 Fire detection texture 0 Not Done bit 11 Aerosols texture 0 Not Done bits 12-15 Spares
fov_qual	0-1 input info quality 0= ok, mask done with highest information quality for cloud mask 1= poor, some channels are discarded 2= bad, cloud mask not done

2	geoloc quality	0= ok 1= bad	summarized geolocation quality
3	IBAND SDR quality	0= ok 1= bad	summarized qual flag of used I-Band channels
4	MBAND SDR quality	0= ok 1= bad	summarized qual flag of used M-Band channels
5	Qual_M(1)	0= ok 1= bad	
6	Qual_M(2)	0= ok 1= bad	
7	Qual_M(3)	0= ok 1= bad	
8	Qual_M(4)	0= ok 1= bad	
9	Qual_M(5)	0= ok 1= bad	
10	Qual_M(6)	0= ok 1= bad	
11	Qual_M(7)	0= ok 1= bad	
12	Qual_M(8)	0= ok 1= bad	
13	Qual_M(9)	0= ok 1= bad	
14	Qual_M(10)	0= ok 1= bad	
15	Qual_M(11)	0= ok 1= bad	
16	Qual_M(12)	0= ok 1= bad	
17	Qual_M(13)	0= ok 1= bad	
18	Qual_M(14)	0= ok 1= bad	
19	Qual_M(15)	0= ok 1= bad	
20	Qual_M(16)	0= ok 1= bad	
21	Qual_I(1)	0= ok 1= bad	
22	Qual_I(2)	0= ok 1= bad	
23	Qual_I(3)	0= ok 1= bad	
24	Qual_I(4)	0= ok 1= bad	
25	Qual_I(5)	0= ok 1= bad	
26-31	spares		

In addition, for AAPP v7.6 onwards a global attribute “format version” is present. Set to 2 in AAPP v7.6.