

## WMO CODE FORMS CHANGES

*(Submitted by WMO)*

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### Summary and purpose of document

This document explains the last additions to satellite data BUFR descriptors recommended by the CBS/Expert Team on Data Representation and Codes and approved by the President of CBS for their immediate experimental use and with a view to their full operational implementation in November 2005. It also contains a proposed set of additions for ENVISAT data but still awaiting full validation.

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### ACTION PROPOSED

The Meeting is invited to take note of the information contained in this document and express any suggestion, remarks or request found necessary in the field of WMO Codes Forms used for exchange of satellite data.

**Appendices:** A. Additional BUFR Code Table entries for Satellite Data  
B. Additions to BUFR Tables for Satellite Data for Pre-Operational Implementation  
C. New Allocated BUFR Entries for Satellite Data awaiting Validation

### References:

1. Report of meeting of CBS/Expert Team on Data Representation and Codes, Arusha, Tanzania, 17-21 February 2003.
2. WMO pub. No. 306, Manual on Codes, Volume I.2.

1. The Meeting of the CBS/Expert Team on Data Representation and Codes took place in Arusha, Tanzania from 17 to 21 February 2003. The Team approved additions to Code Tables which entered in use immediately after approval by Chair of the CBS/OPAG on Information Systems and Services and the CBS President (see Appendix A). The team examined also the requirements for additions to binary code tables for encoding satellite data and recommended changes to Tables of the BUFR WMO Code Form for experimental pre-operational use with a view to their full operational implementation in November 2005. The Chair of the CBS/OPAG on Information Systems and Services and the CBS President endorsed the proposed additions to binary codes. It is understood that use of the new descriptors in pre-operational mode can be performed prior to November 2005 since these new code additions have been tested and validated. The additions to codes are listed below in Appendix B.

2. A project has been ongoing to validate ENVISAT data. Additions to BUFR for ENVISAT data have been proposed but is still awaiting full validation. The additions to codes are listed below in Appendix C.

## APPENDIX A

### ADDITIONAL BUFR CODE TABLE ENTRIES FOR SATELLITE DATA

- (1) Within existing descriptor 0-02-163 "Height assignment method", add the following new table entry:

0            AUTO EDITOR

- (2) Within existing descriptor 0-01-007 "Satellite identifier", add the following new table entries:

055        METEOSAT-8  
056        METEOSAT-9  
057        METEOSAT-10  
058        METEOSAT-1  
070        METEOSAT-11  
720        TOPEX  
721        GFO (GEOSAT Follow On)

- (3) Cancel the existing entries:

071    MSG1  
072    MSG2  
73    MSG3

## APPENDIX B

**ADDITIONS TO BUFR TABLES FOR PRE-OPERATIONAL IMPLEMENTATION  
(updated 1/04/03)**

**DESCRIPTORS FOR AIRS SATELLITE DATA****In BUFR Table B:**

Log-10 of principal components normalized fit to data  
0-25-052                  Numeric        4        0        15

**In BUFR Table D:**

```
-----
3-10-050     Satellite collocated 1C reports with 3 instruments
-----
   3-10-051     Satellite position and instrument temperatures
   3-10-052     Satellite instrument type and position (AIRS)
   1-01-000     Delayed replication of 1 descriptor
   0-31-002     Extended delayed descriptor replication factor
   3-10-053     Satellite channels and brightness temperatures with
                 expanded channel set (AIRS)
   1-01-004     Replicate 1 descriptor 4 times
   3-10-054     Satellite visible channels and albedos with expanded
                 channel set
   0-20-010     Cloud cover (total)
   3-10-052     Satellite instrument type and position (AMSU-A)
   1-01-015     Replicate 1 descriptor 15 times
   3-10-053     Satellite channels and brightness temperatures with
                 expanded channel set (AMSU-A)
   3-10-052     Satellite instrument type and position (HSB)
   1-01-005     Replicate 1 descriptor 5 times
   3-10-053     Satellite channels and brightness temperatures with
                 expanded channel set (HSB)
-----
```

```
-----
3-10-051     Satellite position and instrument temperatures
-----
```

```

0-01-007     Satellite identifier
0-05-040     Orbit number
2-01-133     Change data width
0-05-041     Scan line number
2-01-000     Cancel change data width
2-01-132     Change data width
0-25-070     Major frame count
2-01-000     Cancel change data width
2-02-126     Change scale
0-07-001     Height of station
2-02-000     Cancel change scale
0-07-025     Solar zenith angle
0-05-022     Solar azimuth
1-02-009     Replicate 2 descriptors 9 times
0-02-151     Radiometer identifier
0-12-064     Instrument temperature

```

-----  
 3-10-052     Satellite instrument type and position  
 -----

0-02-019     Satellite instruments  
 3-01-011     Year, month, day  
 3-01-012     Hour, minute  
 2-02-131     Change scale  
 2-01-138     Change data width  
 0-04-006     Second  
 2-01-000     Cancel change data width  
 2-02-000     Cancel change scale  
 3-01-021     Latitude and longitude (high accuracy)  
 0-07-024     Satellite zenith angle  
 0-05-021     Bearing or azimuth  
 0-05-043     Field of view number

-----  
 ---  
 3-10-053     Satellite channels and brightness temperatures with expanded  
                   channel set  
 -----  
 ---

2-01-134     Change data width  
 0-05-042     Channel number  
 2-01-000     Cancel change data width  
 0-25-076     Log-10 of temperature-radiance central wave number for  
                   ATOVS  
 0-33-032     Channel quality flags for ATOVS  
 0-12-163     Brightness temperature (scale 2)

-----  
 3-10-054     Satellite visible channels and albedos with expanded channel  
 set  
 -----

2-01-134     Change data width  
 0-05-042     Channel number  
 2-01-000     Cancel change data width  
 0-25-076     Log-10 of temperature-radiance central wave number for  
                   ATOVS  
 0-33-032     Channel quality flags for ATOVS  
 2-01-131     Change data width  
 2-02-129     Change scale  
 1-02-002     Replicate 2 descriptors 2 times  
 0-08-023     First-order statistics  
 0-14-027     Albedo  
 0-08-023     First-order statistics  
 2-02-000     Cancel change scale  
 2-01-000     Cancel change data width

-----  
3-10-055      Satellite radiance/channel principle components  
-----

3-10-051      Satellite position and instrument temperatures  
3-10-052      Satellite instrument type and position (AIRS)  
1-02-020      Replicate 2 descriptors 20 times  
0-25-076      Log-10 of temperature-radiance central wave number for  
                 ATOVS  
0-25-052      Log-10 of principal components normalized fit to data  
1-01-000      Delayed replication of 1 descriptor  
0-31-002      Extended delayed descriptor replication factor  
0-25-050      Principal components of satellite radiance

## APPENDIX C

## NEW ALLOCATED BUFR ENTRIES AWAITING VALIDATION

## ADDITIONS FOR ENVISAT DATA

a) **AATSR** - **Advanced Along Track Scanning Radiometer** is the advanced version of the ATSR system operated on ERS1 and ERS2. The main objective of the AATSR is precise measurement of sea surface temperature (SST).

**Proposal for standard WMO BUFR Table B entries:**

-----

001096	STATION ACQUISITION	CCITTIA5	0	0	160
002174	MEAN ACROSS TRACK PIXEL NUMBER	NUMERIC	0	0	9
012180	AVERAGED 12 MICRON BT FOR K ALL CLEAR PIXELS AT NADIR		2	0	16
012181	AVERAGED 11 MICRON BT FOR K ALL CLEAR PIXELS AT NADIR		2	0	16
012182	AVERAGED 3.7 MICRON BT K FOR ALL CLEAR PIXELS AT NADIR		2	0	16
012183	AVERAGED 12 MICRON BT FOR K ALL CLEAR PIXELS, FORWARD VIEW		2	0	16
012184	AVERAGED 11 MICRON BT K FOR ALL CLEAR PIXELS, FORWARD VIEW		2	0	16
012185	AVERAGED 3.7 MICRON BT K FOR ALL CLEAR PIXELS, FORWARD VIEW		2	0	16
012186	MEAN NADIR SEA SURFACE TEMPERATURE	K	2	0	16
012187	MEAN DUAL VIEW SEA SURFACE TEMPERATURE	K	2	0	16
021086	NUMBER OF PIXELS IN NADIR ONLY, AVERAGE	NUMERIC	0	0	9
021087	NUMBER OF PIXELS IN DUAL VIEW, AVERAGE	NUMERIC	0	0	9
033043	AST CONFIDENCE	FLAG TABLE	0	0	8

**033043 FLAG TABLE AST CONFIDENCE**

Bit No.	Meaning
1	SEA MDS. NADIR ONLY SST RETRIEVAL USED 3.7 MICRON CHANNEL. LAND MDS RESERVED
2	SEA MDS. DUAL VIEW SST RETRIEVAL USED 3.7 MICRON CHANNEL. LAND MDS RESERVED
3	NADIR VIEW CONTAINS DAY TIME DATA
4	FORWARD VIEW CONTAINS DAY TIME DATA
5-7	RESERVED
All	MISSING VALUE

**Common Code Table C-5:**

001007 - satellite identifier  
Add 60 for ENVISAT

**Proposal for standard WMO BUFR Table D entries:**

```

312045      - AATSR sea surface temperatures

312045      001007 Satellite identifier
            002019 Satellite instruments
            001096 Station acquisition
            025061 Software identification and version number
            005040 Orbit number
            301011 Date
            301013 Time
            301021 Lat/long
            007002 Height or altitude
            012180 Average 12 micron BT for all clear pixels at nadir
            012181 Average 11 micron BT for all clear pixels at nadir
            012182 Average 3.7 micron BT for all clear pixels at nadir
            012183 Average 12 micron BT for all clear pixels, forward
                    view
            012184 Average 11 micron BT for all clear pixels, forward
                    view
            012185 Average 3.7 micron BT for all clear pixels, forward
                    view
            002174 Mean across track pixel number
            021086 Number of pixels in nadir only, average
            012186 Mean nadir sea surface temperature
            021087 Number of pixels in dual view, average
            012187 Mean dual view sea surface temperature
            033043 ATS confidence

```

**b) SCIAMACHY-** The Scanning Imaging Absorbtion Spectrometer for Atmospheric Cartography. The instrument provides spectra measured from light transmitted, back scattered or reflected by trace gases in the atmosphere (Use standard entry 310020).

**c) MIPAS** - The Michelson Interferometer for Passive Atmospheric Sounding. The instrument measures atmospheric radiation emitted by trace gases in the infrared spectral range 4.14 to 14.6 micro meters.

**BUFR Table B reserved entry:**

```

013098 INTEGRATED WATER VAPOUR KG/M**2      8      0      30
      DENSITY

```

**BUFR table D reserved entry:**

```

310030      310022 Satellite id, product type
            301011 Date
            301013 Time
            301021 Lat/long
            304034 Lat/long, solar elevation, number of layers
            310029 Layer, ozone, height, temperature and water vapour

```



```

310029      110000
             031001 Delayed replication
             201138 Change data width
             202130 Change scale
             007004 Pressure
             007004 Pressure
             202000 Cancel operator
             201000 Cancel operator
             015020 Integrated ozone density
             010002 Height
             012101 Temperature
             013098 Integrated water vapour density

```

**d) GOMOS** - The Global Ozone Monitoring by Occultation of Stars Gomos measures tangential atmospheric ultraviolet, visual and infrared light.

The BUFR template is the same as for **MIPAS** data

**e) MERIS** - The Medium Resolution Imaging Spectrometer: The instrument produces multi-spectral images obtained in a downward viewing push broom imaging manner. The 15 bands acquire radiance in the visible and near infra-red bands.

**BUFR table B reserved entries:**

010080	VIEWING ZENITH ANGLE	DEGREE	2	-9000	15
027080	VIEWING AZIMUTH ANGLE	DEGREE TRUE	2	0	16
013093	CLOUD OPTICAL THICKNESS	NUMERIC	0	0	8
013095	TOTAL COLUMN WATER VAPOUR	KG/M**2	4	0	19

**BUFR table D reserved entries:**

```

312050      001007 Satellite identifier
             002019 Instrument type
             001096 Station acquisition
             025061 Software identification
             005040 Orbit number
             301011 Date
             301013 Time
             301021 Lat/long
             007025 Solar zenith angle
             005022 Solar azimuth
             010080 Viewing zenith angle
             027080 Viewing azimuth angle
             008003 Vertical significance
             007004 Pressure
             013093 Cloud optical thickness
             008003 Vertical significance
             201131 Change data width
             202129 Change scale
             007004 Pressure
             007004 Pressure
             202000 Cancel operator
             201000 Cancel operator
             013095 Total column water vapour

```

**f) ASAR - The Advanced Synthetic Aperture Radar is a high resolution imaging radar.**

Ocean cross spectra - ( WVS )

```

312051      001007 Satellite identifier
            002019 Satellite instrument type
            001096 Station acquisition
            025061 Software identification
            005040 Orbit number
            008075 Ascending/descending orbit qualifier
            301011 Date
            301013 Time
            301021 Lat/long
            001012 Direction of motion of moving observing platform
            201131 Change data width
            001013 Speed of motion of moving observing platform
            201000 Cancel operator
            010032 Satellite distance to Earth centre
            010033 Altitude (platform to ellipsoid)
            010034 Earth radius
            007002 Height
            008012 Land/sea qualifier
            025110 Image processing summary
            025111 Number of input data gaps
            025102 Number of missing lines excluding data gaps
            002104 Antenna polarisation
            025103 Number of directional bins
            025104 Number of wave-length bins
            025105 First directional bin
            025106 Directional bin step
            025107 First wave-length bin
            025108 Last wave-length bin
            002111 Radar incidence angle
            002121 Mean frequency
            002026 Cross track resolution
            002027 Along track resolution
            021130 Spectrum total energy
            021131 Spectrum maximum energy
            021132 Direction of spectrum max on higher resolution grid
            021133 Wavelength of spectrum max on higher resolution grid
            021064 Clutter noise estimate
            025014 Azimuth clutter cut-off
            021134 Range resolution of cross covariance spectrum
            107018 Replicate next 7 descriptors 18 times
            005030 Direction (spectral)
            105024 Replicate 5 descriptors 24 time
            201130 Change data width
            006030 Wave number (spectral)
            201000 Cancel operator
            021135 Real part of cross spectra
            021136 Imaginary part of cross spectra
            033044 ASAR quality

```

**New Table B descriptors**

010032	SATELLITE DISTANCE TO EARTH CENTRE	M	1	0	27
010033	ALTITUDE (PLATFORM TO ELLIPSOID)	M	1	0	27
010034	EARTH RADIUS	M	1	0	27
025110	IMAGE PROCESSING SUMMARY	FLAG TABLE	0	0	10
025111	NUMBER OF INPUT DATA GAPS	NUMERIC	0	0	8

025102	NUMBER OF MISSING LINES EXCLUDING NUME DATA GAPS		0	0	8
025103	NUMBER OF DIRECTIONAL BINS	NUMERIC	0	0	8
025104	NUMBER OF WAVE-LENGHT BINS	NUMERIC	0	0	8
025105	FIRST DIRECTIONAL BIN	DEGREES	3	0	19
025106	DIRECTIONAL BIN STEP	DEGREES	3	0	19
025107	FIRST WAVE-LENGHT BIN	M	3	0	29
025108	LAST WAVE-LENGHT BIN	M	3	0	29
021130	SPECTRUM TOTAL ENERGY	NUMERIC	6	0	28
021131	SPECTRUM MAX ENERGY	NUMERIC	6	0	28
021132	DIRECTION OF SPECTRUM MAX ON HIGHER RESOLUTION GRID	DEGREES	3	0	19
021133	WAVE-LENGHT OF SPECTRUM MAX ON HIGHER RESOLUTION GRID	M	3	0	29
021134	RANGE RESOLUTION OF CRESS COVARIANCE SPECTRUM	RAD/M	3	0	19
021135	REAL PART OF CROSS SPECTRA POLAR GRID NUMBER OF BINS	NUMERIC	3	-524288	20
021136	IMAGINARY PART OF CROSS SPECTRA POLAR GRID NUMBER OF BINS	NUMERIC	3	-524288	20
033044	ASAR QUALITY INFORMATION	FLAG TABLE	0	0	15

**Flag table 025110 IMAGE PROCESSING SUMMARY**

bit number	Meaning
1	Raw data analysis used for raw data correction. Correction done using default parameters
2	Raw data analysis used for raw data correction. Correction done using raw data analysis results
3	Antenna elevation pattern correction applied
4	Nominal chirp replica used
5	Reconstructed chirp used
6	Slant range to ground range Conversion applied
7-9	Reserved
All 10	Missing value

**Flag table 033044 ASAR QUALITY INFORMATION**

bit number	Meaning
1	Input data mean outside nominal range flag
2	Input data standard deviation outside nominal range flag
3	Number of input data gaps > threshold value
4	Percentage of missing lines > threshold value
5	Doppler centroid uncertain. Confidence measure < specific value
6	Doppler ambiguity estimate uncertain. Confidence measure < specific value
7	Output data mean outside nominal range flag
8	Output data standard deviation outside nominal range flag
9	Chirp reconstruction failed or is of low quality flag
10	Data set missing
11	Invalid downlink parameters
12	Azimuth cut-off iteration count. The azimuth cut-off fit did not converge within minimum number of iterations
13	Azimuth cut-off fit did not converge within a minimum number of iterations

14 Phase information confidence measure. The imaginary spectral peak is less than a minimum threshold, or the zero lag shift is greater than a minimum threshold  
 All 15 Missing value

**OCEAN WAVE SPECTRA****Table D sequence**

312053 001007 Satellite identifier  
 002019 Satellite instrument type  
 001096 Station acquisition  
 025061 Software identification and version number  
 005040 Orbit number  
 008075 Ascending/descending orbit qualifier  
 301011 Date  
 301013 Time  
 301021 Lat/long  
 001012 Direction of motion of moving observing platform  
 201131 Change data width  
 001013 Speed of motion of moving observing platform  
 201000 Cancel operator  
 010032 Satellite distance to Earth centre  
 010033 Altitude (platform to ellipsoid)  
 010034 Earth radius  
 007002 Height or altitude  
 008012 Land/sea qualifier  
 025110 Image processing summary  
 025111 Number of input data gaps  
 025102 Number of missing lines excluding data gaps  
 002104 Antenna polarisation  
 025103 Number of directional bins  
 025104 Number of wave-length bins  
 025105 First directional bin  
 025106 Directional bin step  
 025107 First wave-length bin  
 025108 Last wave-length bin  
 011001 Wind direction  
 011002 Wind speed  
 022160 Normalized inverse wave age  
 025138 Average signal to noise ratio  
 201130 Change data width  
 202129 Change scale  
 022021 Height of waves  
 202000 Cancel operator  
 201000 Cancel operator  
 033048 Confidence measure for SAR inversion  
 033049 Confidence measure for wind retrieval  
 002026 Cross track resolution  
 002027 Along track resolution  
 021130 Spectrum total energy  
 021131 Spectrum max energy  
 021132 Direction of spectrum max  
 021133 Wave-length of spectrum max  
 025014 Azimuth clutter cut-off  
 106036 Replicate 6 descriptors 36 times  
 005030 Direction (spectral)  
 104024 Replicate 4 descriptors 24 time

201130 Change data width  
 006030 Wave number (spectral)  
 201000 Cancel operator  
 022161 Wave spectra  
 033044 ASAR quality

**Table B descriptors**

022160	NORMALIZED INVERSE WAVE AGE	NUMERIC	6	0	21
025138	AVERAGE SIGNAL TO NOISE RATIO	NUMERIC	0	-2048	12
033048	CONFIDENCE MEASURE OF SAR INVERSION	CODE TABLE	0	0	2
033049	CONFIDENCE MEASURE OF WIND RETRIEVAL	CODE TABLE	0	0	2
022161	WAVE SPECTRA	M**4	4	0	27

**Code table 033048 CONFIDENCE MEASURE OF SAR INVERSION**

code figure	Meaning
0	inversion successful
1	inversion not successful
2	reserved
3	Missing

**Code table 033049 CONFIDENCE MEASURE OF WIND RETRIEVAL**

code figure	Meaning
0	external wind direction used during inversion
1	External wind direction not used during inversion
2	reserved
3	Missing

**g) RA2 - Radar Altimeter-2**

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312052 001007 Satellite identifier  
 002019 Satellite instrument type  
 001096 Station acquisition  
 025061 Software identification  
 005040 Orbit number  
 025120 Ra2 L2 processing flag  
 025121 Ra2 L2 processing quality  
 025124 MWR L2 processing flag  
 025125 MWR L2 processing quality  
 025122 Hardware configuration for RF  
 025123 Hardware configuration for HPA  
 301011 Date  
 301013 Time  
 301021 Lat/long  
 007002 Height or altitude  
 002115 Instrument operations  
 033047 Measurement confidence data  
 010081 Altitude of COG above reference ellipsoid

010082 Instantaneous altitude rate  
 010083 Off nadir angle of the satellite from platform data  
 010084 Off nadir angle of the satellite from waveform data  
 002116 Percentage of 320 MHz band processed  
 002117 Percentage of 80 MHz band processed  
 002118 Percentage of 20 MHz band processed  
 002156 Percentage of valid Ku ocean retracker measurements  
 002157 Percentage of valid S ocean retracker measurements  
 014055 Solar activity index  
 022150 Number of 18 Hz valid points for Ku band  
 022151 Ku band ocean range  
 022152 STD of 18Hz Ku band ocean range  
 022153 Number of 18 Hz valid points for S band  
 022154 S band ocean range  
 022155 STD of 18 Hz S band ocean range  
 022156 Ku band significant wave height  
 022157 STD of 18 Hz Ku band significant wave height  
 022158 S band significant wave height  
 022159 STD 18 Hz S band significant wave height  
 021137 Ku band corrected ocean backscatter coefficient  
 021138 STD Ku band corrected ocean backscatter coefficient  
 021139 Ku band net instrumental correction for AGC  
 021140 S band corrected ocean backscatter coefficient  
 021141 STD S band corrected ocean backscatter coefficient  
 021142 S band net instrumental correction for AGC  
 010085 Mean sea surface height  
 010086 Geoid height  
 010087 Ocean depth/land elevation  
 010088 Total geocentric ocean tide height solution 1  
 010089 Total geocentric ocean tide height solution 2  
 010090 Long period tide height  
 010091 Tidal loading height  
 010092 Solid earth tide height  
 010093 Geocentric pole tide height  
 011002 wind speed  
 025126 Model dry tropospheric correction  
 025127 Inverted barometer correction  
 025128 Model wet tropospheric correction  
 025129 MWR derived wet tropospheric correction  
 025130 Ra2 ionospheric correction on Ku band  
 025131 Ionospheric correction from Doris on Ku band  
 025132 Ionospheric correction from model on Ku band  
 025133 Sea state bias correction on Ku band  
 025134 Ra2 ionospheric correction on S band  
 025135 Ionospheric correction from Doris on S band  
 025136 Ionospheric correction from model on S band  
 025137 Sea state bias correction on S band  
 013096 MWR water vapour content  
 013097 MWR liquid water content  
 011085 u component of model wind vector  
 011086 v component of model wind vector  
 012188 Interpolated 23.8 GHz brightness temp from MWR  
 012189 Interpolated 36.5 GHz brightness temp from MWR  
 002158 RA- 2 instrument  
 002159 MWR instrument  
 033052 S band ocean retracking quality  
 033053 Ku band ocean retracking quality  
 021143 Ku band rain attenuation  
 021144 Altimeter rain flag

**Table B descriptors**

002119	RA - 2 INSTRUMENT OPERATIONS	CODE TABLE	0	0	3
002116	PERCENTAGE OF 320 MHZ BAND PROCESSED	%	0	0	7
002117	PERCENTAGE OF 80 MHZ BAND PROCESSED	%	0	0	7
002118	PERCENTAGE OF 20 MHZ BAND PROCESSED	%	0	0	7
002156	PERCENTAGE OF VALID KU OCEAN RETRACKER MEASUREMENTS	%	0	0	7
002157	PERCENTAGE OF VALID S OCEAN RETRACKER MEASUREMENTS	%	0	0	7
002158	RA - 2 INSTRUMENT	FLAG TABLE	0	0	9
002159	MWR INSTRUMENT	FLAG TABLE	0	0	8
010081	ALTITUDE OF COG ABOVE REFERENCE ELLIPSOID	M	3	0	31
010082	INSTANTANEOUS ALTITUDE RATE	M/S	3	-65536	17
010083	OFF NADIR ANGLE OF THE SATELLITE FROM PLATFORM DATA	DEGREE	2	-36000	17
010084	OFF NADIR ANGLE OF THE SATELLITE FROM WAVEFORM DATA	DEGREE	2	-36000	17
010085	MEAN SEA SURFACE HEIGHT	M	3	-131072	18
010086	GEOID HEIGHT	M	3	-131072	18
010087	OCEAN DEPTH/LAND ELEVATION	M	1	-131072	18
010088	TOTAL GEOCENTRIC OCEAN TIDE HEIGHT SOLUTION 1	M	3	-32768	16
010089	TOTAL GEOCENTRIC OCEAN TIDE HEIGHT SOLUTION 2	M	3	-32768	16
010090	LONG PERIOD TIDE HEIGHT	M	3	-32768	16
010091	TIDAL LOADING HEIGHT	M	3	-32768	16
010092	SOLID EARTH TIDE HEIGHT	M	3	-32768	16
010093	GEOCENTRIC POLE TIDE HEIGHT	M	3	-32768	16
011095	U COMPONENT OF THE MODEL WIND VECTOR	M/S	1	-4096	13
011096	V COMPONENT OF THE MODEL WIND VECTOR	M/S	1	-4096	13
012188	INTERPOLATED 23.8 GHZ BRIGHTNESS T FROM MWR	K	2	0	16
012189	INTERPOLATED 36.5 GHZ BRIGHTNESS T FROM MWR	K	2	0	16
013096	MWR WATER VAPOUR CONTENT	KG/M**2	2	0	14
013097	MWR LIQUID WATER CONTENT	KG/M**2	2	0	14
014055	SOLAR ACTIVITY INDEX	NUMERIC	0	-32768	16
021137	KU BAND CORRECTED OCEAN BACKSCATTER COEFFICIENT	DB	2	-32768	16
021138	STD KU BAND CORRECTED OCEAN BACKSCATTER COEFFICIENT	DB	2	-32768	16
021139	KU BAND NET INSTRUMENTAL CORRECTION FOR ACG	DB	2	-2048	12
021140	S BAND CORRECTED OCEAN BACKSCATTER COEFFICIENT	DB	2	-32768	16
021141	STD S BAND CORRECTED OCEAN BACKSCATTER COEFFICIENT	DB	2	-32768	16
021142	S BAND NET INSTRUMENTAL CORRECTION FOR ACG	DB	2	-1024	11
021143	KU BAND RAIN ATTENUATION	DB	2	-1073741824	31
021144	ALTIMETER RAIN FLAG	FLAG TABLE	0	0	2
022150	NUMBER OF 18 HZ VALID POINTS FOR KU BAND	NUMERIC	0	0	10
022151	KU BAND OCEAN RANGE	M	3	0	31
022152	STD OF 18 HZ KU BAND OCEAN RANGE	M	3	0	16
022153	NUMBER OF 18 HZ VALID POINTS FOR S BAND	NUMERIC	0	0	10

022154	S BAND OCEAN RANGE	M	3	0	31
022155	STD OF 18 HZ S BAND OCEAN RANGE	M	3	0	16
022156	KU BAND SIGNIFICANT WAVE HEIGHT	M	3	0	16
022157	STD 18 HZ KU BAND SIGNIFICANT WAVE HEIGHT	M	3	0	16
022158	S BAND SIGNIFICANT WAVE HEIGHT	M	3	0	16
022159	STD 18 HZ S BAND SIGNIFICANT WAVE HEIGHT	M	3	0	16
025120	RA2_L2_PROCESSING FLAG	CODE TABLE	0	0	2
025121	RA2_L2_PROCESSING QUALITY	%	0	0	7
025122	HARDWARE CONFIGURATION FOR RF	CODE TABLE	0	0	2
025123	HARDWARE CONFIGURATION FOR HPA	CODE TABLE	0	0	2
025124	MWR L2 PROCESSING FLAG	CODE TABLE	0	0	2
025125	MWR L2 PROCESSING QUALITY	%	0	0	7
025126	MODEL DRY TROPOSPHERIC CORRECTION	M	3	-32768	16
025127	INVERTED BAROMETER CORRECTION	M	3	-32768	16
025128	MODEL WET TROPOSPHERIC CORRECTION	M	3	-32768	16
025129	MWR DERIVED WET TROPOSPHERIC CORRECTION	M	3	-32768	16
025130	RA2 IONOSPHERIC CORRECTION ON KU BAND	M	3	-32768	16
025131	IONOSPHERIC CORRECTION FROM DORIS ON KU BAND	M	3	-32768	16
025132	IONOSPHERIC CORRECTION FROM MODEL ON KU BAND	M	3	-32768	16
025133	SEA STATE BIAS CORRECTION ON KU BAND	M	3	-32768	16
025134	RA2 IONOSPHERIC CORRECTION ON S BAND	M	3	-32768	16
025135	IONOSPHERIC CORRECTION FROM DORIS ON S BAND	M	3	-32768	16
025136	IONOSPHERIC CORRECTION FROM MODEL ON S BAND	M	3	-32768	16
025137	SEA STATE BIAS CORRECTION ON S BAND	M	3	-32768	16
033052	S BAND OCEAN RETRACKING QUALITY	FLAG TABLE	0	0	21
033053	KU BAND OCEAN RETRACKING QUALITY	FLAG TABLE	0	0	21
033047	MEASUREMENT CONFIDENCE DATA FLAG TABLE		0	0	31

**Code table 002180 INSTRUMENT OPERATIONS**

Code figure	Meaning
0	Intermediate Frequency Calibration Mode (IF CAL)
1	Built-In Test Equipment Digital (BITE DGT)
2	Built-In test Equipment Radio Frequency (BITE RF)
3	Preset tracking ( PSET TRK)
4	Preset LOOP OUT
5	ACQUISITION
6	TRACKING
7	MISSING VALUE



**Flag table 002158 RA - 2 INSTRUMENT**

bit number	Meaning
1	MISMATCH IN RED VEC HPA
2	MISMATCH IN RED VEC RFSS
3	PTR CALIBRATION BAND 320 MHz (Ku)
4	PTR CALIBRATION BAND 80 MHz (Ku)
5	PTR CALIBRATION BAND 20 MHz (Ku)
6	PTR CALIBRATION BAND 160 MHz (S)
7	Ku FLIGHT CALIBRATION PARAMETERS AVAILABLE
8	S FLIGHT CALIBRATION PARAMETERS AVAILABLE
All	Missing value

PTR - Pulse target response  
 HPA - High Power Amplifier  
 RFSS - Radio Frequency Sub-System  
 RED - Redundancy

**Flag table 002159 MWR INSTRUMENT**

bit number	Meaning
1	Temperature inconsistency
2	Data is missing
3	Redundancy channel
4	Power bus protection
5	Overvoltage/Overload protection
6	Reserved
7	Reserved
ALL	Missing

MWR - Microwave radiometer

**Flag table 021144 Altimeter rain flag**

bit number	Meaning
1	RAIN
all	Missing value

**Code table 025120 RA2\_12\_processing flag**

code figure	Meaning
0	Percentage of DSRs free of processing errors during Level 2 processing is greater than the acceptable threshold
1	Percentage of DSRs free of processing errors during Level 2 processing is less than the acceptable threshold
2	Reserved
3	Missing value

DSR - Data set record

**Code table 025122      Hardware configuration for RF**

Code figure	Meaning
0	Hardware configuration for RF is A
1	Hardware configuration for RF is B
2	Reserved
3	Missing

RF - Radio frequency

**Code table 025123      Hardware configuration for HPA**

Code figure	Meaning
0	Hardware configuration for HPA is A
1	Hardware configuration for HPA is B
2	Reserved
3	Missing

**Code table 025124      MWR 12 processing flag**

Code figure	Meaning
0	Percentage of DSRs free of processing errors during Level 2 processing is greater than the acceptable threshold
1	Percentage of DSRs free of processing errors during Level 2 processing is less than the acceptable threshold
2	Reserved
3	Missing

DSR - Data Set Record  
MWR - Microwave radiometer

**Flag table 033053      Ku band ocean retracking quality**

bit number	Meaning
1-20 values	First 20 least significant bits correspond to the 20 values  (one per data block containing 0=valid measurement, 1=invalid) bit 1 applies to the 20th data block
All	Missing

**Flag table 033052      S band ocean retracking quality**

bit number	Meaning
1-20 values	First 20 least significant bits correspond to the 20 values  (one per data block containing 0=valid measurement, 1=invalid) bit 1 applies to the 20th data block
All	Missing

**Flag table 033047      Measurement confidence data**

bit number	Meaning
1	Error detected and attempts to recover made
2	Anomaly in on-board data handling (OBDH) value
detected	
3	Anomaly in Ultra Stable Oscillator Processing (USOP) value detected
4	Errors detected by on-board computer
5	Automatic gain control (AGC) out of range
6	Rx delay fault. Rx distance out of range
7	Wave form samples fault identifier. Error
8	Reserved
9	Reserved
10	Reserved
11	Reserved
12	Brightness temperature (channel 1) out of range
13	Brightness temperature (channel 2) out of range
14	Reserved
15	Ku Ocean retracking error
16	S Ocean retracking error
17	Ku Ice 1 retracking error
18	S Ice 1 retracking error
19	Ku Ice 2 retracking error
20	S Ice 2 retracking error
21	Ku Sea Ice retracking error
22	Arithmetic fault error
23	Meteo data state. No map
24	Meteo data state. 1 map
25	Meteo data state 2 maps degraded
26	Meteo data state 2 maps nominal
27	Orbit propagator status for propagation mode, several errors
28	Orbit propagator status for propagation mode, warning detected
29	Orbit propagator status for initialisation mode, several errors
30	Orbit propagator status for initialisation mode, warning detected
All 31	Missing

**NEW DESCRIPTOR FOR:**

Satellite zenith angle				
0-07-026	Degrees	4	-900000	21