

## Supplement C. Record Types (revised 26 May 2005)

The IMMA core (Table C0) forms the common front-end for all record types. By itself, the core, which is divided into location and regular sections, forms a useful abbreviated record type incorporating many of the most commonly used data elements in standardized form (drawn from the fields to be agreed internationally, listed in Supp. D). Concatenating one or more “attachments” (attm) after the core creates additional record types. So far, the following attms have been defined or proposed:

- Table C1: ICOADS attm
- Table C2: IMMT-2/FM 13 attm
- Table C3: Model quality control attm
- Table C4: Ship metadata attm
- Table C5: Historical attm (proposed)
- Table C6: Supplemental data attm

The following are examples of the record types that can be constructed from the core plus these attachments (Table numbers are used to indicate the corresponding attm):

- core record:  
core (C0) (108 characters)
- VOSCLim record:  
core + C1 + C2 + C3 + C6 (315 characters, before C6)
- historical record:  
core + C5 + C6 (proposed)

Inclusion of the attm count (*ATTC*) field in the core, and of the attm ID (*ATTI*) and attm data length (*ATTL*) fields at the beginning of each attm, enable computer parsing of the records. Thus additional variations on these basic record types are implemented by inclusion or omission of attms, and new attms can be defined in the future as needed for new data or metadata requirements.

Table C0. IMMA core. The columns in this table contain the following information:

1: “D” is listed if the field configuration is discussed in Supp. D (proposed for international agreement); “C” if the field configuration is defined for ICOADS (e.g., in LMR documentation); “UK” if the field is defined by the UK; or blank (fields to be described nationally). “D = C” is listed if the ICOADS configuration is adopted provisionally, pending international standardization.

2: The projected length (Len.) in characters (i.e., bytes).

3-4: Proposed abbreviation (Abbr.) for each field, and a brief element description.

5-6: For fields with a tentative numeric range, the minimum (Min.) and maximum (Max.) are indicated. In other cases the range and configuration are listed as: “a” for alphabetic (A-Z), “b” for alphanumeric (strictly 0-Z), “c” for alphanumeric plus other characters, or “u” for undecided form (only for fields that are currently unused).

7: Units of data and related WMO codes. Information in parentheses usually relates the proposed field to a field from Supp. B, Table B1 (if applicable): WMO Code symbolic letters are listed, or “•” followed by a field number from Table B1 in the absence of symbolic letters. This information is prefixed by “Δ” if the field is proposed for extension in range or modification in form from the presently defined WMO representation.

Location section (45 characters) :						
Doc.	Len.	Abbr.	Element description	Min.	Max.	Units (Code)
D	4	YR	year UTC	1600	2024	(AAAA)
D	2	MO	month UTC	1	12	(MM)
D	2	DY	day UTC	1	31	(YY)
D = C	4	HR	hour UTC	0	23.99	0.01 hour (Δ GG)
D = C	5	LAT	latitude	−90.00	90.00	0.01°N (Δ LaLaLa)
D = C	6	LON	longitude	−179.99	359.99	0.01°E (Δ LoLoLoLo)

<b>Location section (45 characters) :</b>						
<u>Doc.</u>	<u>Len.</u>	<u>Abbr.</u>	<u>Element description</u>	<u>Min.</u>	<u>Max.</u>	<u>Units (Code)</u>
				0.00	359.99	(ICOADS convention)
				-179.99	180.00	(NCDC convention)
D	2	IM	IMMA version	0	99	( $\Delta$ •65)
D	1	ATTC	attn count	0	9	
D = C	1	TI	time indicator	0	3	
D = C	1	LI	latitude/long. indic.	0	6	
D	1	DS	ship course	0	9	(D <sub>s</sub> )
D	1	VS	ship speed	0	9	( $\Delta$ v <sub>s</sub> )
D	2	NID	national source indic.	0	99	
D = C	2	II	ID indicator	0	10	
D	9	ID	identification/call sign	c	c	( $\Delta$ •42)
D	2	C1	country code	b	b	( $\Delta$ •43)
<b>Regular section (63 characters):</b>						
<u>Doc.</u>	<u>Len.</u>	<u>Abbr.</u>	<u>Element description</u>	<u>Min.</u>	<u>Max.</u>	<u>Units (Code)</u>
D = C	1	DI	wind direction indic.	0	6	
D = C	3	D	wind direction (true)	1	362	°, 361-2 ( $\Delta$ dd)
D = C	1	WI	wind speed indicator	0	8	( $\Delta$ i <sub>w</sub> )
D = C	3	W	wind speed	0	99.9	0.1 m s <sup>-1</sup> ( $\Delta$ ff)
D = C	1	VI	VV indic.	0	2	( $\Delta$ •9)
D	2	VV	visibility	90	99	(VV)
D	2	WW	present weather	0	99	(ww)
D	1	W1	past weather	0	9	(W <sub>1</sub> )
D = C	5	SLP	sea level pressure	870.0	1074.6	0.1 hPa ( $\Delta$ PPPP)
D	1	A	characteristic of PPP	0	8	(a)
D	3	PPP	amt. pressure tend.	0	51.0	0.1 hPa (ppp)
D = C	1	IT	indic. for temperatures	0	9	( $\Delta$ i <sub>T</sub> )
D	4	AT	air temperature	-99.9	99.9	0.1°C ( $\Delta$ s <sub>n</sub> , TTT)
D	1	WBTI	indic. for WBT	0	3	( $\Delta$ s <sub>w</sub> )
D	4	WBT	wet-bulb temperature	-99.9	99.9	0.1°C ( $\Delta$ s <sub>w</sub> , T <sub>b</sub> T <sub>b</sub> T <sub>b</sub> )
D	1	DPTI	DPT indic.	0	3	( $\Delta$ s <sub>t</sub> )
D	4	DPT	dew-point temp.	-99.9	99.9	0.1°C ( $\Delta$ s <sub>t</sub> , T <sub>d</sub> T <sub>d</sub> T <sub>d</sub> )
D = C	2	SI	SST meas. method	0	12	( $\Delta$ •30)
D	4	SST	sea surface temp.	-99.9	99.9	0.1°C ( $\Delta$ s <sub>n</sub> , T <sub>w</sub> T <sub>w</sub> T <sub>w</sub> )
D	1	N	total cloud amount	0	9	(N)
D	1	NH	lower cloud amount	0	9	(N <sub>h</sub> )
D	1	CL	low cloud type	0	9, "A"	( $\Delta$ C <sub>L</sub> )
D = C	1	HI	H indic.	0	1	( $\Delta$ •9)
D	1	H	cloud height	0	9, "A"	( $\Delta$ h)
D	1	CM	middle cloud type	0	9, "A"	( $\Delta$ C <sub>M</sub> )
D	1	CH	high cloud type	0	9, "A"	( $\Delta$ C <sub>H</sub> )
D	2	WD	wave direction	0	38	
D	2	WP	wave period	0	30, 99	seconds (P <sub>w</sub> P <sub>w</sub> )
D	2	WH	wave height	0	99	(H <sub>w</sub> H <sub>w</sub> )
D	2	SD	swell direction	0	38	(d <sub>w1</sub> d <sub>w1</sub> )
D	2	SP	swell period	0	30, 99	seconds (P <sub>w1</sub> P <sub>w1</sub> )
D	2	SH	swell height	0	99	(H <sub>w1</sub> H <sub>w1</sub> )

Table C1. ICOADS attm (column descriptions as for Table C0). 10° and 1° box numbers are available for sorting. The box system indicator is currently unused, but provides flexibility in case other box requirements arise (i.e., future extant values of *BSI* could indicate different contents in *B10* and *B1*). Other fields in this attm are carried forward from LMR to ensure that all required LMR information maps into IMMA; LMR fields *IRD* and *A6* are obsolete and have been omitted from IMMA.

<u>Doc.</u>	<u>Len.</u>	<u>Abbr.</u>	<u>Element description</u>			
D	2	<i>ATTI</i>	attm ID			Note: set <i>ATTI</i> =1
D	2	<i>ATTL</i>	attm length			Note: set <i>ATTL</i> =65
<b>Box elements (6 characters):</b>						
<u>Doc.</u>	<u>Len.</u>	<u>Abbr.</u>	<u>Element description</u>	<u>Min.</u>	<u>Max.</u>	<u>Units (Code)</u>
C	1	<i>BSI</i>	box system indicator	u	u	(currently set to missing)
C	3	<i>B10</i>	10° box number	1	648	(ICOADS BOX10 system)
C	2	<i>B1</i>	1° box number	0	99	
<b>ICOADS processing elements (17 characters):</b>						
<u>Doc.</u>	<u>Len.</u>	<u>Abbr.</u>	<u>Element description</u>	<u>Min.</u>	<u>Max.</u>	<u>Units (Code)</u>
C	3	<i>DCK</i>	deck	0	999	
C	3	<i>SID</i>	source ID	0	999	
C	2	<i>PT</i>	platform type	0	15	
C	2	<i>DUPS</i>	dup status	0	14	
C	1	<i>DUPC</i>	dup check	0	2	
C	1	<i>TC</i>	track check	0	1	
C	1	<i>PB</i>	pressure bias	0	2	
C	1	<i>WX</i>	wave period indicator	1	1	
C	1	<i>SX</i>	swell period indicator	1	1	
C	2	<i>C2</i>	2nd country code	0	40	
<b>ICOADS QC elements (38 characters):</b>						
<u>Doc.</u>	<u>Len.</u>	<u>Abbr.</u>	<u>Element description</u>	<u>Min.</u>	<u>Max.</u>	<u>Units (Code)</u>
C	12	*	adaptive QC flags	1**	35**	6var×2flag×1char.(base36)
C	1	<i>ND</i>	night/day flag	1	2	
C	6	*	trimming flags	1	15	base36
C	14	*	NCDC-QC flags	1	10	base36
C	2	<i>QCE</i> †	external (e.g., MEDS)	0	63	6 flags encoded in 2 char.
C	1	<i>LZ</i>	landlocked flag	1	1	
C	2	<i>QCZ</i> †	source exclusion flags	0	31	5 flags encoded in 2 char.

\* The first letter of each QC flag indicates the applicable fields(s) (or if the QC applies to an entire report), according to the following general scheme (referring to field abbreviations from Table C1): *A*=*AT*, *B*=*VV*, *C*=clouds, *D*=*DPT*, *E*=wave, *F*=swell, *G*=*WBT*, *P*=*SLP*, *R*=relative humidity (or possibly other humidity variables for *RE*†), *S*=*SST*, *T*=*A* and *PPP*, *U* or *V*=wind *U*- or *V*-component, *W*=wind, *X*=*WX*, *Y*=*W1*, *Z*=entire report. The lists of flag abbreviations are then:

- Adaptive QC flags: *SQZ*, *SQA*, *AQZ*, *AQA*, *UQZ*, *UQA*, *VQZ*, *VQA*, *PQZ*, *PQA*, *DQZ*, *DQA*.
- Trimming flags: *SF*, *AF*, *UF*, *VF*, *PF*, *RF*.
- NCDC-QC flags: *ZNC*, *WNC*, *BNC*, *XNC*, *YNC*, *PNC*, *ANC*, *GNC*, *DNC*, *SNC*, *CNC*, *ENC*, *FNC*, *TNC*.

\*\* Table C7 provides further information about the adaptive QC flags.

† Using the 1st-letter naming scheme described in the first footnote, the abbreviations for the flags decoded from *QCE* are: *ZE*, *SE*, *AE*, *WE*, *PE*, *RE*; and those from *QCZ* are: *SZ*, *AZ*, *WZ*, *PZ*, *RZ*. Flag *RE*, presently unused, has been set aside for possible future use.

Table C2. IMMT-2/FM 13 attm (column descriptions as for Table C0).

<u>Doc.</u>	<u>Len.</u>	<u>Abbr.</u>	<u>Element description</u>			
D	2	ATTI	attm ID			Note: set ATTI=2
D	2	ATTL	attm length			Note: set ATTL=76
<b>Common for IMMT-2/-1 (52 characters):</b>						
<u>Doc.</u>	<u>Len.</u>	<u>Abbr.</u>	<u>Element description</u>	<u>Min.</u>	<u>Max.</u>	<u>Units (Code)</u>
D	1	OS	observation source	0	6	(•40)
D	1	OP	observation platform	0	9	(•41)
D	2	FM	FM code version	0	8	(Δ •64)
D	1	IX	station/weather indic.	1	7	(ix)
D	1	W2	2nd past weather	0	9	(W <sub>2</sub> )
D	1	SGN	sig. cloud amount	0	9	ref. N
D	1	SGT	sig. cloud type	0	9, "A"	
D	2	SGH	significant cloud ht.	0	99	(0-50, 56-99)
D	1	WMI	indic. for wave meas.	0	9	(•31)
D	2	SD2	dir. of second. swell	0	38	(d <sub>W2</sub> d <sub>W2</sub> )
D	2	SP2	per. of second. swell	0	30, 99	(P <sub>W2</sub> P <sub>W2</sub> )
D	2	SH2	ht. of second. swell	0	99	(H <sub>W2</sub> H <sub>W2</sub> )
D	1	IS	ice accretion on ship	1	5	(I <sub>s</sub> )
D	2	ES	thickness of I <sub>s</sub>	0	99	cm (E <sub>s</sub> E <sub>s</sub> )
D	1	RS	rate of I <sub>s</sub>	0	4	(R <sub>s</sub> )
D	1	IC1	concentration of sea ice	0	9, "A"	(Δ c <sub>i</sub> )
D	1	IC2	stage of development	0	9, "A"	(Δ S <sub>i</sub> )
D	1	IC3	ice of land origin	0	9, "A"	(Δ b <sub>i</sub> )
D	1	IC4	true bearing ice edge	0	9, "A"	(Δ D <sub>i</sub> )
D	1	IC5	ice situation/trend	0	9, "A"	(Δ z <sub>i</sub> )
D	1	IR	indic. for precip. data	0	4	(i <sub>R</sub> )
D	3	RRR	amount of precip.	0	999	(RRR)
D	1	TR	duration of per. RRR	1	9	(t <sub>R</sub> )
D	1	QCI	quality control indic.	0	9	(•45)
D	1×20	QI1-20	QC indic. for fields	0	9	(Q <sub>1</sub> -Q <sub>20</sub> )
<b>New for IMMT-2 (20 characters):</b>						
<u>Doc.</u>	<u>Len.</u>	<u>Abbr.</u>	<u>Element description</u>	<u>Min.</u>	<u>Max.</u>	<u>Units (Code)</u>
D	1	QI21	MQCS version	0	9	(Q <sub>21</sub> )
D	3	HDG	ship's heading	0	360	° (HDG)
D	3	COG	course over ground	0	360	° (COG)
D	2	SOG	speed over ground	0	99	kt (SOG)
D	2	SLL	max.ht.>sum load ln.	0	99	m (SLL)
D	3	SLHH	dep. load ln.: sea lev.	-99	99	m (s <sub>L</sub> hh)
D = C	3	RWD	relative wind dir.	1	362	°, 361-2 (ref. D)
D = C	3	RWS	relative wind speed	0	99.9	0.1 m s <sup>-1</sup> (ref. W)

Table C3. Model quality control attm (column descriptions as for Table C0).

<u>Doc.</u>	<u>Len.</u>	<u>Abbr.</u>	<u>Element description</u>			
D	2	<i>ATTI</i>	attm ID			Note: set <i>ATTI</i> =3
D	2	<i>ATTL</i>	attm length			Note: set <i>ATTL</i> =66
<b>GTS bulletin header fields (10 characters):</b>						
<u>Doc.</u>	<u>Len.</u>	<u>Abbr.</u>	<u>Element description</u>	<u>Min.</u>	<u>Max.</u>	<u>Units (Code)</u>
UK	4	<i>CCCC</i>	collecting centre	a	a	
UK	6	<i>BUID</i>	bulletin ID	b	b	
<b>UK model comparison elements (52 characters):</b>						
<u>Doc.</u>	<u>Len.</u>	<u>Abbr.</u>	<u>Element description</u>	<u>Min.</u>	<u>Max.</u>	<u>Units (Code)</u>
UK	5	<i>BMP</i>	background (bckd.) <i>SLP</i>	870.0	1074.6	0.1 hPa
UK	4	<i>BSWU</i>	bckd. wind U comp.	-99.9	99.9	0.1 m s <sup>-1</sup>
UK	4	<i>SWU</i>	derived wind U comp.	-99.9	99.9	0.1 m s <sup>-1</sup>
UK	4	<i>BSWV</i>	bckd. wind V comp.	-99.9	99.9	0.1 m s <sup>-1</sup>
UK	4	<i>SWV</i>	derived wind V comp.	-99.9	99.9	0.1 m s <sup>-1</sup>
UK	4	<i>BSAT</i>	bckd. air temperature	-99.9	99.9	0.1°C
UK	3	<i>BSRH</i>	bckd. relative humidity	0	100	%
UK	3	<i>SRH</i>	derived relative humidity	0	100	%
UK	1	<i>SIX</i>	derived stn./wea. indic.	2	3	(subset of ix)
UK	4	<i>BSST</i>	bckd. <i>SST</i>	-99.9	99.9	0.1°C
UK	1	<i>MST</i>	model surface type	0	9	(UK 008204)
UK	3	<i>MSH</i>	model height of land sfc.	0	999	m
UK	4	<i>BY</i>	bckd. year	0	9999	year
UK	2	<i>BM</i>	bckd. month	1	12	month
UK	2	<i>BD</i>	bckd. day	1	31	day
UK	2	<i>BH</i>	bckd. hour	0	23	hour
UK	2	<i>BFL</i>	bckd. forecast length	0	99	hours

Table C4. Ship metadata attm (column descriptions as for Table C0).

<u>Doc.</u>	<u>Len.</u>	<u>Abbr.</u>	<u>Element description</u>			
D	2	ATTI	attm ID			Note: set ATTI=4
D	2	ATTL	attm length			Note: set ATTL=57
<b>Ship metadata elements (&gt;14 characters):</b>						
<u>Doc.</u>	<u>Len.</u>	<u>Abbr.</u>	<u>Element description</u>	<u>Min.</u>	<u>Max.</u>	<u>Units (Code)</u>
D	2	C1M	recruiting country	a	a	(Δ •43)
D	2	OPM	type of ship (programme)	0	99	(code unlike OP)
D	2	KOV	kind of vessel	c	c	
D	2	COR	country of registry	a	a	(Δ •43)
D	3	TOB	type of barometer	c	c	
D	3	TOT	type of thermometer	c	c	
D	2	EOT	exposure of thermometer	c	c	
D	2	LOT	screen location	c	c	
D	1	TOH	type of hygrometer	c	c	
D	2	EOH	exposure of hygrometer	c	c	
D	3	SIM	SST meas. method	c	c	(code unlike SI)
D	3	LOV	length of vessel	0	999	m
D	2	DOS	depth of SST meas.	0	99	m
D	3	HOP	height of visual observation platform	0	999	m
D	3	HOT	height of AT sensor	0	999	m
D	3	HOB	height of barometer	0	999	m
D	3	HOA	height of anemometer	0	999	m
D	5	SMF	source metadata file	0	99999	e.g. "19991" 1st Q 1991
D	5	SME	source meta. element	0	99999	line number in file
D	2	SMV	source format version	0	99	to be defined

Table C5. Historical attm (proposed; column descriptions as for Table C0). ATTI is assigned, and ATTL to be decided (*tbd*).

<u>Doc.</u>	<u>Len.</u>	<u>Abbr.</u>	<u>Element description</u>			
D	2	ATTI	attm ID			Note: set ATTI=5
D	2	ATTL	attm length			Note: set ATTL= <i>tbd</i>
<b>Historical data elements (&gt; 19 characters):</b>						
<u>Doc.</u>	<u>Len.</u>	<u>Abbr.</u>	<u>Element description</u>	<u>Min.</u>	<u>Max.</u>	<u>Units (Code)</u>
D	1	WFI	WF indic.	u	u	
D	2	WF	wind force	0	12	
D	1	XWI	XW indic.	u	u	
D	3	XW	wind speed (ext. W)	0	99.9	0.1 m s <sup>-1</sup>
D	1	XDI	XD indic.	u	u	
D	2	XD	wind dir. (ext. D)	u	u	
D	1	SLPI	SLP indic.	u	u	
D	1	TAI	TA indic.	u	u	
D	4	TA	SLP att. thermometer	-99.9	99.9	ref. AT
D	1	XNI	XN indic.	u	u	
D	2	XN	cloud amt. (ext. N)	u	u	
(plus additional elements to be decided)						

Table C6. Supplemental data attm (column descriptions as for Table C0). If *ATTL*=0 (unspecified length), this attm must appear at the end of the record, and the record terminate with a line feed. For the VOSCLim record type, this attm stores the original input data string in Ascii with *ATTL*=0 and *ATTE*=missing. (Note: if future requirements arise within the VOSCLim record type, or for other record types, *ATTL* and *ATTE* can be adjusted accordingly.)

<u>Doc.</u>	<u>Len.</u>	<u>Abbr.</u>	<u>Element description</u>			
D	2	ATTI	attm ID	Note: set ATTI=99		
D	2	ATTL	attm length	Note: set ATTL=0		
D	1	ATTE	attm encoding	Note: set ATTE=missing		
<b>Supplemental data (format determined nationally, or by data source):</b>						
<u>Doc.</u>	<u>Len.</u>	<u>Abbr.</u>	<u>Element description</u>	<u>Min.</u>	<u>Max.</u>	<u>Units (Code)</u>
	*	SUPD	supplemental data	c	c	

\* The length of the supplemental data is *ATTL* – 5 if *ATTL* > 0, or it may be variable if *ATTL* = 0.

Table C7. A pair of adaptive QC flags is provided for each variable, ending in Z and A (e.g., *SQZ* and *SQA* for *SST*). These refer to the *z*\* and *alpha*\*\* values resulting from the comparison of the observation to the adaptive QC limits. If an observation is missing, or exceeds physical limits (e.g., for *SST*: outside the range –5.0°C to 40°C), the flags are set to missing. The technical details of the flag encoding/decoding (handled by the data access software) are described by this table.†

Value (flag 3rd letter):	<u>True value:</u>		<u>Units</u>	<u>Base</u>	<u>Coded:</u>	
	<u>Min.</u>	<u>Max.</u>			<u>Min.</u>	<u>Max.</u>
<i>z</i> (Z)	–8.5σ	8.5σ	0.5	–18	1	35
<i>alpha</i> (A)	0.0	1.0	0.05	–1	1	21

\* *z*: indicates the relationship of an individual observation to the adaptive standard deviation (σ) limits in 0.5σ steps. The extremes are open-ended in that any values < –8.5σ or > 8.5σ are mapped to ±8.5σ. Other σ values represent intervals of approximately ±0.25σ around the reported values because of rounding to the nearest 0.5σ. E.g., –3.5σ represents the approximate interval –3.75σ to –3.25σ.

\*\* *alpha*: provides a measure of the reliability of the QC: it has a roughly inverse relationship with the number of observations available nearby (smaller *alpha* values indicate more data).

† A 2-stage encoding is applied: 1) The floating-point true value is divided by the “units” (the smallest increment of the data being encoded). Then the base is subtracted to produce, after rounding, a coded positive integer. 2) The integer is transformed into a base36 character. Decoding reverses this process by transforming the base36 value back into the coded value, and then the true value is reconstructed by:

$$\text{true value} = (\text{coded} + \text{base}) * \text{units}$$

## Supplement D. Field Configurations

IMMA fields proposed for, or already subject to, international standardization are described here. These are ordered according to their appearance in Supp. C. Note: Supp. C also lists additional (ICOADS- or nationally-defined) fields, which are not described here.

The suggested field abbreviations are simple alphabetic strings (plus in some cases numeric suffixes), based generally on GTS symbolic letters (if defined) but without subscripts. These are listed in *UPPER-CASE*, for broad computer portability. As discussed in Supp. A, symbolic abbreviations already provide an important means of communication about the fields and data among Member countries and end-users. However, a transition away from subscripts is recommended to facilitate computerized implementation (e.g., headings for listings of the data).

The configurations of numeric fields were developed on the basis of representations that are readily input and output by computer software. Fields are right-justified within the specified field-widths (Supp. C), and to reduce data-volume decimal points are implicit (e.g., -99.9 is represented as -999). For signed numeric data, the plus sign (“+”) is omitted, and the minus sign (“-”) immediately prefixes the numeric portion (i.e., blank left-fill). These conventions have the advantage that numeric data can be readily input without separate steps to handle IMM sign positions (0=positive, 1=negative), and without parsing to ensure that a field does not contain non-numeric characters (e.g., “/”).

In a delimited format, a universal missing value (e.g., -9999.99) could be selected outside the range of all data (except possibly for alphanumeric fields). In contrast, the fixed-field format contains different field-widths so a single numeric value is unworkable. A convention such as all nines filling each indicated field width doesn’t work either, e.g., because many of the 1-character fields have extant numeric values covering the range 0-9.

Therefore, blanks are used as the universal representation for missing data. However, it is important to note that Fortran (by default) considers blanks to be equivalent to zero, thus to ensure correctness the processing must first parse a field as characters to ensure that it is not entirely blank. Machine-portable Fortran software to help read the data (“rdimma0”) is available (<http://www.cdc.noaa.gov/coads/software/>).

Some field configurations (e.g., for the historical atm) are undecided, and will benefit from future feedback and discussion (including possible additional options that are noted for some fields). In other cases existing LMR configurations are proposed. These provisional configurations may warrant modification or expansion after international consideration.

### *Location section*

YR    year UTC  
MO    month UTC  
DY    day UTC  
HR    hour UTC

As for IMMT-1, except *HR* (range: 00.00 to 23.99 UTC). Ship data typically are reported to whole hour, but the extended resolution is needed, e.g., for storage of drifting buoy data.



LAT latitude

LON longitude

Reversed in order from LMR. Position to hundredths of a degree +N or –S (measured north or south of the equator) and +E or –W (measured east or west of the Greenwich Meridian). Extended resolutions are needed, e.g., for storage of drifting buoy data. The longitude range (–179.99° to 359.99°) specified in Supp. C encompasses two distinct longitude conventions (0° to 359.99° and –179.99° to 180.00°), which are desirable for different applications and archival requirements (0° to 359.99° is strongly recommended for use, because it is the simplest formulation and thus helps to reduce the likelihood of location errors). Disallowing 360.00 and –180.00° ensures that meridians are uniquely represented within the convention range (i.e., avoiding: 0°/360.00°; 180.00°/–180.00°). However, even if IMMA records were stored in mixed conventions, all longitude values can be accurately interpreted because the overall range for longitude reserves negative for the western hemisphere. Note: organizing *YR*, *MO*, *DY*, *HR*, *LAT*, *LON* in sequence can facilitate synoptic sort operations.

Options: Characters (N, S, E, W) could be used in place of sign for both latitude and longitude, but this complicates computer I/O and is therefore not recommended. Usage of quadrant or octant numbers also is not recommended, because a strictly numeric system is much more straightforward.

IM IMMA version

ATTC attm count

These fields are positioned near the front of the record to allow computerized input and interpretation (e.g., of different IMMA versions), but after *LON* so as not to interfere with sort operations. The proposed configuration is similar to “IMMT version”:

- 0 = provisional version
- 1 = first internationally agreed version
- 2 = second internationally agreed version
- etc.

*ATTC* provides the attm count:

- 0 = abbreviated record (no attm)
- 1 = one attm
- 2 = two attms
- etc.

TI time indicator

LI latitude/longitude indicator

*TI* preserves the incoming precision of time fields:

- 0 = nearest whole hour
- 1 = hour to tenths
- 2 = hour plus minutes
- 3 = high resolution (e.g., hour to hundredths)

*LI* preserves the precision at which *LAT* and *LON* were recorded or translated from, or if they were derived later by interpolation between known positions:

- 0 = degrees and tenths
- 1 = whole degrees
- 2 = mixed precision
- 3 = interpolated
- 4 = degrees and minutes
- 5 = high resolution data (e.g., degrees to seconds)

6 = other

[Note: This is a direct mapping from the LMR configuration, except that  $L/2$  is described there as “non random tenths” (a type of mixed precision; see p. F4 of Slutz et al., 1985).]

DS ship course

VS ship speed

WMO Codes 0700 and 4451 for contemporary data. A different code for VS, also with range 0-9, applied to data prior to 1 January 1968 (MetO, 1948):

0 = 0 knots	5 = 13-15 knots
1 = 1-3 knots	6 = 16-18 knots
2 = 4-6 knots	7 = 19-21 knots
3 = 7-9 knots	8 = 22-24 knots
4 = 10-12 knots	9 = over 24 knots

Beginning 1 January 1968 (Code 4451):

0 = 0 knots	5 = 21-25 knots
1 = 1-5 knots	6 = 26-30 knots
2 = 6-10 knots	7 = 31-35 knots
3 = 11-15 knots	8 = 36-40 knots
4 = 16-20 knots	9 = over 40 knots

As in LMR, both the old and new VS codes are stored in the same field, to be differentiated by date (DS and VS are named SC and SS in LMR). Note: In IMMPC format documentation, Code 4451 may have been used to refer to both the old and new VS codes. Further research is needed to clarify the timing and details of this code change.

NID national source indicator

A field for national use in identifying data subsets.

[Note: For the VOSclim record type in the provisional format, this is set to 1 for ships that can be identified as part of the VOSclim Project, or missing otherwise.]

// ID indicator

ID identification/call sign

ID is extended to nine characters (versus seven in IMMT-2). In LMR, // indicates whether a call sign or some other sort of recognizable identification is contained in the ID field:

- 0 = ID present, but unknown type
- 1 = ship, Ocean Station Vessel (OSV), or ice station call sign
- 2 = generic ID (e.g., SHIP, BUOY, RIGG, PLAT)
- 3 = WMO 5-digit buoy number
- 4 = other buoy number (e.g., Argos or national buoy number)
- 5 = Coastal-Marine Automated Network (C-MAN) ID (US NDBC operated)
- 6 = station name or number
- 7 = oceanographic platform/cruise number
- 8 = fishing vessel pseudo-ID
- 9 = national ship number
- 10 = composite information from early ship data

C1 country code

The country that recruited a ship, which may differ from the country of immediate receipt (field C2 in Supp. C) and may also differ from the ship's registry. Numeric code values

00-40 were documented by WMO, which transitioned to 2-character ISO alphabetic codes effective 1 January 1998. We envision storage of the numeric codes for historical data, or of the alphabetic codes for recent data, in this field (since, e.g., the old numeric codes include the USSR and other countries no longer named as such by ISO).

### *Regular section*

DI      wind direction indicator

D        wind direction

*DI* gives the compass (and approximate precision) used for reporting the wind direction (in LMR, directions are mapped to degrees according to Table 8 of the LMR documentation):

- 0 = 36-point compass
- 1 = 32-point compass
- 2 = 16 of 36-point compass
- 3 = 16 of 32-point compass
- 4 = 8-point compass
- 5 = 360-point compass
- 6 = high resolution data (e.g., tenths of degrees)

*D* is the direction (true) from which wind is blowing, stored in whole degrees (i.e., 360-point compass; range: 1-360°), or special codes:

- 361 = calm
- 362 = variable

Options: Alternatively, 0 could be used for calm (00 is used in IMMT-2). Similarly, a value such as 999 could be used for variable (99 is used in IMMT-2, but 99 indicates 99° here). However, an unambiguous and numerically closed range (1-362, rather than 0-360, 999) is also advantageous for computational reasons (e.g., range checking).

WI      wind speed indicator

W        wind speed

Wind speed is stored in tenths of a meter per second (to retain adequate precision for winds converted from knots, or high-resolution data). *WI* shows the units in which and/or the method by which *W* was originally recorded (0, 1, 3, 4 follow WMO code 1855):

- 0 = meter per second, estimated
- 1 = meter per second, measured
- 2 = estimated (original units unknown)
- 3 = knot, estimated
- 4 = knot, measured
- 5 = Beaufort force (based on documentation)
- 6 = estimated (original units unknown)/unknown method
- 7 = measured (original units unknown)
- 8 = high-resolution measurement (e.g., hundredths of a meter per second)

For reports derived from, e.g., TDF-11 format, the meaning of *WI*=6 is either “estimated (units unknown),” or “both method and units unknown” (i.e., the indicator was missing). This unfortunate ambiguity derives from the dual meaning present in some original archive formats, including IMMPC (ref. Supp. B).

VI      visibility indicator

VV      visibility

The “Cloud height and visibility measuring indicator” from IMMT-2 is separated into independent indicators *H* and *VV*. *VI* shows whether *VV* was:

0 = estimated (or unknown method of observation)

1 = measured

2 = fog present

The “fog present” value is not defined in IMMT-2, but stems from early IMMPC definitions (see Supp. B).

WW present weather

W1 past weather

WMO Codes 4677 and 4561. For use of weather data after 1982, refer to *IX*.

SLP sea level pressure

A barometric tendency

PPP amount of SLP change

*SLP* and *PPP* in tenths of hPa (i.e., millibars), and *A* according to WMO Code 0200. IMMT-2 contains a 4-character (PPPP) representation of *SLP* in IMMT-2 (dropping the leading digit).

IT indicator for temperatures

AT air temperature (i.e., dry bulb)

WBTI *WBT* indicator

WBT wet bulb temperature

DPTI *DPT* indicator

DPT dew point temperature

SI SST method indicator

SST sea surface temperature

Temperatures are stored in tenths of a degree Celsius. *IT* provides information about the precision and/or units that the temperature elements were translated from (0-2 match *i<sub>T</sub>*=3-5 in IMMT-2; the full configuration matches *T1* in LMR):

0 = tenths °C

1 = half °C

2 = whole °C

3 = whole or tenths °C (mixed precision among temperature fields)

4 = tenths °F

5 = half °F

6 = whole °F

7 = whole or tenths °F (mixed precision among temperature fields)

8 = high resolution data (e.g., hundredths °C)

9 = other

[Note: Early historical temperatures were also reported in degrees Réaumur, or mixed units. Additional fields may be desirable in the historical attm to record these details.]

*WBTI* and *DPTI* indicate which of *WBT* or *DPT* was measured or computed, and ice bulb conditions (derived from sign positions *s<sub>t</sub>* and *s<sub>w</sub>* in IMMT-2):

0 = measured

1 = computed

2 = iced measured

3 = iced computed

[Note: For data translated e.g. from IMMT-2 format, *T2* from LMR provides a subset of information derived from *s<sub>t</sub>* and *s<sub>w</sub>*, plus information about whether *DPT* was computed during ICOADS processing (such that for data translated from LMR to IMMA, we set *DPTI*=1 or 3). Future work should seek to recover more complete information from original formats,

and consider new configurations to separately document ICOADS processing.]

*SI* shows the method by which *SST* was taken (0-7 follow the IMMT-2 code):

- 0 = bucket
- 1 = condenser inlet (intake)
- 2 = trailing thermistor
- 3 = hull contact sensor
- 4 = through hull sensor
- 5 = radiation thermometer
- 6 = bait tanks thermometer
- 7 = others
- 9 = unknown or non-bucket
- 10 = "implied" bucket [Note: applicable to early ICOADS data.]
- 11 = reversing thermometer or mechanical sensor
- 12 = electronic sensor

[Note: Except for omitting *SI*=8 ("unknown"), an unintended setting applicable only to decks 705-705), this is a direct mapping from the LMR configuration. In translation from LMR, *SI*=8 is made missing.]

*N* total cloud amount  
*NH* lower cloud amount  
*CL* low cloud type  
*HI* cloud height indicator  
*H* cloud height  
*CM* middle cloud type  
*CH* high cloud type

Configurations as in IMMT-2, except for use of "A" (10 in base36) in place of "I" (LMR uses 10 in place of "I"), with ordering of *N*,...,*CH* as in LMR. The "Cloud height and visibility measuring indicator" from IMMT-2 is separated into independent indicators *H* and *VV*. *HI* (not presently part of the GTS SHIP code) shows if cloud height *H* was:

- 0 = estimated
- 1 = measured

*WD* wave direction  
*WP* wave period  
*WH* wave height

Historically, the (wind) wave and swell fields have been subject to complicated code changes. Both the wave and swell fields were reported in descriptive terms according to the SHIP code, and thus are expected to be missing, prior to 1949 (and the swell fields are expected to be missing prior to 1 July 1963, as discussed below). *WD* codes 00 to 36 (WMO Code 0877) show the direction (if any) from which (wind) waves come, in tens of degrees (e.g., 00 = calm, 01 = 005°-014°, ..., 36 = 355°-004°). Codes 37-38 (99 in WMO Code 0877) show "waves confused, direction indeterminate" under *WH* conditions explained in the LMR documentation. Starting in 1968, *WD* was no longer reported and *WP* was reported in seconds. Prior to 1968, period was reported as a code, which was converted into whole seconds per Table 10 of the LMR documentation, with *WX* (ref. Table C1) set accordingly. *WH* is wave height in 1/2 meter increments, i.e., 1=0.5 m, 2=1 m, etc.

[Note: *WP*=99, indicating a confused sea, is not presently defined in LMR. Future work should seek to recover this information from original formats.]

SD swell direction

SP swell period

SH swell height

Configurations similar to the corresponding wave fields *WD*, *WP*, and *WH*. Beginning 1 July 1963 both sea (i.e., wind wave) and swell were reported. Prior to that date only the higher of sea and swell was reported. Starting in 1982, *SP* was reported in seconds. Prior to 1968 (1982), *SP* was reported as a code, which was converted into whole seconds per Table 10 (Table 11) of the LMR documentation, with *SX* (ref. Table C1) set accordingly.

#### *Attm control*

ATTI attm ID

ATTL attm length

ATTE attm data encoding

Each attm begins with *ATTI* and *ATTL*. *ATTI* identifies the attm contents, and *ATTL* provides the total length of the attm (including *ATTI* and *ATTL*) in bytes, or zero for length unspecified (record terminated by a line feed; line feed not counted as part of *ATTL*). The supplementary data attm (ref. Table C6) also includes *ATTE*, which indicates whether the supplementary data that follow are in Ascii or encoded:

missing = Ascii

0 = base64 encoding

The “rdimma0” software IMMA tests to determine if each individual IMMA record is properly configured, including checking *ATTC* (ref. Table C0) against the number of attachments present. It requires that duplicate attms (i.e., two attms with the same *ATTI*) not appear in a record. The software does not require that attachments appear in any particular order by *ATTI*, with one exception: the supplementary data attm must be the final attm within the record if *ATTL*=0.

#### *IMMT-2/FM 13 attm*

OS observation source

OP observation platform

As defined in IMMT-2.

FM FM code version

For *FM*, the corresponding field in IMMT-2 ranges from 0-8, but is extended here to two characters to allow room for expansion.

IX station/weather indicator

W2 second past weather

*IX* (WMO Code 1860) indicates both whether the station is manned or automatic, and the status of present and past weather data. *IX* is vital for proper interpretation of weather data starting in 1982; see LMR documentation for a detailed discussion, including unforeseen complications that attended its introduction (with *W2*; WMO Code 4561) in 1982 (e.g., *IX* was not included in IMMT until March 1985).

SGN significant cloud amount

SGT significant cloud type

SGH significant cloud height

Use of “A” (10 in base36) in place of “/.” The significant cloud fields are listed in MetO (1948), but they were omitted from the IMM formats. Space is allocated for these, but it

is not clear how widely available they would be in logbook data or existing digital archives.

WMI indicator for wave measurement

WMI is the IMMT-2 “indicator for wave measurement” (shipborne wave recorder, buoy, or other measurement systems).

SD2 swell direction (2nd)

SP2 swell period (2nd)

SH2 swell height (2nd)

As defined for IMMT-2 (configurations as for *SD*, *SP*, and *SH*).

IS ice accretion

ES ice thickness

RS ice accretion rate

Fields for ice accretion on the ship, as defined for IMMT-2.

IC1 concentration of sea ice

IC2 stage of development

IC3 ice of land origin

IC4 true bearing ice edge

IC5 ice situation/trend

Configurations as in IMMT-2, except for use of “A” (10 in base36) in place of “/.” These are not presently included among LMR regular fields. The fields changed dramatically in 1982 (field descriptions reflect the 1982 Codes):

pre-1982

starting 1 Jan. 1982

description of ice type

concentration of ice (WMO Code 0639)

effect of ice on navigation

stage of ice development (WMO Code 3739)

bearing of principal ice edge

ice of land origin (WMO Code 0439)

distance to ice edge

true bearing principal ice edge (WMO Code 0739)

orientation of ice edge

ice situation/trend (WMO Code 5239)

Like TD-1129, IMMA simply stores the old/new information as listed above in the same field, thus making it critical that users be aware of the code change.

Options: Separate fields (or an indicator field) could be considered. Earlier historical ice codes might also need to be researched for possible consideration. MetO (1948) lists an Ice Group (c<sub>2</sub>KD<sub>i</sub>re) that may be similar or identical to the above pre-1982 code (see also Table B3 of Supp. B).

IR indicator for precipitation data

RRR amount of precipitation

TR duration of period of reference for amount of precipitation

As defined for IMMT-2. The precipitation fields are not presently included among regular LMR fields.

QCI quality control (QC) indicator

QI1-21 QC indicators for fields

Field *QCI* provides general information about the level of manual or automated QC that has been applied to the data. Twenty *QI* indicators for individual fields or field groups are included in IMMT-2 and IMMT-1 (see Table B2 of Supp. B), whereas 18 were included in the 1982 IMMT format, and none were available in IMMPC. IMMT-2 adds a 21st element to document the QC version.

HDG ship's (bow) heading in degrees (referenced to true North)  
COG course over ground (reference to true North)  
SOG speed over ground (the speed at which the vessel moves over the fixed earth)  
SLL max. height (m) of deck cargo above summer max. load line  
SLHH departure of summer max. load line from actual sea level

Fields added to IMMT-2 for VOSCLim.

RWD relative wind direction

RWS relative wind speed

Fields added to IMMT-2 for VOSCLim.

#### *Ship metadata attm*

C1M recruiting country

OPM type of ship (programme)

KOV kind of vessel

COR country of registry

TOB type of barometer

TOT type of thermometer

EOT exposure of thermometer

LOT screen location

TOH type of hygrometer

EOH exposure of hygrometer

SIM SST measurement method

LOV length of vessel

DOS depth of SST measurement

HOP height of visual observation platform

HOT height of air temperature sensor

HOB height of barometer

HOA height of anemometer

SMF source metadata file

SME source metadata element

SMV source format version

Metadata selected from WMO—No. 47 (1955-) by the Southampton Oceanography Centre (SOC draft report, 2004). The codes defined in WMO—No. 47, and used in IMMA, for *OPM* and *SIM* differ from the codes used for the similar IMMT-based fields *OP* and *SI*. Prior to 1995 a 3-digit numeric code was defined in WMO—No. 47 for *C1M*; starting in 1995, WMO—No. 47 adopted the 2-character ISO alphabetic code, which was in 1998 also adopted for IMMT. For *C1M*, the earlier 3-digit numeric codes were transformed by SOC into the 2-character alphabetic codes.

Options: A possible expansion for LOT would add extra codes for paired screens in unknown locations, etc.

#### *Historical attm (proposed)*

WFI wind force indicator

WF wind force

XWI *XW* indicator

XW wind speed (extension field for *W*)

XDI *XD* indicator

XD wind direction code (extension field for *D*)



*WFI* and *WF* are proposed primarily for 0-12 Beaufort wind force codes, but potentially could be extended to other 2- or 1-digit codes, with *WFI* indicating the type of information, e.g.: 0-6 (half Beaufort code in 19th century Norwegian logbooks), Ben Nevis Observatory code. *XWI* and *XW* are proposed for equivalent wind speed, with *XWI* indicating the scale used to convert from *WF* (e.g., the existing WMO Code 1100 scale or newer alternatives). Similarly, fields *XDI* and *XD* are proposed for older 2- or 1-digit wind direction codes, with *XDI* indicating the type of information, e.g.: 32-, 16-, or 8-point compasses.

*SLPI*    *SLP* indicator

*TAI*    *TA* indicator

*TA*    *SLP* attached thermometer

*SLPI* is proposed for historical data to indicate the barometer type (e.g., mercurial, aneroid, or metal). *TAI* (configuration undecided, but probably similar to some of the other temperature indicators) and *TA* are proposed for older mercurial barometer data, in which the attached thermometer is critical for data adjustments.

*XNI*    *XN* indicator

*XN*    cloud amount (extended field for *N*)

*XN* is proposed for historical cloud amount data (e.g., in tenths), with *XNI* indicating the units (e.g., tenths).

#### **Document Revision Information**

Document revisions and additions outside this section are **highlighted** (previous document version: 19 December 2004). The following are substantive format revisions, in Supp. C: In Table C4, the configuration (min and max) of field *LOT* was changed to “c” (character), from a numeric range, because “OT” (for other) can appear in this field in addition to numeric values. Table C6 previously contained an error in the length of the supplemental data, which has been corrected with a footnote.