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New software package for archival of synoptic and upper air meteorological data

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सार—सतह और ऊपरी वायु कोडित आंकड़ों को पुनः प्राप्त करने, विकोडित करने, गुणता नियंत्रण और फोर्मेट रचना के लिए विकसित 6 प्रोग्रामों के सोफ्टवेयर पैकेज के प्रकार्यों को यहां संक्षिप्त रूप में प्रस्तुत किया गया है। इन प्रोग्रामों को पूर्णतः सफल बनाने के लिए फोर्ट्रान-77 की सुविधाओं का बौद्धिक प्रयोग किया गया। पूरे दिन के लिए जी टी एस पर प्राप्त सतह और ऊपरी वायु के लिए भूमंडलीय आंकड़े, वी ए एक्स 8810 प्रणाली पर लगभग साढ़े तीन मिनट (सी पी यू समय) में गुणता नियंत्रण के पश्चात छांटे गए, विकोडित और फोर्मेट किए गए।

ये प्रोग्राम फाइलों को व्यवस्थित करते हैं और इनका प्रयोग संपठनीय कापी आंकड़ों की मासिक आंकड़ा फाइलों को विकोडित करने के लिए भी किया जा सकता है। आंकड़ों को कोडित करने के लिए बहुत सूक्ष्म संशोधनों सहित एफ जी जी ई कोड का प्रयोग किया गया है। गुणता नियंत्रण के परिणामों की जांच की जाती है और प्रत्येक विश्व मौसम संगठन खंड के लिए प्रत्येक समकालीन घंटे के लिए घंटेवार प्राप्त रिपोर्टों की संख्या का मानीटरन किया जाता है। दोनों से प्राप्त सूचना टर्मिनल पर प्रदर्शित की जाती है और सारणीबद्ध फार्म में मासिक आंकड़ा संग्रह के लिए डिस्क में भी अभिलेखित की जाती है।

ABSTRACT. The functions of a software package of 6 programmes developed for retrieving, decoding, quality control and formatting of surface and upper air coded data have been presented here in brief. Intelligent use has been made of Fortran-77 facilities to make these programmes extremely efficient. Global data for surface and upper air received on GTS for an entire day is sorted, decoded & formatted after quality control in about three and a half minutes (CPU time) on VAX 8810 system.

The programmes do the management of files and can also be used for decoding the monthly data files of hard copy data. For coding of data, FGGE code has been used with very minor modifications. The results of quality control checks and number of reports received hourwise for each synoptic hour for each WMO block are monitored. Information from both is displayed on the terminal in tabular form and also recorded in disk for monthly archival.

Key words — Software package, Fortran-77, Global Telecommunication System (GTS), Quality Control, Consistency Check.

1. Introduction

Observational data provided by the WWW Global Observing System is exchanged internationally as coded messages. Manual on codes WMO No. 306 describes in detail the various code forms, symbolic letters, code figures, symbolic words and symbolic figure groups etc. WMO uses FM system of numbering the code forms. List of all code forms and binary codes is given in WMO No. 306.

The authors developed the basic software about three years back (for decoding & formatting in FGGE format for most of the coded reports mentioned below) and the results with basic features were presented in the first symposium on data processing organised at New Delhi by NCMRWF in September 1989. Afterwards, the programmes have been refined further, extended to include more types of reports and detailed quality control procedures about two years back. Recent changes introduced in the codes with effect from November 1991 have also been taken care of. In view of these changes limits for 925 hPa were required. In the absence of WMO guidelines on these, adhoc limits have been introduced in the limit tables. Present paper is the outcome of all these efforts. The decoding and archival software now serves the following codes, *viz.*, SYNOP, SHIP, PILOT, PILOT SHIP, PILOT, MOBIL, TEMP, TEMP SHIP, TEMP DROP, TEMP MOBIL, CLIMAT, CLIMAT TEMP.

Data received at Regional Telecommunication Hub (RTH), New Delhi are stored on magnetic tapes (referred hereafter as GTS tapes) for each day and are also available as disk or tape files with NCMRWF, in slightly different format. These files contain various kinds of meteorological information, data and messages exchanged over Global Telecommunication System (GTS). The format of the messages is described in "Manual on the Global Telecommunication System"; WMO No. 386. Briefly, a routine meteorological message transmitted on the GTS comprises of:

— A starting line		
— An abbreviated heading	Meteorological bulletin	Meteorological message
— A text		
— End of message signals		

Different modules of the software package are run in a sequence through a command file. Disk command file is automatically run by computer at a fixed time, thus, making the system completely automatic.

The modules manage a large number of daily or or monthly files and a well defined nomenclature system has been adopted for this purpose. The software package has been developed specifically to meet the data archival requirement of Monsoon Activity Centre and TOGA Tropical Upper Air Data Centre.

The software package has used Fortran-77 language and is transportable. Basically the processing has been done using the data as characters. Intelligent use has been made of relevant character handling facilities of Fortran-77 to make the package extremely efficient. The tasks performed by the software are correction of raw data, quality control, formatting (FGGE format), monitoring reception of data, the performance of the module themselves and the quality control results.

As the software package consists of six modules each of which has a large number of Fortran statements, it is not desirable to include the listing of the modules with the write up. The purpose of this paper is to provide only the essential information about the software package and so details of individual modules have not been included here.

2. The decoding software

The first step in this software package is to process the day's data stored on magnetic tape or hard disk with the purpose of conversion of code from EBCDIC to ASC II, correcting and selecting required types of bulletins, breaking them into individual reports, removing telecommunication, formatting or coding errors and to save them on different disk files. Data with almost similar codes are put on common file. Defective bulletins or bad reports are stored on separate files for manual correction. This job is done by a programme named MACSORT.

The coded data files are then accessed by five modules which decode, check and format the data. The programme named SYPDSM handles the SYNOP and SHIP reports. A series of four programmes UPACSM, UPBDSM, UTACSM & UTBDSM handle the different parts of Pilot and Temp reports as per details in Table 1.

The decoding programmes use the good data files created by the programme MACSORT. Coded data for each element are subject to quality control for logical limits for each character. For decoding, character format has been used throughout. After decoding, each element is subject to quality control for physical limits and climatological limits which have been adopted from guide on the Global Data Processing System, WMO No. 305. Normally the programmes accept data for the current date and the previous date. Information on latitude, longitude and elevation, in case of land stations, is provided from a resident directory in the system.

3. Disk file management

A single record file named DATEFIL is generated automatically or manually depending on type of processing. This file provides basic information of

TABLE 1

Details of programmes for processing GTS data (Global) of 24 hours

S. No.	Programme name	Function	Reports handled	CPU time Min : Sec	Size of decoded data files in blocks (512 bytes)
1	MACSORT	Reads data from disk or tape in EBCDIC or ASC II code from RTHGTS format or NCMRWF history data format, corrects bulletins for format error & error signs, separates bulletins into individual reports, corrects reports for telecommunication & format errors, corrects individual erroneous characters, flags good & bad reports and puts them on different files, puts defective bulletins on separate file, monitors statistics on its performance & reports total number of good & bad reports of each type	Surface, upper air, climat & aircraft reports including reports from ships & dropsonde	2 : 00.49	—
2	SYPDSM	Decoding quality control formatting in FGGE format and some corrections	AAXX, BBXX	0 : 37.07	6581
3	UTACSM	Do.	TTAA, TTCC, UUAA, UUCC, XXAA, XXCC, IIAA, IICC	0:39.97	3093
4	UTBDSM	Do.	TTBB, TTDD, UUBB, UUDD, XXBB, XXDD, IIBB, IIDD	0 : 12.00	900
5	UPACSM	Do.	PPAA, PPCC, QQAA, QQCC, EEAA, EECC	0 : 3.76	527
6	UPBDSM	Do.	PPBB, PPDD, QQBB, QQDD, EEBB, EEDD	0 : 6.48	661
		Total CPU time		03 : 39.77	

TABLE 2

Algorithms for internal consistency control of surface observations

Checking algorithm	Result
$DD > 36 \wedge DD \neq 99$	DD is erroneous
$\{DD = 0 \wedge FF \neq 0\} V \{DD \neq 0 \wedge FF = 0\}$	DD or FF are erroneous
$\{DD < 0 \wedge FF \geqslant 0\} V \{DD \geqslant 0 \wedge FF < 0\}$	DD or FF are erroneous
$DD = 99 \wedge FF \geqslant 5$	DD or FF are erroneous
$DD = 99 \wedge FF = 0$	DD or FF are erroneous
$51 \leqslant VV \leqslant 55$	VV is erroneous
$[\{10 \leqslant VV \leqslant 89\} V \{94 \leqslant VV \leqslant 99\}] \wedge [42 \leqslant WW \leqslant 49]$	VV or WW are erroneous
$[\{60 \leqslant VV \leqslant 89\} V \{96 \leqslant VV \leqslant 99\}] \wedge [0 \leqslant h \leqslant 1]$	VV or h are suspect
$N < N_H$	N or N_h are erroneous
$\{N=9\} \wedge [\{WW < 39\} V \{40 \leqslant WW \leqslant 42\} V \{WW=44\} V \{WW=46\} V \{WW = 48\} V \{WW = 50\} V \{WW \geqslant 79\}]$	N or WW are erroneous
$\{N \neq 9\} \wedge [\{WW = 43\} V\{WW=45\}V \{WW = 47\}V \{WW=49\}]$	N or WW are erroneous
$[\{a < 0\} \wedge \{PP \geqslant 0\}] V [\{a \geqslant 0\} \wedge \{PP < 0\}]$	a or PP* are erroneous
$\{a = 4\} \wedge \{PP > 0\}$	a or PP are erroneous
$[PP = 0] \wedge [(1 \leqslant a \leqslant 3) V (6 \leqslant a \leqslant 8)]$	a or PP are erroneous
$TT < T_dT_d$	TT or T_dT_d are erroneous
$(N_h = 0) \wedge (C_L \neq 0 V C_M \neq 0) \wedge (h \neq 9)$	N_h or C_L or C_M or h are erroneous
$(N_h \neq 0) \wedge (C_L = 0) \wedge (C_M = 0)$	N_h or C_L or C_M are erroneous
$\{N_h = 9\} \wedge \{C_L \geqslant 0 V C_M \geqslant 0 V C_H \geqslant 0 V h \geqslant 0\}$	N_h or C_L or C_M or h are erroneous
$\{TT > 5°C\} \wedge \{(68 \leqslant WW \leqslant 79) V (83 \leqslant WW \leqslant 88)\}$	TT or WW are erroneous
$\{TT < -2°C\} \wedge \{(50 \leqslant WW \leqslant 55) V (58 \leqslant WW \leqslant 65) V (80 \leqslant WW \leqslant 82) V (68 \leqslant WW \leqslant 69)\}$	TT or WW are erroneous
$\{(D_s = 0) \wedge (V_S \neq 0) V (D_S \neq 0) \wedge (V_s = 0)\} V \{(D_s \leqslant 0) \wedge (V_s \geqslant 0)\} V \{(D_s \geqslant 0) \wedge (V_s \leqslant 0)\}$ (applied for Ship reports only)	D_s or V_s are erroneous
$FF > 150 \wedge DD = 0$	DD or FF are erroneous
$FF > 100 \wedge DD = 0$	DD or FF are doubtful
Dew point depression > 25	Dew point is doubtful
$T_XT_X < TT$	TT or T_XT_X are erroneous
$T_NT_N > T_XT_X$	T_NT_N or T_XT_X are erroneous

*PP is pressure tendency.

source and type of data and type of special processing required to all the modules. It controls creation of new files and opening of old files.

4. Design characteristics and efficiency of programmes

As stated earlier, intelligent use has been made of character handling features of Fortran-77. Character strings have been used for input, output and initialisation statements making them extremely efficient. The programmes are multi-tasking thereby acheiving economy. Index facility has been used to perform many types of tasks including location of various types of indicators or groups. Concatenation of strings has been preferred to arithmetic statements. Relational operators and lexical relational operators have been used for comparing character sub-strings. Use of GO TO statement has been kept to barest minimum.

5. Basic tasks performed by the programmes

5.1. *Programme MACSORT*

(*a*) Access GTS data from appropriate disk/tape drive.

(*b*) Convert the data from EBCDIC to ASC II mode if necessary.

(*c*) Reformat the data if required.

(*d*) Identify the bulletin and categorise it good or bad after proper quality check and correction for formatting, transmission or other errors including lower case/upper case mixup and error signs.

(*e*) Dump the bad and certain types of bulletins on monthly files and process the good bulletins further to obtain individual reports.

TABLE 3(a)

Limit values for the surface temperature

Area	Winter				Summer			
	Min 2	Min 1	Max 1	Max 2	Min 2	Min 1	Max 1	Max 2
45°S–45°N	−40°C	−30°C	+50°C	+55°C	−30°C	−20°C	+50°C	+60°C
45°N–90°N and 45°S–90°S	−90°C	−80°C	+35°C	+40°C	−40°C	−30°C	+40°C	+50°C

(The value is considered suspect when Min 2 $\leqslant T <$ Min 1 or Max 1 $< T \leqslant$ Max 2;
the value is considered erroneous when $T <$ Min 2 or $T >$ Max 2)

TABLE 3(b)

Limit values for the surface dew-point temperature

Area	Winter				Summer			
	Min 2	Min 1	Max 1	Max 2	Min 2	Min 1	Max 1	Max 2
45°S–45°N	−45°C	−35°C	+35°C	+40°C	−35°C	−25°C	+35°C	+40°C
45°N–90°N and 45°S–90°S	−99°C	−85°C	+30°C	+35°C	−45°C	−35°C	+35°C	+40°C

(The value is considered suspect when Min 2 $\leqslant T_d <$ Min 1 or Max 1 $< T_d \leqslant$ Max 2;
the value is considered erroneous when $T_d <$ Min 2 or $T_d >$ Max 2)

TABLE 3(c)

Limit values for the station pressure

Area	All year			
	Min 2	Min 1	Max 1	Max 2
45°S–45°N	300 hPa	400 hPa	1080 hPa	1100 hPa
45°N–90°N and 45°S–90°S	300 hPa	400 hPa	1080 hPa	1100 hPa

(The value is considered suspect when Min 2 $\leqslant p$ (station) $<$ Min 1 or Max 1 $< p$(station) $\leqslant$ Max 2
the value is considered erroneous when p(station) $<$ Min 2 or p(station) $>$ Max 2)

TABLE 3(d)

Limit values for the mean sea-level pressure

Area	Winter				Summer			
	Min 2	Min 1	Max 1	Max 2	Min 2	Min 1	Max 1	Max 2
45°S–45°N	870 hPa	910 hPa	1080 hPa	1100 hPa	850 hPa	900 hPa	1080 hPa	1100hPa
45°N–90°N and 45°S–90°S	910 hPa	940 hPa	1080 hPa	1100 hPa	920 hPa	950 hPa	1080 hPa	1100 hPa

(The value is considered suspect when Min 2 $\leqslant p <$ Min 1 or Max 1 $< p \leqslant$ Max 2;
the value is considered erroneous when $p <$ Min 2 or $p >$ Max 2)

TABLE 3(e)

Limit values for the 3-hour mean sea-level pressure tendency

Area	All year	
	Max 1	Max 2
45°S–45°N	40 hPa	50 hPa
45°N–90°N and 45°S–90°S	40 hPa	50 hPa

(The value is considered suspect when Max 1 $\leqslant ppp \leqslant$ Max 2; the value is considered erroneous when $ppp >$ Max 2)

TABLE 3(f)

Limit values for the sea-surface temperature

Area	Winter				Summer			
	Min 2	Min 1	Max 1	Max 2	Min 2	Min 1	Max 1	Max 2
45°S–45°N	0°C	+2°C	+32°C	+35°C	0°C	+2°C	+32°C	+35°C
45°N–90°N and 45°S–90°S	−2.1°C	−1.0°C	+27°C	+30°C	−2.1°C	−1.0°C	+30°C	+35°C

(The value is considered suspect when Min 2 $\leqslant T <$ Min 1 or Max 1 $< T \leqslant$ Max 2; the value is considered erroneous when $T <$ Min 2 or $T >$ Max 2)

TABLE 4(a)

Limit values for the geopotential height at different levels

Vertical level (hPa)	Area 45°S–45°N				Area 45°N–90°N and 45°S–90°S			
	Min 2	Min 1	Max 1	Max 2	Min 2	Min 1	Max 1	Max 2
1000	−1000	−800	600	800	−700	−550	650	800
925	−500	−300	1300	1500	−250	−100	1300	2200
850	0	200	2000	2200	200	400	2000	2200
700	2200	2350	3450	3600	2300	2450	3450	3600
500	4500	4700	6100	6300	See values for 45°S–45°N			
400	6100	6300	7800	8000				
300	7300	7550	9800	9999				
250	8500	8800	11100	11400				
200	10000	10300	12900	13200				
150	12000	12300	14900	15200				
100	14000	14400	17700	18100				
70	15500	16100	20900	21500				
50	17700	18300	23100	23700				
30	20500	21100	25900	26500				
20	23300	23900	29700	30300				
10	26000	26800	33200	34000				
7	30700	31300	35800	36400				
5	33300	33800	37800	38300				
3	36600	37100	41600	42100				
2	39400	39800	44400	44900				
1	44900	45500	50100	50700				

(The value is considered suspect when Min 2 $\leqslant Z <$ Min 1 or Max 1 $< Z \leqslant$ Max 2; the value is considered erroneous when $Z <$ Min 2 or $Z >$ Max 2; units are in gpm)

TABLE 4(b)

Limit values for the temperature at different levels

Vertical level (hPa)	Area 45°S–45°N				Area 45°N–90°N and 45°S–90°S			
	Min 2	Min 1	Max 1	Max 2	Min 2	Min 1	Max 1	Max 2
1000	— 50°C	—30°C	+50°C	+60°C	— 90°C	—70°C	+40°C	+50°C
925	— 50°C	—40°C	+40°C	+50°C	— 90°C	—70°C	+30°C	+40°C
850	— 65°C	—50°C	+30°C	+40°C	— 90°C	—70°C	+20°C	+30°C
700	— 80°C	—70°C	+20°C	+30°C	— 90°C	—70°C	+10°C	+20°C
500	— 95°C	—80°C	+ 5°C	+10°C	—100°C	—80°C	— 5°C	+ 5°C
400	—100°C	—85°C	— 5°C	0°C	—100°C	—85°C	—10°C	— 5°C
300–100	—100°C	—85°C	—10°C	— 5°C	See values for 45°S–45°N			
70–10	—100°C	—85°C	—5°C	+ 5°C				
7	—90°C	—80°C	+10°C	+20°C				
5	—80°C	—70°C	+15°C	+30°C				
3	—70°C	—60°C	+25°C	+35°C				
2	—70°C	—60°C	+30°C	+40°C				
1	—70°C	—50°C	+30°C	+40°C				

(The value is considered suspect when Min 2 $\leq T \leq$ Min 1 or Max 1 $< T \leq$ Max 2;
the value is considered erroneous when $T <$ Min 2 or $T >$ Max 2)

TABLE 5

Statistics on synops for a typical day (090291) — Blockwise stations

Time (UTC)	Blocks													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
0	14	19	39	14	0	9	13	20	4	9	14	10	2	0
3	0	0	7	0	0	28	0	1	0	0	0	36	0	0
6	14	20	43	14	0	9	16	22	5	14	9	10	5	0
9	0	0	11	0	0	27	0	1	0	30	0	61	0	0
12	14	20	40	14	0	9	15	21	7	10	15	9	5	0
15	0	0	11	0	0	28	0	1	0	30	0	35	0	0
18	14	19	39	15	0	8	14	20	4	12	13	9	6	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
0	16	61	26	0	0	10	10	15	26	22	14	29	17	26
3	52	38	39	0	0	0	0	0	0	0	0	0	0	10
6	16	57	43	0	0	11	10	15	30	27	15	30	17	26
9	68	41	47	0	0	0	0	0	0	0	0	0	0	10
12	16	57	24	0	0	7	8	15	23	24	15	30	17	26
15	50	53	48	0	0	0	0	0	0	0	0	0	0	10
18	20	52	37	0	0	11	9	15	26	23	25	30	17	26
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	29	30	31	32	33	34	35	36	37	38	39	40	41	42
0	24	25	21	11	18	31	23	12	16	29	0	26	59	170
3	1	0	0	0	0	1	29	16	0	50	0	19	62	361
6	23	25	23	11	31	34	24	12	15	44	0	49	55	200
9	1	0	0	0	0	1	29	15	0	51	0	22	67	134
12	24	18	17	11	17	32	24	12	18	31	0	31	87	249
15	1	0	0	0	0	1	29	16	0	49	0	17	56	96
18	24	20	22	13	16	32	24	12	17	29	0	32	38	106
21	0	0	0	0	0	0	0	0	0	0	0	22	22	61

TABLE 5 (*contd.*)

Time (UTC)	Blocks													
	43	44	45	46	47	48	49	50	51	52	53	54	55	56
0	157	35	2	0	93	147	0	25	26	23	36	58	8	55
3	299	12	2	0	0	108	0	36	44	39	53	81	7	76
6	155	35	2	0	171	65	0	47	56	46	70	116	11	83
9	139	6	0	0	0	62	0	21	27	23	36	59	7	55
12	251	60	1	0	72	89	0	42	60	40	57	91	15	86
15	106	1	0	0	0	90	0	18	19	16	13	11	4	23
18	115	39	1	0	73	56	0	38	77	39	53	84	14	89
21	52	0	0	0	0	55	0	24	27	23	38	56	8	52
	57	58	59	60	61	62	63	64	65	66	67	68	69	70
0	61	49	40	111	48	82	53	12	54	0	53	16	0	13
3	84	69	52	1	0	20	0	0	4	0	4	0	0	0
6	89	75	54	154	125	124	74	10	80	0	105	86	0	11
9	59	48	39	9	0	32	0	0	0	0	13	0	0	0
12	84	76	59	153	91	89	71	24	60	0	45	90	0	12
15	18	26	18	9	0	24	0	0	0	0	4	0	0	0
18	72	52	50	135	89	94	75	19	42	0	50	84	0	12
21	57	49	40	0	0	30	0	0	0	0	0	0	0	0
	71	72	73	74	75	76	77	78	79	80	81	82	83	84
0	114	74	0	0	0	30	0	23	0	0	0	13	5	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	64	50	0	1	0	6	0	12	0	0	0	0	0	7
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	114	76	0	0	0	25	0	31	0	39	5	43	67	8
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	112	104	0	0	0	35	0	29	0	16	0	33	53	7
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	85	86	87	88	89	90	91	92	93	94	95	96	97	98
0	0	0	0	0	6	0	78	0	2	127	1	148	106	18
3	0	0	0	0	3	0	44	0	9	98	0	4	0	0
6	0	0	0	0	7	0	59	0	14	84	1	1	0	43
9	0	0	0	0	1	0	1	0	0	47	0	0	0	0
12	37	21	57	1	11	0	80	0	21	84	0	9	0	19
15	0	0	0	0	3	0	30	0	0	11	0	0	0	0
18	37	23	62	2	7	0	85	0	16	90	1	25	6	24
21	0	0	0	0	0	0	40	0	22	92	0	10	0	0

Programme successfully completed	090291	AAXX or BBXX not found in	0	SN wrong for TDTD in	13
Number of synops read	20693	Ship name or LA/LO problem in	6	PPP doubtful or wrong in	11
Stations not found in direction	501	Date CHK failed in	75	MSG not consistent in	580
Synops smaller then 28 CH	1	Time CHK failed	0	GRP clash in sec one	127
Synops outside the region	0	IX CHK failed in	7	GRP clash in sec two	3
Synops decoded fully	201003	DDFF conflict in	84	GRP clash in sec three	165
Extra synops decoded	0	SN wrong for TTT in	0	Synops with	1
				Stations in directory	9351

Land obs 00, 03, 06 etc	UTC—2906	1899	3217	1300	3478	975	8068	780
Ship obs. 00, 03, 06 etc	UTC—284	18	290	23	271	15	194	5

(*f*) A number of quality checks are done to all the characters of each report making corrections wherever possible to make each report complete in itself.

(*g*) Flag the good and bad reports and dump them on separate files.

(*h*) Special provision has been made to retrieve data even when;

(*i*) The types of bulletins or report indicators are only partially recognizable.

(*ii*) Beginning/end of bulletins sign or report separators are missing.

(*iii*) The time group is incompletely reported.

(*iv*) The sectional indicators are missing.

(*v*) Different types of data are reported in the same bulletin,

(*vi*) Upper case characters are reported as lower case characters,

(*vii*) Recognizable systematic exchange of characters have taken place.

(*i*) The programme provides various statistics on the reception of data for various types of data *viz.*, Synop, Synop Ship, Pilot, Temp, etc,.

5.2. *Programme SYPDSM*

(*i*) Access appropriate data file & decide the type of processing (monthly or daily).

(*ii*) Decode the three sections of the report as per manual on codes (WMO No. 306).

(*iii*) Handle problem of missing report separator or section indicator groups.

(*iv*) Provide locational information — latitude, longitude and elevation.

(*v*) Perform internal consistency checks as per algorithm (Swedish Meteorological and Hydrological Institute July 1980) reproduced in Table 2 and put quality control flag, as under :

Value of the "Quality Control Internal Consistency"-Flag	*Meaning*
0	Internal consistency control has not been performed.
1	No elements in the surface observation were found suspect or erroneous during the control.
2	At least one element in the surface observation was found suspect during the control but no elements were found erroneous.
3	At least one element in the surface observation was found erroneous during the control.

(*vi*) Perform logical, physical and climatological limit checks (WMO 1985) as per Table 3 and put appropriate quality control flag.

(*vii*) Format the data in FGGE format (WMO 1978) and create intermediate data file.

(*viii*) Bring out blockwise, synoptic hourwise statistics on reception of data for synops and ship reports (Table 5).

(*ix*) Monitor statistics on performance of the programme itself and results of quality control.

5.3. *Programmes UPACSM, UPBDSM, UTACSM and UTBDSM*

These programmes do similar tasks for upper air data as done by SYPDSM in respect of surface data. In their case also the quality control checks are limited to physical, logical and climatological limits. Internal consistency checks for different levels have not been done. However, sequence check is made for the levels at the time of decoding. Various coding errors in the reports are handled successfully through ingenious algorithms. The limits used (Table 4) for checking of elements in upper air observations are mostly adopted from WMO No. 305.

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