CGMS

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STATUS OF NEW REQUEST FOR SATELLITE DATA REPRESENTATION IN WMO GRIB 2 OR BUFR CODES

In response to CGMS Actions 34.27 and 34.28

This document summarizes the recommendations of the last meeting of the Commission for Basic Systems (CBS-Ext.(06)) related to satellite data representation and the last recommendations of the CBS/Expert Team on Data Representation and Codes related to additions for satellite data GRIB 2 and BUFR codes.

Annex 1 contains the allocated BUFR entries for GHRSST data, currently in pre-operational status. Annex 2 contains the proposed entries for encoding Jason-2 data, currently submitted for validation.

Bearing in mind that CGMS Actions 34.27 and 34.28 foresee the setting up of a dedicated Task Force on Codes to review such issues in detail, CGMS Members are invited to take note and provide guidance to the future Task Force as appropriate.

STATUS OF NEW REQUEST FOR SATELLITE DATA REPRESENTATION IN WMO GRIB 2 OR BUFR CODES

1 APPROVAL BY CBS-EXT.(06)

CBS-Ext.(06) approved additions in GRIB 2 Code for fire detection from space and for clear sky reflectance.

CBS-Ext.(06) approved additions in BUFR Code for:

- Data on Tropical cyclone analysed by satellite images;
- The European polar orbiting satellite data with the instruments MHS, IASI and ASCAT.

2 ROLE OF CGMS IN THE COORDINATION OF THE APPROACH TO ACCOMMODATE SATELLITE DATA IN BUFR CODE TABLES

During its last session, the CBS Expert Team on Data Representation and Codes (ET/DR&C) (EUMETSAT, April 2007) discussed the issues for making a new Master Table for satellite data in BUFR. Three main problems were identified: the management of the new Master Table; the respect of BUFR regulations, especially for additions; and the implementation of the process. Starting a new Master Table would require some coordination and commitment from the parties concerned. Whether the requirements for representing new satellite data in BUFR were met by the introduction of a new BUFR Master Table or by the allocation of specific classes of descriptors, the coordination of this process would be simplified by the involvement of an independent group of experts. In this case such a group could be a Working Group of CGMS. It is expected that the CGMS Task Force on Codes for satellite data will meet for the first time during 2008. The task force, in accordance to its terms of reference, should nominate a rapporteur to link between this Task Force and the CBS ET/DR&C. The Task Force will coordinate requests for additions to BUFR Codes, related to satellite data and will also consider the creation of a Master Table specifically for Satellite data. Its recommendations will be considered at the next session of the ET/DR&C in the second quarter of 2008.

3 RECOMMENDATIONS FOR ADDITIONS FOR NEW SATELLITE DATA

The ET/DR&C considered requests for additions for new satellite data and made the following recommendations.

3.1 Atmospheric divergence

At the request of its users, EUMETSAT has introduced an atmospheric divergence product. This product is derived from the atmospheric motion vector fields produced from the 6.2 micron channel on METEOSATs 8 and 9. These data are currently being disseminated via the EUMETCast DVB multicast service. In order to standardize the GRIB encoding of the data, an addition to Code table 4.2 has been approved by the Team.

Code Table 4.2, Product Discipline 3 – Space products, Parameter category 1: quantitative products
Add:
Number 13, Parameter = Atmospheric divergence, Units = s-1

3.2 New descriptors for GHRSST data

The Global Ocean Data Assimilation Experiment (GODAE) high-resolution sea surface temperature pilot project (GHRSST-PP) provides a new generation of global high-resolution (<10km) SST data products to the operational oceanographic, meteorological, climate and general scientific community, in near real time and delayed mode. The project involves a wide range of international participants who have invested a great deal in delivering high quality SST products. There is a requirement to exchange GHRSST data between operational centres in a WMO standard format. Although the GHRSST standard product is delivered in NetCDF, and is being converted to BUFR at the UK Met Office for operational use, this necessitates the use of suitable descriptors for the exchange of these data. These descriptors are now being used operationally at the UK Met Office. The team agreed to declare these descriptors pre-operational (see Annex 1).

3.3 Entries for encoding of JASON-2 data

EUMETSAT intends to encode the OGDR (Operational Geophysical Data Record) data from JASON-2 in BUFR in order to exchange the data on the GTS and via satellite dissemination on EUMETCast. New entries are proposed for validation as listed in Annex 2.

4 REQUEST BY EUMETSAT FOR NEW ENTRIES FOR QUALIFICATION OF RARS SATELLITE REPORTS

In accordance with Action RARS-IG-1.4 from the 1st Meeting of the WMO RARS Implementation Group (see WMO-WP-25 and:

http://www.wmo.int/pages/prog/sat/documents/RARS-IG-1FinalReport.pdf),

EUMETSAT requested on 1 October 2007 the addition of the following entries to Common Code Table C-13:

Category 003 - Vertical soundings (satellite)
Add:
002 - ATOVS
003 - AMSU-A
004 - AMSU-B
005 - HIRS
006 - MHS
007 - IASI

(Note that ATOVS refers here to level 2 products based on the ATOVS suite of instruments, while AMSU-A, AMSU-B, HIRS and MHS refer to level 1 data from the individual ATOVS instruments).

Category 012 - Surface data (satellite)
Add
007 - ASCAT

These additional entries to the table of international sub-categories will facilitate the unambiguous exchange of satellite data between operators and users via the GTS as part of the RARS initiative.

5 CONCLUSIONS

CGMS Members are invited to take note and provide guidance as appropriate to the future Task Force on Codes.

6 REFERENCES

- Abridged Final Report of CBS-Ext.(06), Seoul, 9-16 November 2006
- Meeting of the Expert Team on Data Representation and Codes (ET/DR&C) EUMETSAT, 23-27 April 2007
- WMO pub. No. 306, Manual on Codes, Volume I.2.

ANNEX 1

(PREOPERATIONAL)

DESCRIPTORS TO BE USED WHEN EXCHANGING GHRSST DATA:

Table Reference	*Element name*	*BUFR*				*CREX*		
F X Y		*Unit*	*Scale*	*Ref. value*	*Data width (bits)*	*Unit*	*Scale*	*Data width (chars)*
0 25 037	SST bias	K	2	-127	8	K	2	3
0 14 035	Solar Radiation Flux	W m^{-2}	1	0	14			
0 25 022	GHRSST Rejection Flag	Flag table	0	0	9			
0 25 023	GHRSST Confidence Flag	Flag table	0	0	9			
0 25 024	GHRSST data quality.	Code table	0	0	4			
0 01 028	Aerosol optical Depth (AOD) source	Code table	0	0	5			
0 01 024	Wind Speed source	Code Table	0	0	5			
0 01 029	SSI Source	Code Table	0	0	5			
0 01 038	Source of Sea Ice Fraction	Code Table	0	0	5			
0 25 038	Difference between SST and analysis	K	1	-127	8	K	1	3
0 22 046	Sea Ice Fraction	Numeric	2	0	7			

0 25 022 - GHRSST Rejection Flag

Bit No.	
1	Unprocessed
2	Land suspected.
3	Wind speed too large
4	Ice detected.
5	Rain detected (Microwave retrievals only)
6	Cloudy detected (Infra-red retrievals only)
7	Cosmetic value
8	SST out of range
All 9	Missing value

0 25 023 - GHRSST Confidence Flag

Bit No.	
1	Default confidence value has been used.
2	Default bias and standard deviation has been used.
3	Sun glint suspected
4	Sea ice retrieval for microwave data
5	High wind speed retrieval
6	Inaccurate SST due to low SST (< 285K). (Only applies to the TMI instrument).
7	Relaxed rain contamination suspected
8	Potential side lobe contamination
All 9	Missing value

0 25 024 – GHRSST proximity confidence.

Code figure	
0	Unprocessed infrared retrieval
1	Cloudy retrievals.
2	Bad: Data that are probably contaminated by cloud.
3	Suspect data.
4	Acceptable data.
5	Excellent data.
6	Cool skin suspected.
7-9	Reserved
10	Unprocessed microwave retrieval.
11	Questionable microwave retrieval that may be contaminated.
12	Acceptable microwave retrieval.
13	High probability of diurnal variability.
14	Reserved
15	Missing value

0 01 028 - Aerosol optical Depth (AOD) source

Code figure	
0	No AOD data available
1	NESDIS
2	NAVOCEANO
3	NAAPS
4	MERIS
5	AATSR
6-30	Reserved for future use
31	**Missing value**

0 01 024 - Wind Speed source

Code figure	
0	No wind speed data available
1	AMSR-E data
2	TMI data
3	NWP: ECMWF
4	NWP: UK Met Office
5	NWP: NCEP
6	Reference climatology
7	ERS_Scatterometer
8-30	Reserved for future use
31	**Missing value**

0 01 029 - SSI Source

Code figure	
0	No SSI data available
1	MSG_SEVIRI
2	GOES East
3	GOES West
4	ECMWF
5	NCEP
6	UK Met Office
7-30	Reserved for future use
31	**Missing value**

0 01 038 - Source of Sea Ice Fraction

Code figure	
0	No sea ice set
1	NSIDC SSM/I Cavalieri et al (1992)
2	AMSR-E
3	ECMWF
4	CMS (France) cloud mask used by Medspiration
5	EUMETSAT OSI-SAF
6-30	Reserved for future use
31	**Missing value**

ANNEX 2

(FOR VALIDATION)

PROPOSED ENTRIES FOR THE ENCODING OF JASON-2 OGDR DATA

It is proposed to use the following sequence of entries for the encoding of the JASON2 OGDR data (new entries are in *italicised and underlined*):

BUFR	Description	*Min*	*Max*	Unit	Scale	Reference	Width
F X Y	**Satellite**						
0 01 007	SATELLITE IDENTIFIER						
0 02 019	SATELLITE INSTRUMENTS						
0 01 096	ACQUISITION STATION IDENTIFIER						
0 25 061	SOFTWARE IDENTIFICATION						
0 05 044	SATELLITE CYCLE NUMBER						
0 05 040	ORBIT NUMBER						
0 01 030	NUMERICAL MODEL IDENTIFIER						
	Datation						
0 04 001	YEAR						
0 04 002	MONTH						
0 04 003	DAY						
0 04 004	HOUR						
0 04 005	MINUTE						
0 04 007	SECONDS WITHIN A MINUTE						
	Location and Surface Type						
0 05 001	LATITUDE (HIGH ACCURACY)	-70	70				
0 06 001	LONGITUDE (HIGH ACCURACY)	0	360				
0 08 029	REMOTELY SENSED SURFACE TYPE						
0 08 074	ALTIMETER ECHO TYPE						
0 08 077	*RADIOMETER SENSED SURFACE TYPE*	-	-	*CODE TABLE*	*0*	*0*	*7*
	Flags						
0 40 011	*INTERPOLATION FLAG*	-	-	*FLAG TABLE*	*0*	*0*	*8*
0 25 090	*ORBIT STATE FLAG*	-	-	*CODE TABLE*	*0*	*0*	*4*
0 25 095	ALTIMETER STATE FLAG			CODE TABLE			
0 25 098	*ALTIMETER DATA QUALITY FLAG*	-	-	*FLAG TABLE*	*0*	*0*	*9*
0 25 099	*ALTIMETER CORRECTION QUALITY FLAG*	-	-	*FLAG TABLE*	*0*	*0*	*9*
0 21 144	ALTIMETER RAIN FLAG						

0 25 096	RADIOMETER STATE FLAG						
0 40 012	*RADIOMETER DATA QUALITY FLAG*	-	-	*FLAG TABLE*	*0*	*0*	*8*
0 40 013	*RADIOMETER BRIGHTNESS TEMPERATURE INTERPRETATION FLAG*	-	-	*CODE TABLE*	*0*	*0*	*3*
0 21 169	*ICE PRESENCE INDICATOR*	-	-	*CODE TABLE*	*0*	*0*	*2*
	Altimeter: Ku Band						
0 22 151	KU BAND OCEAN RANGE						
0 22 162	*RMS OF 20 Hz KU BAND OCEAN RANGE*	-	-	*M*	*3*	*0*	*16*
0 22 163	*NUMBER OF 20Hz VALID POINTS FOR KU BAND*	-	-	*NUMERIC*	*0*	*0*	*10*
0 25 160	*KU BAND NET INSTRUMENTAL CORRECTION*	*-120000*	*120000*	*M*	*4*	*-120000*	*18*
0 25 133	SEA STATE BIAS CORRECTION ON KU BAND						
0 22 156	KU BAND SIGNIFICANT WAVE HEIGHT						
0 22 164	*RMS 20 HZ KU BAND SIGNIFICANT WAVE HEIGHT*	-	-	*M*	*3*	*0*	*16*
0 22 165	*NUMBER OF 20HZ VALID POINTS FOR KU BAND SIGNIFICANT WAVE HEIGHT*	-	-	*NUMERIC*	*0*	*0*	*10*
0 22 166	*KU BAND NET INSTRUMENTAL CORRECTION FOR SIGNIFICANT WAVE HEIGHT*	*-1000*	*1000*	*M*	*3*	*-1000*	*11*
0 21 137	KU BAND CORRECTED OCEAN BACKSCATTER COEFFICIENT						
0 21 138	STD KU BAND CORRECTED OCEAN BACKSCATTER COEFFICIENT						
0 22 167	*NUMBER OF VALID POINTS FOR KU BAND BACKSCATTER*	-	-	*NUMERIC*	*0*	*0*	*10*
0 21 139	KU BAND NET INSTRUMENTAL CORRECTION FOR AGC						
0 21 118	ATTENUATION CORRECTION ON SIGMA-0						
0 21 145	*KU BAND AUTOMATIC GAIN CONTROL*	-	-	*DB*	*2*	*0*	*13*
0 21 146	*RMS KU BAND AUTOMATIC GAIN CONTROL*	-	-	*DB*	*2*	*0*	*8*
0 21 147	*NUMBER OF VALID POINTS FOR KU BAND AUTOMATIC GAIN CONTROL*	-	-	*NUMERIC*	*0*	*0*	*5*
	Altimeter: C band						
0 22 168	*C BAND OCEAN RANGE*	-	-	*M*	*3*	*0*	*31*
0 22 169	*RMS OF C BAND OCEAN RANGE*	-	-	*M*	*3*	*0*	*16*
0 22 170	*NUMBER OF 20Hz VALID POINTS FOR C BAND*	-	-	*NUMERIC*	*0*	*0*	*10*

0 25 161	*C BAND NET INSTRUMENTAL CORRECTION*	*-120000*	*120000*	*M*	*4*	*-120000*	*18*
0 25 162	*SEA STATE BIAS CORRECTION ON C BAND*	*-6000*	*0*	*M*	*4*	*-6000*	*13*
0 22 171	*C BAND SIGNIFICANT WAVE HEIGHT*	-	-	*M*	*3*	*0*	*16*
0 22 172	*RMS 20HZ C BAND SIGNIFICANT WAVE HEIGHT*	-	-	*M*	*3*	*0*	*16*
0 22 173	*NUMBER OF 20HZ VALID POINTS FOR C BAND SIGNIFICANT WAVE HEIGHT*	-	-	*NUMERIC*	*0*	*0*	*10*
0 22 174	*C BAND NET INSTRUMENTAL CORRECTION FOR SIGNIFICANT WAVE HEIGHT*	*-1000*	*1000*	*M*	*3*	*-1000*	*11*
0 21 170	*C BAND CORRECTED OCEAN BACKSCATTER COEFFICIENT*	-	-	*DB*	*2*	*-32768*	*16*
0 21 171	*RMS C BAND CORRECTED OCEAN BACKSCATTER COEFFICIENT*	-	-	*DB*	*2*	*-32768*	*16*
0 22 175	*NUMBER OF VALID POINTS FOR C BAND BACKSCATTER*	-	-	*NUMERIC*	*0*	*0*	*10*
0 21 172	*C BAND NET INSTRUMENTAL CORRECTION FOR AGC*	-	-	*DB*	*2*	*-2048*	*12*
0 21 118	ATTENUATION CORRECTION ON SIGMA-0						
0 21 173	*C BAND AUTOMATIC GAIN CONTROL*	-	-	*DB*	*2*	*0*	*13*
0 21 174	*RMS C BAND AUTOMATIC GAIN CONTROL*	-	-	*DB*	*2*	*0*	*9*
0 21 175	*NUMBER OF VALID POINTS FOR C BAND AUTOMATIC GAIN CONTROL*	-	-	*NUMERIC*	*0*	*0*	*10*
	Radiometer						
0 12 063	BRIGHTNESS TEMPERATURE						
0 12 063	BRIGHTNESS TEMPERATURE						
0 12 063	BRIGHTNESS TEMPERATURE						
0 13 090	RADIOMETER WATER VAPOR CONTENT						
0 13 091	RADIOMETER LIQUID CONTENT						
	Wind						
0 11 097	*WIND SPEED FROM ALTIMETER*	-	-	*M/S*	*2*	*0*	*12*
0 11 098	*WIND SPEED FROM RADIOMETER*	-	-	*M/S*	*2*	*0*	*12*
0 11 095	U COMPONENT OF THE MODEL WIND VECTOR						
0 11 096	V COMPONENT OF THE MODEL WIND VECTOR						
	Dynamic Topography						
0 10 096	*MEAN DYNAMIC TOPOGRAPHY*	-	-	*M*	*3*	*-131072*	*18*
0 07 002	HEIGHT OR ALTITUDE						
0 10 082	INSTANTANEOUS ALTITUDE RATE						
0 10 083	OFF NADIR ANGLE OF THE SATELLITE FROM PLATFORM						

	DATA						
0 10 084	OFF NADIR ANGLE OF THE SATELLITE FROM WAVEFORM DATA						
0 25 132	IONOSPHERIC CORRECTION FROM MODEL ON KU BAND						
0 25 163	*ALTIMETER IONOSPHERIC CORRECTION ON KU BAND*	-	-	*M*	*3*	*-32768*	*16*
025 126	MODEL DRY TROPOSPHERIC CORRECTION						
0 25 128	MODEL WET TROPOSPHERIC CORRECTION						
0 25 164	*RADIOMETER WET TROPOSPHERIC CORRECTION*	*-5000*	*0*	*M*	*4*	*-5000*	*13*
0 10 085	MEAN SEA SURFACE HEIGHT						
0 10 097	*MEAN SEA SURFACE HEIGHT FROM ALTIMETER ONLY*	-	-	*M*	*3*	*-131072*	*18*
0 10 086	GEOID'S HEIGHT						
0 10 087	OCEAN DEPTH/LAND ELEVATION						
0 10 092	SOLID EARTH TIDE HEIGHT						
0 10 088	GEOCENTRIC OCEAN TIDE HEIGHT SOLUTION 1						
0 10 089	GEOCENTRIC OCEAN TIDE HEIGHT SOLUTION 2						
0 10 098	*LOADING TIDE HEIGHT GEOCENTRIC OCEAN TIDE SOLUTION 1*	*-2000*	*2000*	*M*	*4*	*-2000*	*12*
0 10 099	*LOADING TIDE HEIGHT GEOCENTRIC OCEAN TIDE SOLUTION 2*	*-2000*	*2000*	*M*	*4*	*-2000*	*12*
0 10 090	LONG PERIOD TIDE HEIGHT						
0 10 100	*N0N-EQUILIBRIUM LONG PERIOD TIDE HEIGHT*	*-2000*	*2000*	*M*	*4*	*-2000*	*12*
0 10 093	GEOCENTRIC POLE TIDE HEIGHT						
0 25 127	SEA SURFACE HEIGHT CORRECTION DUE TO PRESSURE LOADING						
0 40 013	*HIGH FREQUENCY FLUCTUATIONS OF THE SEA SURFACE TOPOGRAPHY CORRECTION*	-	-	*M*	*4*	*-3000*	*13*

It is proposed to allocate the Table D entry ***3 40 005*** for the above sequence.

Proposal for code and flag tables

Code Table 0 08 077 (Radiometer sensed surface type) should be based on existing entries 0 08 012 (Land/sea qualifier) and 0 08 029 (Remotely sensed surface type).

0 08 077

Radiometer sensed surface type

Code figure	
0	Land
1	Sea
2	Coastal
3	Open ocean or semi-enclosed sea
4	Enclosed sea or lake
5	Continental ice
6-126	Reserved
127	Missing value

0 40 011

Interpolation flag

Bit number	
1	Mean sea surface (MSS) interpolation flag
2	Ocean tide solution 1 interpolation flag (0=4 points over ocean, 1=less than 4 points)
3	Ocean tide solution 2 interpolation flag (0=4 points over ocean, 1=less than 4 points)
4	Meteorological data interpolation flag (0=4 points over ocean, 1=less than 4 points)
5	Spare
6	Spare
7	Spare
All 8 bits	Missing

0 25 090

Orbit state flag

Code figure	
1	Orbit computed during a manoeuvre
2	Adjusted mission operations orbit
3	Extrapolated mission operations orbit
4	Adjusted (preliminary/precise) orbit
5	(preliminary/precise) orbit is estimated during a manoeuvre period
6	(preliminary/precise) orbit is interpolated over a tracking data gap
7	(preliminary/precise) orbit is extrapolated for a duration less than 1 day
8	(preliminary/precise) orbit is extrapolated for a duration that ranges from 1 day to 2 days
9	(preliminary/precise) orbit is extrapolated for a duration larger than 2 days, or that the orbit is extrapolated just after a manoeuvre
10	DORIS[†] DIODE[‡] navigator orbit
11 - 14	Reserved
15	Missing value

† DORIS stands for “Doppler Orbitography and Radio-positioning Integrated by Satellite”.
‡ DIODE means "Détermination Immédiate d'Orbite par Doris Embarqué" or immediate onboard orbit determination by DORIS. It is part of the DORIS instrument, which calculates the satellite's position and velocity.

0 25 098

Altimeter data quality flag

Bit number	(0 is good, 1 is bad)
1	Ku band range
2	C band range
3	Ku band SWH*
4	C band SWH*
5	Ku band backscatter coefficient
6	C band backscatter coefficient
7	Off nadir angle from Ku band waveform parameters
8	Off nadir angle from platform
All 9 bits	Missing

* SWH stands for “Significant wave height”

0 25 099

Altimeter correction quality flag

Bit number	(0 is good, 1 is bad)
1	Ku band range instrumental correction
2	C band range instrumental correction
3	Ku band SWH* instrumental correction
4	C band SWH* instrumental correction
5	Ku band backscatter coefficient instrumental correction
6	C band backscatter coefficient instrumental correction
7	Spare
8	Spare
All 9 bits	Missing

* SWH stands for “Significant wave height”

0 40 012

Radiometer data quality flag

Bit number	(0 is good, 1 is bad)
1	18.7 GHz brightness temperature
2	23.8 GHz brightness temperature
3	34 GHz brightness temperature
4	Spare
5	Spare
6	Spare
7	Spare
All 8 bits	Missing

0 40 013

Radiometer brightness temperature interpretation flag

Code figure	
0	Interpolation with no gap between JMR§ data
1	Interpolation with gaps between JMR§ data
2	Extrapolation of JMR§ data
3	Failure of extrapolation and interpolation
4 - 6	Reserved
7	Missing

§ JMR stands for “JASON-1 Microwave Radiometer”

0 21 169

Ice presence indicator

Code figure	
0	No ice present
1	Ice present
2	Reserved
3	Missing