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AAPP DOCUMENTATION DATA FORMATS

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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

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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 yyy/mm/dd at time hh:mn is the reception date of the file.

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

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

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)

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:

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 → Publications → Technical and scientific documentation → Technical notes → Eumetsat Polar System: Document EPS:GGS.SPE.96167.

7. FORMAT OF HRPT.L1B FILE

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

HRPT.l1a format = HRPT.l1b format (in HRPT.l1a, 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
GENERAL INFORMATION				
avh_h_siteid	C	3	1	Data set creation site ID
avh_h_blank	C	1	1	ASCII blank
avh_h_l1bversnb	I2	2	1	level 1b format version number
avh_h_l1bversyr	I2	2	1	level 1b format version year
avh_h_l1bversdy	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_hdrcnt	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-N'(TBC) 11=Metop-1 (TBC) 12=Metop-2 13=Metop-3(TBC) 14=Metop simulator
avh_h_instid	I2	2	1	instrument identification
avh_h_datatyp	I2	2	1	data type code

				(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)
DATA SET QUALITY INDICATORS				
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_callocscnlin	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

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)
CALIBRATION				
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

				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_irttcoef	I2	2	6*4	IR Target Temperature Conversion Coefficients scaling factor of avh_h_irttcoef(1,*) = 10^2 avh_h_irttcoef(2,*) = 10^5 avh_h_irttcoef(3,*) = 10^8 avh_h_irttcoef(4,*) = 10^11 avh_h_irttcoef(5,*) = 10^14 avh_h_irttcoef(6,*) = 10^17
avh_h_filler5	I4	4	2	Unassigned (no value)
RADIANCE TO TEMPERATURE CONVERSION				
avh_h_albcnv	I4	4	2*3	albedo conversion order of channels : 1, 2, 3A. for nochannel = 1 to 3A : 10^1 x (albedo-radiance nochannel solar filtered irradiance in wavelength) 10^3 x (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 x (temperature-radiance nochannel central wavenumber Ch3b) or 10^3 x (temperature-radiance nochannel central wavenumber Ch4,5) 10^5 x (temperature-radiance nochannel constant 1) 10^6 x (temperature-radiance nochannel constant 2) *Note: prior to v5, constant 1 and constant 2 contained the temp->radiance constants not radiance->temp*
avh_h_filler6	I4	4	3	Unassigned (no value)
NAVIGATION				
avh_h_modelid	C	8	1	Reference Ellipsoid Model ID ="GRS 80" in the actual version of AAPP
avh_h_nadloctol	I2	2	1	10 x (nadir Earth location tolerance in kilometers)

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	10^3 x (constant roll attitude error in degrees)
avh_h_pitcherr	I2	2	1	10^3 x (constant pitch attitude error in degrees)
avh_h_yawerr	I2	2	1	10^3 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	10^5 x (semi-major axis in kilometers)
avh_h_eccen	I4	4	1	10^8 x (eccentricity)
avh_h_incli	I4	4	1	10^5 x (inclination in degrees)
avh_h_argper	I4	4	1	10^5 x (argument of perigee in degrees)
avh_h_rascnod	I4	4	1	10^5 x (right ascension of the ascending node in degrees)
avh_h_manom	I4	4	1	10^5 x (mean anomaly in degrees)
avh_h_xpos	I4	4	1	10^5 x (position vector x component in kilometers)
avh_h_ypos	I4	4	1	10^5 x (position vector y component in kilometers)
avh_h_zpos	I4	4	1	10^5 x (position vector z component in kilometers)
avh_h_xvel	I4	4	1	10^8 x (velocity vector x-dot component in kilometers/second)
avh_h_yvel	I4	4	1	10^8 x (velocity vector y-dot component in kilometers/second)
avh_h_zvel	I4	4	1	10^8 x (velocity vector z-dot component in kilometers/second)
avh_h_earthsun	I4	4	1	10^6 x (Earth/sun distance ratio)
avh_h_filler8	I4	4	4	Unassigned (no value)
ANALOG TELEMETRY CONVERSION				
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_rdtemp	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.

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_chtemp	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)
FILLER				
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
SCAN LINE INFORMATION				
avh_scnlin	I2	2	1	Scan line number

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)
QUALITY INDICATORS				
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 **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. bit 19-16 : spare **Calibration Problem Code** (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 **Earth location Problem Code** (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
avh_calqual	I2	2	3	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 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)
CALIBRATION COEFFICIENTS				
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
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 **Case 1:** 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, operational) 10^6 x (IR calibration nochannel coefficient 2, operational) 10^6 x (IR calibration nochannel coefficient 3, operational) 10^6 x (IR calibration nochannel coefficient 1,

				test) 10^6 x (IR calibration nochannel coefficient 2, test) 10^6 x (IR calibration nochannel coefficient 3, test) **If not case 1:** 10^9 x (IR calibration nochannel coefficient 1, operational) 10^6 x (IR calibration nochannel coefficient 2, operational) 10^6 x (IR calibration nochannel coefficient 3, operational) 10^9 x (IR calibration nochannel coefficient 1, test) 10^6 x (IR calibration nochannel coefficient 2, test) 10^6 x (IR calibration nochannel coefficient 3, test)
avh_filler2	I4	4	3	the exponents of the IR calibration coefficients. 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
NAVIGATION				
avh_navstat	I4	4	1	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 inYGC 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)
avh_attangtime	I4	4	1	Time associated with TIP Euler angles(seconds)
avh_rollang	I2	2	1	10^3xRoll Angle in Degrees
avh_pitchang	I2	2	1	10^3xPitch Angle in Degrees
avh_yawang	I2	2	1	10^3xYaw 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 : 10^2 x (solar zenith angle) second angle : 10^2 x (satellite zenith angle) third angle : 10^2 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 : 10^4 x (latitude) second : 10^4 x (longitude) (North latitude and East longitude are positive)
avh_filler4	I4	4	2	Unassigned (no value)
HRPT MINOR FRAME TELEMETRY				
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)
AVHRR SENSOR DATA				
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)
THIS PART DOES NOT RESPECT THE NOAA 1B FORMAT SPECIFICATION BUT IT KEEPS THE POSSIBILITY TO DERIVE THE ANALOG AND DIGITAL TELEMETRY STRUCTURE				
TIP MINOR FRAME HEADER				
avh_tipmfhd	I2	2	7*5	the following sequence is repeated 5 times : words 1 to 3 : bit 47-28 : TIP minor frame sync 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
CPU TELEMETRY				
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)

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

The comparison was done with:

- HRPT.l1b format of NOAA version: NOAA KLM user's guide after amendments of September 24, 2001
- HRPT.l1b format of NOAA version: AAPP version .3.3
- No change of HRPT.l1b format between the AAPP version 3.3 and the AAPP version 4.

The first difference between AAPP HRPT l1b and NOAA HRPT l1b is :
AAPP has no missing record. It fills records even if scan lines are missing.
NOAA HRPT l1b can have missing records (do not use the module chk1btime – after the end of the decommutation task - with NOAA HRPT.l1b)

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.l1b of AAPP	HRPT.l1b of NOAA
Total number of header record (avh_h_hdrcnt)	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)

avh_h_tipsrc: always equal to 4 in AAPP (TIP source code always stored AIP)

avh_h_instst1: 2 possible values for AAPP for bits15-0

1111 1011 0000 0000 à channel 3a is enabled

or 1111 0111 0000 0000 à channel 3b is enabled

avh_h_instst2: 2 possible values for AAPP for bits15-0

1111 1011 0000 0000 à channel 3a is enabled

or 1111 0111 0000 0000 à channel 3b is enabled

avh_h_callocscnlin: always equal to avh_h_scnlin in AAPP

avh_h_pcalalgind: always equal to 0 in AAPP

avh_h_pcalalgopt: always equal to 0 in AAPP

avh_h_scalalgind: always equal to 0 in AAPP

avh_h_scalalgopt: 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_chtemp(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_blksz

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)

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 à avh_calvis(*,1 or 2,*) = 0
Scaling factor are 10^10 and 10^7
NOAA : Scaling factor are 10^7 and 10^6

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 10^9 , 10^6 , 10^6
Note they are equal to 10^6 , 10^6 , 10^6
if (avh_h_siteid.eq.'CMS' .and. avh_h_startdatajd.lt.17923.5)

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)

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.l1a format = HIRS.l1b format (in HIRS.l1a, 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
GENERAL INFORMATION				
hrs_h_siteid	C	3	1	Data set creation site ID
hrs_h_blank	C	1	1	ASCII blank
hrs_h_l1bversnb	I2	2	1	level 1b format version number
hrs_h_l1bversyr	I2	2	1	level 1b format version year
hrs_h_l1bversdy	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-N'(TBC) 11=Metop-1 (TBC) 12=Metop-2 13=Metop-3(TBC) 14=Metop simulator

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)
DATA SET QUALITY INDICATORS				
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_misscnlin	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

				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)
CALIBRATION				
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)
TEMPERATURE TO RADIANCE CONVERSION				
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)

				10^6 x (nochannel constant 1) 10^6 x (nochannel constant 2)
hrs_h_20solfiltirrad	I2	2	1	10^6 x (albedo-radiance ch20 solar filtered irradiance)
hrs_h_20equifiltwidth	I2	2	1	10^6 x (albedo-radiance ch 20 equivalent filter width)
hrs_h_filler6	I4	4	1	Unassigned (no value)
NAVIGATION				
hrs_h_modelid	C	8	1	Reference Ellipsoid Model ID ="GRS 80" in the actual version of AAPP
hrs_h_nadloctol	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	10^3 x (constant roll attitude error (dg))
hrs_h_pitcherr	I2	2	1	10^3 x (constant pitch attitude error (dg))
hrs_h_yawerr	I2	2	1	10^3 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	10^5 x (semi-major axis in kilometers)
hrs_h_eccen	I4	4	1	10^8 x (eccentricity)
hrs_h_incli	I4	4	1	10^5 x (inclination in degrees)
hrs_h_argper	I4	4	1	10^5 x (argument of perigee in degrees)
hrs_h_rascnod	I4	4	1	10^5 x (right ascension of the ascending node in degrees)
hrs_h_manom	I4	4	1	10^5 x (mean anomaly in degrees)
hrs_h_xpos	I4	4	1	10^5 x (position vector X component in km)
hrs_h_ypos	I4	4	1	10^5 x (position vector Y component in km)
hrs_h_zpos	I4	4	1	10^5 x (position vector Z component in km)
hrs_h_xvel	I4	4	1	10^8 x (velocity vector X-dot component in kilometers/seconds)
hrs_h_yvel	I4	4	1	10^8 x (velocity vector Y-dot component
hrs_h_zvel	I4	4	1	10^8 x (velocity vector Z-dot component in kilometers/seconds)
hrs_h_earthsun	I4	4	1	10^6 x (earth/sun distance ratio)
hrs_h_filler8	I4	4	4	Unassigned (no value)
ANALOG TELEMETRY CONVERSION				
hrs_h_rdtemp	I2	2	6	radiator temp.conversion coefficients
hrs_h_bptemp	I2	2	6	base plate temp. conv. coef.
hrs_h_eltemp	I2	2	6	electronics temp. conv. coef.

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_fwmtemp	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_fwmcur	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
SCAN LINE INFORMATION				
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)
QUALITY INDICATORS				
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: 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 **time problem code :** (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> **calibration problem code :** (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>

				Earth location problem code (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 reasonableness check bit 3-0: <zero fill>
hrs_chqualflg	I2	2	20	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. (all bits off implies a good calibration) bit 15-6: <zero fill> bit 5: all bad blackbody counts for scan line bit 4: all bad space view counts for scan line bit 3: all bad PRTs counts for scan line bit 2: marginal blackbody view counts for this line bit 1: marginal space view counts for this line bit 0: marginal PRTs counts for scan line
hrs_mnfrqual	I1	1	64	minor frame quality indicators for nel 0 to 63 (for bits 7 through 1,if bit is on(=1) then statement is true) bit 7 : 1 = this frame suspect due to a time error bit 6 : 1 = this frame contains data gap data fill bit 5 : 1 = this frame contains TIP dwell data fill bit 4 : 1 = data suspect due to PACS QC error bit 3 : 1 = mirror locked during this frame bit 2 : 1 = mirror position error during this frame bit 1 : 1 = mirror was moving during this frame bit 0 : minor word odd parity bit
hrs_filler2	I4	4	4	Unassigned (no value)
CALIBRATION COEFFICIENTS				
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. - 10^12*the second one - 10^9*the first one - 10^6*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. - 10^12*the second one - 10^9*the first one - 10^6*the zeroth one
hrs_filler3	I4	4	3	Unassigned (no value)
NAVIGATION				
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	10^3xRoll angle in degrees
hrs_pitchang	I2	2	1	10^3xPitch angle in degrees
hrs_yawang	I2	2	1	10^3xYaw 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: 10^4*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)
HIRS DATA ELEMENTS				
hrs_elem	I2	2	24*64	element data **for nel 0 to 63** 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 **for nel 0 to 55** 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 **for nel 56** 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 **for nel 57** 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 **for nel 58** 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 **for nel 59** 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 **for nel 60** 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 **for nel 61** 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 **for nel 62** 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 **for nel 63** 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)
DIGITAL B DATA				
hrs_digbinvwbf	I2	2	1	invalid word bit flags
hrs_digitbwrd	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

				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>
ANALOG TELEMETRY				
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_anwrd	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
FILLER				
hrs_filler6	I4	4	11	Unassigned (no value)

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.l1a format = HIRS.l1b format (in HIRS.l1a, 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

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
GENERAL INFORMATION				
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_l1bversnb	I2	2	1	level 1b format version number
hrs_h_l1bversyr	I2	2	1	level 1b format version year
hrs_h_l1bversdy	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-N'(TBC) 11=Metop-1 (TBC) 12=Metop-2 13=Metop-3(TBC) 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'
DATA SET QUALITY INDICATORS				
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)

				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 occured)
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_misscnlin	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

				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

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)
CALIBRATION				
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. 10^6*(mean calibration slope of channel nochannel) 10^6*(stantard deviation of calibration slope) 10^6*(B1 for channel nochannel) 10^6*(stantard deviation of linear regression for B1 for channel nochannel)
hrs_h_filler5	I4	4	2	Unassigned (no value)
TEMPERATURE TO RADIANCE CONVERSION				
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) 10^6 x (nochannel constant 1) 10^6 x (nochannel constant 2)
hrs_h_20solfiltirrad	I2	2	1	10^2 x (albedo-radiance ch20 solar filtered irradiance) (Note scale factor different from pre-2005 format)
hrs_h_20equifiltwidth	I2	2	1	10^4 x (albedo-radiance ch 20 equivalent filter width) (Note scale factor different from pre-2005 format)

hrs_h_filler5	I4	4	1	Unassigned (no value)
NAVIGATION				
hrs_h_modelid	C	8	1	Reference Ellipsoid Model ID ="GRS 80" in the actual version of AAPP
hrs_h_nadloctol	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	10^3 x (constant roll attitude error (dg))
hrs_h_pitcherr	I2	2	1	10^3 x (constant pitch attitude error (dg))
hrs_h_yawerr	I2	2	1	10^3 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	10^5 x (semi-major axis in kilometers)
hrs_h_eccen	I4	4	1	10^8 x (eccentricity)
hrs_h_incli	I4	4	1	10^5 x (inclination in degrees)
hrs_h_argper	I4	4	1	10^5 x (argument of perigee in degrees)
hrs_h_rascnod	I4	4	1	10^5 x (right ascension of the ascending node in degrees)
hrs_h_manom	I4	4	1	10^5 x (mean anomaly in degrees)
hrs_h_xpos	I4	4	1	10^5 x (position vector X component in km)
hrs_h_ypos	I4	4	1	10^5 x (position vector Y component in km)
hrs_h_zpos	I4	4	1	10^5 x (position vector Z component in km)
hrs_h_xvel	I4	4	1	10^8 x (velocity vector X-dot component in kilometers/seconds)
hrs_h_yvel	I4	4	1	10^8 x (velocity vector Y-dot component
hrs_h_zvel	I4	4	1	10^8 x (velocity vector Z-dot component in kilometers/seconds)
hrs_h_earthsun	I4	4	1	10^6 x (Earth/sun distance ratio)
hrs_h_filler7	I4	4	4	Unassigned (no value)
ANALOG TELEMETRY CONVERSION (volts to engineering units, scaling factors 10^(2, 2, 3, 3, 3, 5)				
hrs_h_rdtemp	I4	4	6	radiator temp.conversion coefficients
hrs_h_bptemp	I4	4	6	base plate temp. conv. coef.
hrs_h_eltemp	I4	4	6	electronics temp. conv. coef.

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_fwmtemp	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_fwmcur	I4	4	6	filter wheel motor current conv. coef.
hrs_h_scmcur	I4	4	6	scan motor current conv. coef.
hrs_h_pchcpow	I4	4	6	patch controller power conv. coef.
DIGITAL A TELEMETRY CONVERSION				
hrs_h_iwtcnttmp	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_ictcnttmp	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_tttcnttmp	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_fwcnttmp	I4	4	4*6	filter wheel housing, temperature sensors 4 sensors. 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_patchexpcnttmp	I4	4	6	patch temperature (expanded Scale) 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_fsradcnttmp	I4	4	6	first stage radiator temperature sensor 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_scmircnttmp	I4	4	6	scan mirror temperature 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_pttcnttmp	I4	4	6	primary telescope, temperature sensor 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_sttcnttmp	I4	4	6	secondary telescope, temperature sensor 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_bpcnttmp	I4	4	6	baseplate temperature 6 scaling factors 10^(6, 9, 14, 17, 21, 25)
hrs_h_electcnttmp	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_scmotcnttmp	I4	4	6	scan motor temperature 6 scaling factors 10^(6, 9, 14, 17, 21, 25)

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_moonscnlin	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
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

				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
SCAN LINE INFORMATION				
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_mjfrcnt	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)
QUALITY INDICATORS				
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

				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 **additional calibration problem code :** bit 31: not calibrated because of satellite manoeuvre (METOP) zero fill (NOAA) bit 30-24: <zero fill> **time problem code :** (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> **calibration problem code :** (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)

				Earth location problem code (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 reasonableness check bit 3-2: <zero fill> bit 1: Not calibrated because of in-plane manoeuvre (Metop) bit 0: Not calibrated because of out-of-plane manoeuvre (Metop)
hrs_chqualflg	I2	2	20	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. (all bits off implies a good calibration) bit 15-6: <zero fill> bit 5: all bad blackbody counts for scan line bit 4: all bad space view counts for scan line bit 3: all bad PRTs counts for scan line bit 2: marginal blackbody view counts for this line bit 1: marginal space view counts for this line bit 0: marginal PRTs counts for scan line
hrs_mnfrqual	C	1	64	minor frame quality indicators for nel 0 to 63 (for bits 7 through 1,if bit is on(=1) then statement is true) bit 7 : 1 = this frame suspect due to a time error (NOAA) bit 6 : 1 = this frame contains data gap data fill (NOAA) bit 5 : 1 = this frame contains TIP dwell data fill (NOAA) bit 4 : 1 = data suspect due to PACS QC error (NOAA) bit 3 : 1 = mirror locked during this frame bit 2 : 1 = mirror position error during this frame bit 1 : 1 = mirror was moving during this frame

				bit 0 : minor word odd parity bit
hrs_filler2	I4	4	4	Unassigned (no value)
CALIBRATION COEFFICIENTS				
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. - 10^12*the second one - 10^9*the first one - 10^6*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. - 10^12*the second one - 10^9*the first one - 10^6*the zeroth one
NAVIGATION				
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

				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	10^3xRoll angle in degrees
hrs_pitchang	I2	2	1	10^3xPitch angle in degrees
hrs_yawang	I2	2	1	10^3xYaw 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: 10^4*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_moonang	I2	2	1	100*angle between moon and space view
hrs_filler4	I2	2	3	Unassigned (no value)
HIRS DATA ELEMENTS				
hrs_elem	I2	2	24*64	element data **for nel 0 to 63** 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 **for nel 0 to 55** 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 **for nel 56** 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 **for nel 57** 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 **for nel 58** 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 **for nel 59** 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 **for nel 60** 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 **for nel 61** 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 **for nel 62** 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

				for nel 63 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)
DIGITAL B DATA				
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_digitbwrd	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

				(0=normal,1=yes) bit 2 : patch temperature controller (0=off,1=on) bit 1-0: <zero fill>
ANALOG TELEMETRY				
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_anwrd	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
FILLER				
hrs_filler5	I4	4	11	Unassigned (no value)

11.FORMAT OF THE AMSUA.L1B FILE

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

AMSU-A.l1a format = AMSU-A.l1b format (in AMSU-A.l1a, 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
GENERAL INFORMATION				
ama_h_siteid	C	3	1	Data set creation site ID
ama_h_blank	C	1	1	ASCII blank
ama_h_l1bversnb	I2	2	1	level 1b format version number
ama_h_l1bversyr	I2	2	1	level 1b format version year
ama_h_l1bversdy	I2	2	1	level 1b format version day of year
ama_h_reclg	I2	2	1	record length
ama_h_blksz	I2	2	1	blocksize
ama_h_hdrcnt	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-N'(TBC) 11=Metop-1 (TBC) 12=Metop-2 13=Metop-3(TBC) 14=Metop simulator
ama_h_instid	I2	2	1	AMSU-A instrument identification (Bits 15-8:AMSU-A2 ID - 2=EM, 6=PFM,

				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
DATA SET QUALITY INDICATORS				
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_scnlin	I2	2	1	count of scan lines in this data set
ama_h_callocsclin	I2	2	1	count of calibrated, Earth located scan lines in this data set
ama_h_misscnlin	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

				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
CALIBRATION PARAMETERS				
ama_h_plloid	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
TEMPERATURE TO RADIANCE CONVERSION FACTORS				
ama_h_temrad	I4	4	45	10^6*(Central wavenumber, Const1, Const2 (slope)) for 15 channels
ama_h_filler7	I4	4	3	filler
NAVIGATION				
ama_h_modelid	C	8	1	Reference Ellipsoid Model ID =“GRS 80” in the actual version of AAPP
ama_h_nadloctol	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)

ama_h_filler8	I2	2	1	filler
ama_h_rollerr	I2	2	1	10^3 x (constant roll attitude error, deg)
ama_h_pitcherr	I2	2	1	10^3 x (constant pitch attitude error, deg)
ama_h_yawerr	I2	2	1	10^3 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	10^6 x (semi-major axis in kilometers)
ama_h_eccen	I4	4	1	10^8 x (eccentricity)
ama_h_incli	I4	4	1	10^5 x (inclination in degrees)
ama_h_argper	I4	4	1	10^5 x (argument of perigee in degrees)
ama_h_rascnod	I4	4	1	10^5 x (right ascension of the ascending node in degrees)
ama_h_manom	I4	4	1	10^5 x (mean anomaly in degrees)
ama_h_xpos	I4	4	1	10^6 x (position vector x component in kilometers)
ama_h_ypos	I4	4	1	10^6x (position vector y component in kilometers)
ama_h_zpos	I4	4	1	10^6 x (position vector z component in kilometers)
ama_h_xvel	I4	4	1	10^8 x (velocity vector x-dot component in kilometers/second)
ama_h_yvel	I4	4	1	10^8 x (velocity vector y-dot component in kilometers/second)
ama_h_zvel	I4	4	1	10^8 x (velocity vector z-dot component in kilometers/second)
ama_h_earthsun	I4	4	1	10^6 x (Earth/sun distance ratio)
ama_h_filler9	I4	4	4	filler
DIGITAL A AND ANALOG TELEMETRY CONVERSION COEFFICIENTS				
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; PLLO#2; PLLO#1; PLLO (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

				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
LUNAR CONTAMINATION CORRECTION (NESDIS)				
ama_h_moonscnlin	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	
METOP MANOEUVRES IDENTIFICATION (zero fill for NOAA)				
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
SCAN LINE INFORMATION				
ama_scnlin	I2	2	1	scan line number
ama_scnlinyr	I2	2	1	scan line year
ama_scnlindy	I2	2	1	scan line day of year
ama_clockdrift	I2	2	1	satellite clock drift delta in milliseconds
ama_scnlintime	I4	4	1	scan line UTC time of day in milliseconds
ama_scnlinbit	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

CALIBRATION COEFFICIENTS				
ama_pmcal	I4	4	45	Primary calib. coeffs Second, first and zeroth order coefficients for 15 channels
ama_sdcal	I4	4	45	Secondary calib. coeffs Second, first and zeroth order coefficients for 15 channels
ama_filler3	I4	4	1	filler
NAVIGATION				
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	10^3*Roll angle in degrees
ama_pitchang	I2	2	1	10^3*Pitch angle in degrees
ama_yawang	I2	2	1	10^3*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

				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: 10^4*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 ..... word60: 10^4*longitude in degrees, point 30
ama_filler4	I4	4	1	filler
AMSU-A1 DIGITAL A TELEMETRY				
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
AMSU-A1 DIGITAL B TELEMETRY				
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
AMSU-A1 ANALOG HOUSEKEEPING DATA (TIP)				
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
AMSU-A2 DIGITAL A TELEMETRY				
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

ama2_warmcal	I2	2	6	2 position + 2 channels(1-2) + 2 channels repeat, warm view
ama_filler8	I4	4	1	filler
AMSU-A2 DIGITAL B TELEMETRY				
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
AMSU-A2 ANALOG HOUSEKEEPING DATA (TIP)				
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)
LUNAR CONTAMINATION CORRECTION (NESDIS method using antenna patterns)				
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

12. FORMAT OF THE AMSUB.L1B FILE

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

AMSU-B.l1a format = AMSU-B.l1b format (in AMSU-B.l1a, 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
GENERAL INFORMATION				
amb_h_siteid	C	3	1	Data set creation site ID CMS = Centre de MeteorologiSpatiale/France NSS = NESDIS/USA UKM = UK Met Office
amb_h_blank	C	1	1	Zero fill
amb_h_l1bversnb	I2	2	1	level 1b format version number
amb_h_l1bversyr	I2	2	1	level 1b format version year
amb_h_l1bversdy	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) 7=NOAA-18 (NOAA-N) 8=NOAA-N'(TBC) 11=Metop-1 (TBC) 12=Metop-2 13=Metop-3(TBC) 14=Metop simulator

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)
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
DATA SET QUALITY INDICATORS				
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_callocsclin	I2	2	1	count of calibrated, Earth located scan lines in this data set
amb_h_misscnlin	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) 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
CALIBRATION PARAMETERS				
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
TEMPERATURE TO RADIANCE CONVERSION FACTORS				
amb_h_temrad	I4	4	15	10^6*(Central wavenumber, const1 and const2)
amb_h_filler7	I4	4	4	Zero fill
NAVIGATION – EARTH LOCATION				
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 x (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 x (constant roll attitude error in degrees)
amb_h_pitcherr	I2	2	1	10^3 x (constant pitch attitude error in degrees)
amb_h_yawerr	I2	2	1	10^3 x (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 x (semi-major axis in kilometers)

amb_h_eccen	I4	4	1	10^8 x (eccentricity)
amb_h_incli	I4	4	1	10^5 x (inclination in degrees)
amb_h_argper	I4	4	1	10^5 x (argument of perigee in degrees)
amb_h_rascnod	I4	4	1	10^5 x (right ascension of the ascending node in degrees)
amb_h_manom	I4	4	1	10^5 x (mean anomaly in degrees)
amb_h_xpos	I4	4	1	10^6 x (position vector x component in kilometers)
amb_h_ypos	I4	4	1	10^6 x (position vector y component in kilometers)
amb_h_zpos	I4	4	1	10^6 x (position vector z component in kilometers)
amb_h_xvel	I4	4	1	10^8 x (velocity vector x-dot component in kilometers/second)
amb_h_yvel	I4	4	1	10^8 x (velocity vector y-dot component in kilometers/second)
amb_h_zvel	I4	4	1	10^8 x (velocity vector z-dot component in kilometers/second)
amb_h_earthsun	I4	4	1	10^6 x (Earth/sun distance ratio)
amb_h_filler9	I4	4	4	Zero fill
DIGITAL A AND ANALOG TELEMETRY CONVERSION COEFFICIENTS				
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
CORRECTIONS FOR S-BAND TRANSMITTER INTERFERENCE				
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
LUNAR CONTAMINATION				
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
SPARE WORDS				
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
SCAN LINE INFORMATION				

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 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
CALIBRATION COEFFICIENTS				
amb_pmcal	I4	4	15	Primary calib. coeffs Second, first and zeroth order coefficients for 5 channels
amb_sdcal	I4	4	15	Secondary calib. coeffs Second, first and zeroth order coefficients for 5 channels
amb_filler3	I2	2	5	Zero fill
NAVIGATION				
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_nadloctol) (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	10^3*Roll angle in degrees
amb_pitchang	I2	2	1	10^3*Pitch angle in degrees
amb_yawang	I2	2	1	10^3*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: 10^4*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 ..... word180: 10^4*longitude in degrees, point 90
amb_moonang	I2	2	4	100*angle (deg) between moon and each space view
AMSU-B SENSOR DATA				
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
AMSU-B CALIBRATION DATA				
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 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
AMSU-B DIGITAL A TELEMETRY				
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
AMSU-B ANALOG TELEMETRY				
amb_ahkval	I4	4	1	Invalid analogue data bit flags
amb_ahk	I2	2	27	Added STX and SARR information
FILLERS				
amb_filler9	I2	2	1	Zero fill
amb_filler10	I4	4	67	Zero fill

13. FORMAT OF THE MHS.L1B FILE

MHS.l1a format = MHS.l1b format (in MHS.l1a, 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
GENERAL INFORMATION				
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_l1bversnb	I2	2	1	level 1b format version number
mhs_h_l1bversyr	I2	2	1	level 1b format version year
mhs_h_l1bversdy	I2	2	1	level 1b format version day of year
mhs_h_reclg	I2	2	1	logical record length
mhs_h_blksz	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: 4=NOAA-15 (NOAA-K) 2=NOAA-16 (NOAA-L) 6=NOAA-17 (NOAA-M) 7=NOAA-18 (NOAA-N) 8=NOAA-N'(TBC) 11=Metop-1 (TBC) 12=Metop-2 13=Metop-3(TBC) 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-2) (TBC), 5 = FM5 (Metop-3) (TBC))
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
DATA SET QUALITY INDICATORS				
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_callocsclin	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
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
CALIBRATION PARAMETERS				
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
TEMPERATURE TO RADIANCE CONVERSION FACTORS				
mhs_h_temrad	I4	4	15	10^6*(Central wavenumber, const1 and const2)
mhs_h_filler7	I4	4	4	Zero fill

NAVIGATION – EARTH LOCATION				
mhs_h_modelid	C	8	1	Reference Ellipsoid Model ID
mhs_h_nadloctol	I2	2	1	10 x (nadir Earth location tolerance in 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	10^3 x (constant roll attitude error in degrees)
mhs_h_pitcherr	I2	2	1	10^3 x (constant pitch attitude error in degrees)
mhs_h_yawerr	I2	2	1	10^3 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	10^6 x (semi-major axis in kilometers)
mhs_h_eccen	I4	4	1	10^8 x (eccentricity)
mhs_h_incli	I4	4	1	10^5 x (inclination in degrees)
mhs_h_argper	I4	4	1	10^5 x (argument of perigee in degrees)
mhs_h_rascnod	I4	4	1	10^5 x (right ascension of the ascending node in degrees)
mhs_h_manom	I4	4	1	10^5 x (mean anomaly in degrees)
mhs_h_xpos	I4	4	1	10^6 x (position vector x component in kilometers)
mhs_h_ypos	I4	4	1	10^6 x (position vector y component in kilometers)
mhs_h_zpos	I4	4	1	10^6 x (position vector z component in kilometers)
mhs_h_xvel	I4	4	1	10^8 x (velocity vector x-dot component in kilometers/second)
mhs_h_yvel	I4	4	1	10^8 x (velocity vector y-dot component in kilometers/second)
mhs_h_zvel	I4	4	1	10^8 x (velocity vector z-dot component in kilometers/second)
mhs_h_earthsun	I4	4	1	10^6 x (Earth/sun distance ratio relative to the mean distance of 1AU)
mhs_h_filler9	I4	4	4	Zero fill
TEMPERATURE, CURRENT AND RESISTANCE CONVERSION COEFFICIENTS				
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 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 = 10^8 x 0.00703125
mhs_h_refres	I4	4	6	10^4 x reference resistance in ohms PIE-A 3 channels, PIE-B 3 channels
THRESHOLDS				
mhs_h_moonthresh	I2	2	1	100 x lunar angle threshold in degrees
RFI CORRECTION, AS FOR AMSU-B, OR ZERO FILL IF NOT NEEDED				
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
METOP MANOEUVRES IDENTIFICATION				
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
SPARE WORDS				
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
SCAN LINE INFORMATION				
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 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^-16 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
QUALITY INDICATORS				
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 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
CALIBRATION COEFFICIENTS				
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_sdcal	I4	4	15	Secondary calib. coeffs Second, first and zeroth order coefficients for 5 channels
mhs_filler3	I2	2	2	Zero fill
NAVIGATION				
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) bit 17: Nadir Earth location OK (see mhs_h_nadloctol) (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
mhs_attangtime	I4	4	1	time associated with Euler angles (seconds)
mhs_rollang	I2	2	1	10^3*Roll angle in degrees
mhs_pitchang	I2	2	1	10^3*Pitch angle in degrees
mhs_yawang	I2	2	1	10^3*Yaw angle in degrees
mhs_scalti	I2	2	1	10*spacecraft altitude (MSL) in km
mhs_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
mhs_pos	I4	4	180	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 ..... word180: 10^4*longitude in degrees, point 90
mhs_moonang	I2	2	4	100*angle (deg) between moon and each space view
MHS SENSOR DATA				
mhs_earth_data	I2	2	540	90 x [position, counts(H1-H5)]
mhs_filler4	I4	4	2	Zero fill
MHS CALIBRATION DATA				
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
MHS POSITION VALIDITY FLAGS				
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
MHS FULL HOUSEKEEPING DATA				
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) 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
MHS STATUS WORD				
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
SIGNAL PROCESSING STATUS				
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
OBCT TEMPERATURE DATA				
mhs_obctprt	I2	2	5	PRT counts
mhs_refrescts	I2	2	3	Reference resistor counts (upper, mid, lower)
mhs_filler9	I2	2	1	Zero fill
mhs_obcttemp	I4	4	5	Computed temperatures (mK)
mhs_filler10	C	1	46	Zero fill
MHS DISCRETE TELEMETRY (digb/analog)				
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

14. FORMAT OF THE MSU.L1B FILE

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

MSU.l1a format = MSU.l1b format (in MSU.l1a, 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
GENERAL INFORMATION				
msu_h_siteid	C	3	1	Data set creation site ID CMS = Centre de MeteorologiSpatiale/France NSS = NESDIS/USA UKM = UK Met Office
msu_h_blank	C	1	1	ASCII blank
msu_h_l1bversnb	I2	2	1	level 1b format version number
msu_h_l1bversyr	I2	2	1	level 1b format version year
msu_h_l1bversdy	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-N'(TBC) 11=Metop-1 (TBC) 12=Metop-2 13=Metop-3(TBC) 14=Metop simulator

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
DATA SET QUALITY INDICATORS				
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

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
CALIBRATION				
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)
RADIANCE TO TEMPERATURE CONVERSION				
msu_h_nolincor	I4	4	3*4	nonlinearity correction coefficients for nochannel 1 to 4 : 10^12 x (second order term nochannel (zero in 1A data)) 10^6 x (first order term nochannel (zero in 1A data)) 10^6 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 : 10^12 x (second order term (zero in 1A data)) 10^6 x (first order term (zero in 1A data)) 10^6 x (zeroth order term (zero in 1A data)
msu_h_censperes	I4	4	4	centroid of spectral response functions for nochannel 1 to 4 : 10^4 x (nochannel (cm-1)(zero in 1A data))
msu_h_radspa	I4	4	4	Radiance of space for nochannel 1 to 4 : 10^6 x (radiance of space nochannel(cm-1)(zero in 1A data))

msu_h_filler5	I4	4	3	zero fill
NAVIGATION				
msu_h_modelid	C	1	8	Reference Ellipsoid Model ID ="GRS 80" in the actual version of AAPP
msu_h_nadloctol	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	10^3 x (constant roll attitude error in degrees)
msu_h_pitcherr	I2	2	1	10^3 x (constant pitch attitude error in degrees)
msu_h_yawerr	I2	2	1	10^3 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	10^5 x (semi-major axis in kilometers)
msu_h_eccen	I4	4	1	10^8 x (eccentricity)
msu_h_incli	I4	4	1	10^5 x (inclination in degrees)
msu_h_argper	I4	4	1	10^5 x (argument of perigee in degrees)
msu_h_rascnod	I4	4	1	10^5 x (right ascension of the ascending node in degrees)
msu_h_manom	I4	4	1	10^5 x (mean anomaly in degrees)
msu_h_xpos	I4	4	1	10^5 x (position vector x component in kilometers)
msu_h_ypos	I4	4	1	10^5 x (position vector y component in kilometers)
msu_h_zpos	I4	4	1	10^5 x (position vector z component in kilometers)
msu_h_xvel	I4	4	1	10^8 x (velocity vector x-dot component in kilometers/second)
msu_h_yvel	I4	4	1	10^8 x (velocity vector y-dot component in kilometers/second)
msu_h_zvel	I4	4	1	10^8 x (velocity vector z-dot component in kilometers/second)
msu_h_earthsun	I4	4	1	10^6 x (Earth/sun distance ratio)
msu_h_filler7	I2	2	272	zero fill

One Data Record for one MSU scan line

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
SCAN LINE INFORMATION				
msu_scnlin	I2	2	1	scan line number
msu_scnlinyr	I2	2	1	scan line year
msu_scnlindy	I2	2	1	scan line day of year
msu_clockdrift	I2	2	1	satellite clock drift delta in ms
msu_scnlintime	I4	4	1	scan line UTC time of day in ms
msu_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)
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
QUALITY INDICATORS				
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. **General** 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 **Time Problem Code** (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. **TIP Problem Code** bit 19: TIP synch error bit 18: TIP minor or major frame sequence error bit 17: TIP status error bit 16: TIP parity error **Calibration Problem Code** (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 **Earth Location Problem Code** (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
msu_scnlinqual	I2	2	4	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

				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
CALIBRATION COEFFICIENTS				
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_sdcal	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)
NAVIGATION				
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 inYGC 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		10^3 xRoll Angle in Degrees
msu_pitchang	I2	2		10^3 xPitch Angle in Degrees
msu_yawang	I2	2		10^3 xYaw 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 : 10^2 x (solar zenith angle) second angle: 10^2 x (satellite zenith angle) third angle : 10^2 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 : 10^4 x (latitude) second : 10^4 x (longitude)

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

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
GENERAL INFORMATION				
dcs_h_siteid	C	3	1	Data set creation site ID
dcs_h_blank	C	1	1	ASCII blank
dcs_h_l1bversnb	I2	2	1	level 1b format version number
dcs_h_l1bversyr	I2	2	1	level 1b format version year
dcs_h_l1bversdy	I2	2	1	level 1b format version day of year
dcs_h_reclg	I2	2	1	reserved for logical record length
dcs_h_blksz	I2	2	1	reserved for block size
dcs_h_hdrcnt	I2	2	1	count of header records in data set
dcs_h_filler0	I2	2	3	Zero fill
dcs_h_dataname	C	42	1	data set name
dcs_h_prblkid	C	8	1	processing block identification
dcs_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-N'(TBC) 11=Metop-1 (TBC) 12=Metop-2 13=Metop-3(TBC) 14=Metop simulator
dcs_h_instid	I2	2	1	instrument identification
dcs_h_datatyp	I2	2	1	data type code
dcs_h_tipsrc	I2	2	1	TIP source code (0 = not applicable; 1 = GAC embedded; 2 = stored; 3 = third CDA; 4 = HRPT embedded)
dcs_h_startdatajd	I4	4	1	start of data set day count from 00h,1 Jan 1950
dcs_h_startdatayr	I2	2	1	start of data set year
dcs_h_startdatady	I2	2	1	start of data set day of year

dcs_h_startdatatime	I4	4	1	start of data set UTC time of day in milliseconds
dcs_h_enddatajd	I4	4	1	end of data set day count from 00h,1 Jan 1950
dcs_h_enddatayr	I2	2	1	end of data set year
dcs_h_enddatady	I2	2	1	end of data set day of year
dcs_h_enddatatime	I4	4	1	end of data set UTC time of day in milliseconds
dcs_h_cpidsyr	I2	2	1	year of Last CPIDS Update
dcs_h_cpidsdy	I2	2	1	Day of Year of Last CPIDS Update
dcs_h_filler1	I4	4	2	filler
DATA SET QUALITY INDICATORS				
dcs_h_inststat	I4	4	1	instrument status
dcs_h_statchrecnb	I2	2	1	record number of status change (if 0, none occurred)
dcs_h_scnlin	I2	2	1	count of scan lines in this data set
dcs_h_datagaps	I2	2	1	count of data gaps in this data set
dcs_h_okdatafr	I2	2	1	count of data frames without frame sync word errors
dcs_h_pacsparityerr	I2	2	1	count of PACS detected TIP parity errors
dcs_h_auxsyncerrsum	I2	2	1	Sum of all auxiliary sync errors detected in the input data.
dcs_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)
dcs_h_pacsdatasrc	I2	2	1	PACS data source (0 = unused; 1 = Gilmore; 2 = Wallops; 3 = SOCC)
dcs_h_spare1	C	8	1	spare (reserved for ingester)
dcs_h_spare2	C	8	1	spare (reserved of the decommutation)
dcs_h_filler2	I4	4	4	filler
ANALOG TELEMETRY CONVERSION				
dcs_h_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

				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
dcs_h_filler3	I2	2	5202	filler

Data Record

Name in AAPP code	Type	Word Size in byte	Number of words	Meaning
FRAME INFORMATION STRUCTURE				
dcs_mjfrcnt	I2	2	1	major frame count
dcs_mjfryr	I2	2	1	major frame year
dcs_mjfrdy	I2	2	1	major frame day of year
dcs_clockdrift	I2	2	1	satellite clock drift delta in milliseconds
dcs_mjfrtime	I4	4	1	scan line UTC time of day in milliseconds
dcs_mjfbf	I2	2	1	major frame bit field
dcs_filler1	I2	2	5	filler
QUALITY INDICATORS				
dcs_qualind	I4	4	1	quality indicator bit field
dcs_mjfqf	I4	4	1	major frame quality flags
dcs_filler2	I4	4	2	filler
DCS MINOR FRAME DATA				
dcs_data	I4	4	320*8	DCS minor frame data
dcs_filler3	I4	4	1	filler
DIGITAL B TELEMETRY				
dcs_digbinvwbf	I2	2	1	invalid word bit flags
dcs_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

				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
dcs_filler4	I4	4	1	filler
ANALOG TELEMETRY				
dcs_aninvwbf	I2	2	1	invalid word bit flags
dcs_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)
dcs_filler5	I2	2	221	filler

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
GENERAL INFORMATION				
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-N'(TBC) 1=Metop-1 2=Metop-2 3=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)

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
TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS				
hrs1c_h_tempradcnv	I4	4	3*19	order of channels = 1,2,3,4,...,18,19 for nochannel = 1 to 19 : 10^6 x (nochannel central wavenumber) 10^6 x (nochannel constant 1) 10^6 x (nochannel constant 2) (scaling factor for wavenumber changes to 10^5 for channels 13-19 inclusive)
hrs1c_h_20solfiltirrad	I4	4	1	10^6 x (albedo-radiance ch20 solar filtered irradiance,W/m2)
hrs1c_h_20equifiltwidth	I4	4	1	10^6 x (albedo-radiance ch 20 equivalent filter width cm^-1)
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_scnlindy	I4	4	1	scan line day of year
hrs1c_scnlintime	I4	4	1	scan line UTC time of day in milliseconds
hrs1c_mjfrcnt	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. **general** 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>
hrs1c_scanqual	I4	4	1	scan line quality flags **time problem code** (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 **calibration problem code** (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 **Earth location problem code** (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

				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 : 10^4 x (latitude) second : 10^4 x (longitude)
hrs1c_angles	I4	4	4*56	scan angles for Hnfovs first: 10^2 x (local zenith angle) second: 10^2 x (local azimuth angle) third: 10^2 x (solar zenith angle) fourth: 10^2 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 10^2 x scene brightness temperature (K) for channels 1-19 10^2 x radiance Wm-2sr-1(cm-1)-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

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
General information				
ama1c_h_site	C	3	1	dataset creation site ID
ama1c_h_cfill1	C	1	1	filler
ama1c_h_1bsite	C	3	1	creation site for original 1B data
ama1c_h_cfill2	C	1	1	filler
ama1c_h_versnb	I4	4	1	level 1c format version number
ama1c_h_versyr	I4	4	1	level 1c format version year
ama1c_h_versdy	I4	4	1	level 1c format version day of year
ama1c_h_hdrcnt	I4	4	1	count of header records in this data set
ama1c_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-N'(TBC) 1=Metop-1 2=Metop-2 3=Metop-3 4=Metop simulator
ama1c_h_instrument	I4	4	1	instrument code (10=AMSU-A)
ama1c_h_satht	I4	4	1	nominal satellite altitude, km*10
ama1c_h_period	I4	4	1	nominal orbit period (seconds)
ama1c_h_startorbit	I4	4	1	orbit number (at start of file)
ama1c_h_startdatayr	I4	4	1	start of data set year
ama1c_h_startdatady	I4	4	1	start of data set day of the year

ama1c_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
ama1c_h_endorbit	I4	4	1	orbit number (at end of file)
ama1c_h_enddatayr	I4	4	1	end of data set year
ama1c_h_enddatady	I4	4	1	end of data set day of the year
ama1c_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
ama1c_h_scnlin	I4	4	1	count of scan lines in this data set
ama1c_h_misscnlin	I4	4	1	count of missing scan lines
ama1c_h_vnantennacorr	I4	4	1	version number, antenna corrections
ama1c_h_spare	I4	4	1	spare
TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS				
ama1c_h_tempradcnv	I4	4	3*15	order of channels = 1,2,3,4,...,15 for nochannel = 1 to 15 : 10^6 x (nochannel central wavenumber) 10^6 x (nochannel constant 1) 10^6 x (nochannel constant 2)
ama1c_h_wmosatid	I4	4	1	WMO satellite id (e.g. 3 for METOP-1)
ama1c_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
ama1c_scnlin	I4	4	1	scan line number
ama1c_scnlinyr	I4	4	1	scan line year
ama1c_scnlindy	I4	4	1	scan line day of year
ama1c_scnlintime	I4	4	1	scan line UTC time of day in milliseconds
ama1c_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. **general** 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>
ama1c_scanqual	I4	4	1	scan line quality flags **time problem code**

				(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. **moon problem code** bit 19: Moon in AMSU-A2 space view corrected bit 18: Moon in AMSU-A1 space view corrected bit 17: Moon in AMSU-A2 space view uncorrected bit 16: Moon in AMSU-A1 space view uncorrected **calibration problem code** (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 **Earth location problem code** (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 reasonableness check bit 3: Earth location questionable because of antenna position check [rs060794.doc & rs062094.do1] 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_instrtemp1	I4	4	1	AMSU-A1 RF shelf temp (K*100)
ama1c_instrtemp2	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 : 10^4 x (latitude) second : 10^4 x (longitude)
ama1c_angles	I4	4	4*30	scan angles for Anfovs first: 10^2 x (local zenith angle) second: 10^2 x (local azimuth angle) third: 10^2 x (solar zenith angle) fourth: 10^2 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 10^2 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 unreasonable or has not been calculated due to calibration problems. bit 0: set if all channels missing
ama1c_filler	I4	4	80	filler

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
GENERAL INFORMATION				
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-N'(TBC) 1=Metop-1 2=Metop-2 3=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)

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_scnlin	I4	4	1	count of scan lines in this data set
amb1c_h_misscnlin	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
TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS				
amb1c_h_tempradcnv	I4	4	3*5	order of channels = 1,2,3,4,5 for nochannel = 1 to 5 : 10^6 x (nochannel central wavenumber) 10^6 x (nochannel constant 1) 10^6 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_scnlin	I4	4	1	scan line number
amb1c_scnlinyr	I4	4	1	scan line year
amb1c_scnlindy	I4	4	1	scan line day of year
amb1c_scnlintime	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. **general** 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 **time problem code** (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 **calibration problem code** (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 **Earth location problem code** (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 reasonableness check bit 3: Earth location questionable because of antenna position check [rs060794.doc & rs062094.do1] bit 2-0: spare
amb1c_chanqual	I4	4	5	quality flag for each channel with the channels

				in the order 1,2,3,4,5. (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_instrtemp	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 : 10^4 x (latitude) second : 10^4 x (longitude)
amb1c_angles	I4	4	4*90	scan angles for Bnfovs first: 10^2 x (local zenith angle) second: 10^2 x (local azimuth angle) third: 10^2 x (solar zenith angle) fourth: 10^2 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 10^2 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

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
GENERAL INFORMATION				
msu1c_h_site	C	3	1	dataset creation site ID
msu1c_h_cfill1	C	1	1	filler
msu1c_h_1bsite	C	3	1	creation site for original 1B data
msu1c_h_cfill2	C	1	1	filler
msu1c_h_versnb	I4	4	1	level 1c format version number
msu1c_h_versyr	I4	4	1	level 1c format version year
msu1c_h_versdy	I4	4	1	level 1c format version day of year
msu1c_h_hdrcnt	I4	4	1	count of header records in this data set
msu1c_h_satid	I4	4	1	satellite idendification (e.g. 14 for NOAA-14)
msu1c_h_instrument	I4	4	1	instrument code (6=MSU)
msu1c_h_satht	I4	4	1	nominal satellite altitude, km*10
msu1c_h_period	I4	4	1	nominal orbit period (seconds)
msu1c_h_startorbit	I4	4	1	orbit number (at start of file)
msu1c_h_startdatayr	I4	4	1	start of data set year
msu1c_h_startdatady	I4	4	1	start of data set day of the year
msu1c_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
msu1c_h_endorbit	I4	4	1	orbit number (at end of file)
msu1c_h_enddatayr	I4	4	1	end of data set year
msu1c_h_enddatady	I4	4	1	end of data set day of the year
msu1c_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
msu1c_h_scnlin	I4	4	1	count of scan lines in this data set
msu1c_h_misscnlin	I4	4	1	count of missing scan lines
msu1c_h_spare1	I4	4	1	spare
msu1c_h_spare2	I4	4	1	spare

TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS				
msu1c_h_tempradcnv	I4	4	3*4	order of channels = 1,2,3,4 for nochannel = 1 to 4 : 10^6 x (nochannel central wavenumber) 10^6 x (nochannel constant 1) 10^6 x (nochannel constant 2)
msu1c_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
msu1c_scnlin	I4	4	1	scan line number
msu1c_scnlinyr	I4	4	1	scan line year
msu1c_scnlindy	I4	4	1	scan line day of year
msu1c_scnlintime	I4	4	1	scan line UTC time of day in milliseconds
msu1c_mjfrcnt	I4	4	1	major frame count
msu1c_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. **general** 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>
msu1c_scanqual	I4	4	1	scan line quality flags **time problem code** (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. **TIP Problem Code** (All bits off implies no errors.) bit 19: TIP synch error bit 18: TIP minor or major frame sequence error bit 17: TIP status error bit 16: TIP parity error **calibration problem code** (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 **Earth location problem code** (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 reasonableness check bit 3-0: spare
msu1c_chanqual	I4	4	4	quality flag for each channel with the channels in the order 1,2,3,4 (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
msu1c_spare1	I4	4	3	spare
msu1c_latlon	I4	4	2*11	lat/lon in degrees for Mnfovs(11) first : 10^4 x (latitude) second : 10^4 x (longitude)
msu1c_angles	I4	4	2*11	scan angles for Mnfovs(11) first: 10^2 x (local zenith angle) second: 10^2 x (local azimuth angle)
msu1c_scalti	I4	4	1	sat altitude above reference ellipsoid, km*10
msu1c_spare2	I4	4	1	spare
msu1c_btemps	I4	4	4*11	BT data for Mnfovs(11) 10^2 x scene brightness temperature (K) for channels 1-4
msu1c_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
msu1c_filler	I4	4	34	filler

20. FORMAT OF THE IASI L1C FILE

Header and record length
Header length = record length
545561*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
GENERAL INFORMATION				
iasi1c_h_site	C	3	1	dataset creation site ID
iasi1c_h_cfill1	C	1	1	filler
iasi1c_h_1bsite	C	3	1	creation site for original 1B data
iasi1c_h_cfill2	C	1	1	filler
iasi1c_h_versnb	I4	4	1	level 1c format version number
iasib1c_h_versyr	I4	4	1	level 1c format version year
iasi1c_h_versdy	I4	4	1	level 1c format version day of year
iasi1c_h_hdrcnt	I4	4	1	count of header records in this data set
iasi1c_h_satid	I4	4	1	satellite identification: 1=Metop-1 2=Metop-2 3=Metop-3 4=Metop simulator
iasi1c_h_instrument	I4	4	1	instrument code (13=IASI)
iasi1c_h_satht	I4	4	1	nominal satellite altitude, km*10
iasi1c_h_period	I4	4	1	nominal orbit period (seconds)
iasi1c_h_startorbit	I4	4	1	orbit number (at start of file)
iasi1c_h_startdatayr	I4	4	1	start of data set year
iasi1c_h_startdatady	I4	4	1	start of data set day of the year
iasi1c_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
iasi1c_h_endorbit	I4	4	1	orbit number (at end of file)
iasi1c_h_enddatayr	I4	4	1	end of data set year
iasi1c_h_enddatady	I4	4	1	end of data set day of the year
iasi1c_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
iasi1c_h_scnlin	I4	4	1	count of scan lines in this data set
iasi1c_h_misscnlin	I4	4	1	count of missing scan lines
iasi1c_h_spare	I4	4	2	spare
iasi1c_h_wmosatid	I4	4	1	WMO satellite id (e.g. 3 for METOP-1)

iasi1c_h_startchan	I4	4	10	Start channel for scaling definition
iasi1c_h_endchan	I4	4	10	End channel for scaling definition
iasi1c_h_scalefactor	I4	4	10	Radiance = scalrad*10^-scalefactor
iasi1c_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
iasi1c_scnlin	I4	4	1	scan line number
iasi1c_granule	I4	4	1	Granule number
iasi1c_scnlinyr	I4	4	1	scan line year
iasi1c_scnlindy	I4	4	1	scan line day of year
iasi1c_scnlintime	I4	4	30	scan line UTC time of day in milliseconds
iasi1c_GQisFlagQual	I4	4	4*30	1=some anomaly
iasi1c_GQisQualIndex	I4	4	1	NEDT estimated/expected
iasi1c_GQisQualIndexLoc	I4	4	1	IIS/AVHRR co-registration uncertainty
iasi1c_GQisQualIndexRad	I4	4	1	NEDT estimated/expected radiometric
iasi1c_GQisQualIndexSpect	I4	4	1	NEDT estimated/expected spectral
iasi1c_GQisSysTecSondQual	I4	4	1	
iasi1c_latlon	I4	4	2*4*30	lat/lon in degrees first : 10^4 x (latitude) second : 10^4 x (longitude)
iasi1c_angles	I4	4	4*4*30	scan angles first: 10^2 x (local zenith angle) second: 10^2 x (local azimuth angle) third: 10^2 x (solar zenith angle) fourth: 10^2 x (solar azimuth angle)
iasib1c_scalti	I4	4	1	sat altitude above reference ellipsoid, km*10
iasi1c_scalrad	I2	2	8700*4*30	Scaled radiance
iasi1c_avhcombination	I4	4	1	1 bit for each channel
iasi1c_avhrrmean	I4	4	6*7*4*30	Mean radiance for 6 channels, 7 classes
iasi1c_avhmeanscalefactor	I4	4	6*7*4*30	Factor scales
iasi1c_avhrrsdev	I4	4	6*7*4*30	Std dev radiance for 6 channels, 7 classes
iasi1c_avhsdevscalefactor	I4	4	7*4*30	10^6 x Fraction in each class
iasi1c_avhrrCGy	I4	4	7*4*30	10^6 x Y angular position of centre of gravity
iasi1c_avhrrCGz	I4	4	7*4*30	10^6 x Z angular position of centre of gravity

21.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
GENERAL INFORMATION				
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-N'(TBC) 1=Metop-1 2=Metop-2 3=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
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
HIRS TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS (Planck function)				
hrs1d_h_hrsPlanck	I4	4	3*19	order of channels = HIRS 1,2,3,4,...,18,19 (1,*) = 10^6 x (central wavenumber) (scaling factor for wavenumber changes to 10^5 for channels 13-19 inclusive) (2,*) = 10^6 x (constant 1) (3,*) = 10^6 x (constant 2)
hrs1d_h_20solfiltirrad	I4	4	1	10^6 x (albedo-radiance ch20 solar filtered irradiance W/m2)
hrs1d_h_20equifiltwidth	I4	4	1	10^6 x (albedo-radiance ch 20 equivalent filter width cm^-1)
hrs1d_h_spare2	I4	4	1	spare
AMSU(-A&B) TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS (Planck function)				
hrs1d_h_amsPlanck	I4	4	3*20	order of channels = AMSU-A 1-15, AMSU-B 1-5 (1,*) = 10^6 x (central wavenumber) (2,*) = 10^6 x (constant 1) (3,*) = 10^6 x (constant 2)
PRE-PROCESSING INFORMATION				
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_Apcpvn	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 (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. **general** 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 **time problem code** (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 **calibration problem code** (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 **Earth location problem code** (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 reasonableness check bit 3-0: spare
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 : 10^4 x (latitude) second : 10^4 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: 10^2 x (local zenith angle) second: 10^2 x (local azimuth angle) third: 10^2 x (solar zenith angle) fourth: 10^2 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	10^2 x scene brightness temperature (K) for channels HIRS 1-20, AMSU-A 1-15, AMSU-B 1-5 10^2 x radiance Wm-2sr-1(cm-1)-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 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)
hrs1d_prepro	I4	4	7*56	values from pre-processing **(1,*): pre-processing quality control word with flags** 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/MHSdata 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) 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,*) logistic precipitation probability (*100)** **(6,*) spare** **(7,*) spare**
hrs1d_filler	I4	4	89	filler

22.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
GENERAL INFORMATION				
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 idendification: .15=NOAA-15 (NOAA-K) 16=NOAA-16 (NOAA-L) 17=NOAA-17 (NOAA-M) 18=NOAA-18 (NOAA-N) 19=NOAA-N'(TBC) 1=Metop-1 2=Metop-2 3=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)
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
AMSU(-A&B) TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS (Planck function)				
amb1d_h_amsPlanck	I4	4	3*20	order of channels = AMSU-A 1-15, AMSU-B 1-5 (1,*) = 10^6 x (central wavenumber) (2,*) = 10^6 x (constant 1) (3,*) = 10^6 x (constant 2)
PRE-PROCESSING INFORMATION				
amb1d_h_Bcorrvn	I4	4	1	vn no AMSU-B/MHS limb/emiss correction

				(=0 if data not corrected)
amb1d_h_Bpcpvn	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. **general** 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 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 **time problem code** (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 **calibration problem code** (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 **Earth location problem code** (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 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 : 10^4 x (latitude) second : 10^4 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: 10^2 x (local zenith angle) second: 10^2 x (local azimuth angle) third: 10^2 x (solar zenith angle) fourth: 10^2 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	10^2 x scene brightness temperature (K) for channels AMSU-A 1-15, AMSU-B 1-5
PRE-PROCESSING OUTPUTS				
amb1d_prepro	I4	4	6*90	values from nearest AMSU-A **(1,*): pre-processing quality control word with flags** 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 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) **(2,*) estimated AMSU-A surface type:** 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 (*100)** **(4,*) scattering index (*100) (recalculated with AMSU-B 89GHz)** **(5,*) microwave cirrus index (*1000) (range is +/-200)** **(6,*) NWC-SAF scattering index and precipitation probabilities:** 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 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.

23.FORMAT OF THE IASI.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
(6087 + 15*iasi_1dnchan + 30*iasi_1dnpc)*4 bytes (default 19587*4 bytes)
where iasi_1dnchan is the number of channels required (default 300), 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
GENERAL INFORMATION				
iasi1d_h_site	C	3	1	1D dataset creation site ID
iasi1d_h_cfill1	C	1	1	filler
iasi1d_h_1bsite	C	3	1	creation site for original 1B data
iasi1d_h_cfill2	C	1	1	filler
iasi1d_h_versnb	I4	4	1	level 1d format version number
iasi1d_h_versyr	I4	4	1	level 1d format version year
iasi1d_h_versdy	I4	4	1	level 1d format version day of year
iasi1d_h_hdrcnt	I4	4	1	count of header records in this data set
iasi1d_h_satid	I4	4	1	satellite identification: 1=Metop-1 2=Metop-2 3=Metop-3 4=Metop simulator
iasi1d_h_grid	I4	4	1	code for instrument grid (12=IASI)
iasi1d_h_satht	I4	4	1	nominal satellite altitude, km*10
iasi1d_h_period	I4	4	1	nominal orbit period (seconds)
iasi1d_h_startorbit	I4	4	1	orbit number (at start of dataset)
iasi1d_h_startdatayr	I4	4	1	start of data set year
iasi1d_h_startdatady	I4	4	1	start of data set day of the year
iasi1d_h_startdatatime	I4	4	1	start of data set UTC time of day (ms)
iasi1d_h_endorbit	I4	4	1	orbit number (at end of dataset)
iasi1d_h_enddatayr	I4	4	1	end of data set year
iasi1d_h_enddatady	I4	4	1	end of data set day of the year

iasi1d_h_enddatatime	I4	4	1	end of data set UTC time of day (ms)
iasi1d_h_scnlin	I4	4	1	count of scan lines in this data set
iasi1d_h_misscnlin	I4	4	1	count of missing scan lines
iasi1d_h_atovppvn	I4	4	1	ATOVPP version number (test vns = 9000+)
iasi1d_h_instruments	I4	4	1	instruments present (bit0=HIRS, bit1=MSU, bit3=AMSU-A, bit4=AMSU-B or MHS, bit5=AVHRR, bit6=IASI)
iasi1d_h_wmosatid	I4	4	1	WMO satellite id (3 for METOP-1, 4 for METOP-2, 5 for METOP-3))
iasi1d_h_spare1	I4	4	1	spare
IASI VARIABLES)				
iasi1d_h_startchan	I4	4	10	Start channel for scaling definition
iasi1d_h_endchan	I4	4	10	End channel for scaling definition
iasi1d_h_scalefactor	I4	4	10	Radiance = scalrad*10^-scalefactor
iasi1d_h_eigvn	I4	4	1	Version number of eigenvectors
iasi1d_h_npc	I4	4	1	Number of PCs in format
iasi1d_h_npcused	I4	4	1	Number of PCs used
iasi1d_h_chanvn	I4	4	1	Version number of channel selection
iasi1d_h_nchan	I4	4	1	Number of channels in format
iasi1d_h_nchanused	I4	4	1	Number of channels used
iasi1d_h_channels	I4	4	300	List of IASI channels range 1 to 8461
AMSU(-A&B) TEMPERATURE TO RADIANCE CONVERSION COEFFICIENTS (Planck function)				
iasi1d_h_amsPlanck	I4	4	3*20	order of channels = AMSU-A 1-15, MHS 1-5 (1,*) = 10^6 x (central wavenumber) (2,*) = 10^6 x (constant 1) (3,*) = 10^6 x (constant 2)
PRE-PROCESSING INFORMATION				
iasi1d_h_dT	I4	4	1	size of data batches processed within ATOVPP (seconds - see ATOVPP documentation)
iasi1d_h_mapBTmode	I4	4	1	mapping method used for BTs (1=nearest neighbour, 2=bilinear interpolation, 3=spatial averaging)
iasi1d_h_Acorrvn	I4	4	1	vn no AMSU-A limb/emiss correction (=0 if data not corrected)
iasi1d_h_Apcpvn	I4	4	1	vn no AMSU-A precip/scatter detection (=0 if not done)
iasi1d_h_Aantenna	I4	4	1	vn no, AMSU-A antenna corrections (from ATOVIN)
iasi1d_h_Bcorrvn	I4	4	1	vn no MHS limb/emiss correction (=0 if data not corrected)
iasi1d_h_Bpcpvn	I4	4	1	vn no.MHS precip/scatter detection (=0 if not done)
iasi1d_h_Bantenna	I4	4	1	vn no, MHS antenna corrections (from ATOVIN)
iasi1d_h_Ascat	I4	4	1	threshold value for AMSU-A scattering index

iasi1d_h_ACrosby	I4	4	1	threshold value for AMSU-A logistic precip
iasi1d_h_AB89	I4	4	1	threshold value for AMSU-A/AMSU-B or MHS 89GHz differences
iasi1d_h_cloudtests	I4	4	1	Cloud tests used (0 if none)
iasi1d_h_recperscan	I4	4	1	Records per scan: 1 or 4
iasi1d_h_fovmode	I4	4	1	0 = full resolution 1 to 4 = fixed detector 5+ = other methods (TBD)
iasi1d_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
iasi1d_scnlin	I4	4	1	scan line number
iasi1d_scnlinyr	I4	4	1	scan line year
iasi1d_scnlindy	I4	4	1	scan line day of year
iasi1d_scnlintime	I4	4	30	scan line UTC time of day in milliseconds
iasi1d_instrtempa1	I4	4	1	AMSU-A1 RF shelf temp (K*100)
iasi1d_instrtempa2	I4	4	1	AMSU-A2 RF shelf temp (K*100)
iasi1d_instrtempb	I4	4	1	AMSU-B mixer ch 18-20 temp (K*100) (all from the nearest scanlines)
iasi1d_spare1	I4	4	2	spare
iasi1d_latlon	I4	4	2*30	lat/lon in degrees first : 10^4 x (latitude) second : 10^4 x (longitude)
iasi1d_surface	I4	4	2*30	height/type first : surface height (metres) second : surface type (0=sea, 1=mixed, 2=land)
iasi1d_angles	I4	4	4*30	scan angles first: 10^2 x (local zenith angle) second: 10^2 x (local azimuth angle) third: 10^2 x (solar zenith angle) fourth: 10^2 x (solar azimuth angle)
iasi1d_scalti	I4	4	1	sat altitude above reference ellipsoid, km*10
iasi1d_spare2	I4	4	2	spare
AMSU-A+MHS MAPPED TO IASI				
iasi1d_btemps	I4	4	(15+5)*30	10^2 x scene brightness temperature (K) for AMSU-A 1-15, MHS 1-5 10^2 x radiance Wm-2sr-1(cm-1)-1 for channel HIRS 20
iasi1d_iasiqual	I4	4	30	Quality control word for each field of view: (all bits off implies acceptable data)

				[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)
iasi1d_prepro	I4	4	7*30	values from pre-processing **(1,*): pre-processing quality control word with flags** 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 **(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) 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,*) logistic precipitation probability (*100)** **(6,*) spare** **(7,*) spare**
iasi1d_emiss	I4	4	13*30	13 emissivity parameters
IASI DATA				
iasi1d_GQisFlagQual	I4	4	30	1=some anomaly
iasi1d_GQisQualIndex	I4	4	1	NEDT estimated/expected
iasi1d_GQisQualIndexLoc	I4	4	1	IIS/AVHRR co-registration uncertainty
iasi1d_GQisQualIndexRad	I4	4	1	NEDT estimated/expected radiometric
iasi1d_GQisQualIndexSpect	I4	4	1	NEDT estimated/expected spectral
iasi1d_GQisSysTecSondQual	I4	4	1	
iasi1d_scalrad	I4	4	[300]*30	Scaled radiance (default 300 channels)
iasi1d_scores	I4	4	[300]*30	PC scores (default 300 scores)
iasi1d_logfit	I4	4	3*30	Reconstruction Scores for 3 bands
iasi1d_FOV	I4	4	30	30 values in range 1 to 120
AVHRR DATA				
iasi1d_avhcombination	I4	4	1	1 bit for each channel
iasi1d_avhrrmean	I4	4	6*7*30	Scaled mean radiance for 6 channels, 7 classes
iasi1d_avhrrsdev	I4	4	6*7*30	Scaled Std Dev for 6 channels, 7 classes
iasi1d_avhmeanscalefactor	I2	2	6*7*30	

iasi1d_avhsdevscalefactor	I2	2	6*7*30	
iasi1d_avhrrfrac	I4	4	7*30	10^6 x Fraction in each class
iasi1d_avhrrCGy	I4	4	7*30	10^6 x Y angular position of centre of gravity (deg)
iasi1d_avhrrCGz	I4	4	7*30	10^6 x Z angular position of centre of gravity (deg)
CLOUD FLAG (user defined)				
iasi1d_cloudflag	I4	4	10*30	

24.FORMAT OF THE TBUS_NOAA*XX*.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:

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

25. FORMAT OF THE TLE_SSS*XX*.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:

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

26.FORMAT OF THE SPM_SSS*XX*.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

27. FORMAT OF THE CLKERR_NOAA*XX*.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.

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.

28. FORMAT OF THE SATPOS_NOAA*XX*_*YYMMDD*.TXT FILE

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

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
yyyymmdd 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
1st header line	('satellite ',a6)	NOAA name of the satellite
2nd header line	('ground station ',a)	Ground station name
3rd header line	('start date ',a22)	Start date

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

29. 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,
6f6.1,6f5.1,6f5.1,6f5.1,6f5.1)

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 1st coefficients of each sub-block
k2mean(3)	R	3f11.7	Mean of 2nd coefficients of each sub-block
k3mean(3)	R	1f11.7,2f9.2	Mean of 3rd 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.
pspinf(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.

30. 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,i2,20f5.2,20f14.10,20f14.6,20f5.2,20f13.10,20f13.10,4f9.2,4f9.6,4f5.2,19f9.2,19f6.3,19f5.2,19f5.2,19f5.2,19f5.2,19f9.2,19f6.3,19f5.2,19f5.2,19f5.2,19f5.2)

Type
C : character
I4 : integer 4
R : real
DP : double precision

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		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

			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.

31. 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 hirs_historic.txt file: *hirs_historic_file_manage.ksh*
The purpose of the script is :
When the ${HIST} file has a number of lines greater than ${HIST_SIZE_HIGH, it is copied to ${HIST}.0 file.
If ${HIST}.0 file alreday exists, it is moved to ${HIST}.1 .
${HIST}.${HIST_NMAX} can be stored.
The final part of ${HIST} is remained in ${HIST}. The final part is defined from the first line with the chain 'HIRS CALIB INFO' after having remained the last ${HIST_SIZE_LOW} lines of ${HIST} to the last line of ${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 hirs_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) + hang(85,spl))/2/100.	I2	Free	Value of the solar zenith angle 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	'(20l2)'	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	'(l2)'	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
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 2nd 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 2nd 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 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, - 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			'!'	

32. FORMAT OF THE HIRS_B1ASLOPE.TXT FILE

ASCII file of 22 lines

Type
I4 : integer 4
R : real

Line Nb	Name in AAPP code	Type	Format	Meaning
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

33. 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.

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

			good ones and bad ones (missing)
gprt2bpct	R	f7.2	Percent of good PRT 2B values
misprt2bpct	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
gsppct(1)	R	f7.2	Percent of good space view counts, channel 1
missppct(1)	R	f7.2	Percent of missing space view counts, channel 1
ejectsppct(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
gsppct(2)	R	f7.2	Percent of good space view counts, channel 2
missppct(2)	R	f7.2	Percent of missing space view counts, channel 2
ejectsppct(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
gsppct(3)	R	f7.2	Percent of good space view counts, channel 3
missppct(3)	R	f7.2	Percent of missing space view counts, channel 3
ejectsppct(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
gsppct(4)	R	f7.2	Percent of good space view counts, channel 4

missppct(4)	R	f7.2	Percent of missing space view counts, channel 4
ejectsppct(4)	R	f7.2	Percent of rejected space view counts, channel 4
tgcntmn(1)	DP	f10.4	Mean of the target view counts for channel 1
tgcntdev(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
ejecttgpct(1)	R	f7.2	Percent of rejected target view counts, channel 1
tgcntmn(2)	DP	f10.4	Mean of the target view counts for channel 2
tgcntdev(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
ejecttgpct(2)	R	f7.2	Percent of rejected target view counts, channel 2
tgcntmn(3)	DP	f10.4	Mean of the target view counts for channel 3
tgcntdev(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
ejecttgpct(3)	R	f7.2	Percent of rejected target view counts, channel 3
tgcntmn(4)	DP	f10.4	Mean of the target view counts for channel 4
tgcntdev(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,

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

34. FORMAT OF THE MONAMSUA.TXT FILE

This file is empty for the version 6 of AAPP and previous versions

35. FORMAT OF THE MONAMSUB.TXT FILE

This file is empty for the version 6 of AAPP and previous versions

36. FORECAST IN ASCII FORMAT OR IN GRIB FORMAT

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

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 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_ENV6 to the value "grib"

If ASCII file is used:

- Update the variable FORECAST_FORMAT in ~/ATOVS_ENV to the value "ascii"

37. FORMAT FOR A FORECAST FILE IN ASCII

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

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

38. FORMAT OF THE MAPQUAL_NOAA*XX*.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.