History of the International Code

The International Synoptic Land Code is an arrangement of digits, agreed upon by the various national meteorological services through the auspices of the World Meteorological Organization and its predecessors, which enable the elements of a weather observation to be recorded and transmitted, by telegraph or radio, without the redundancy of naming each element for each observation. The positioning of digits within the code describe in general the element being reported, and the digits themselves denote the value of that element. The basic observation is established for use throughout most of the world; regional and national agreements allow the use of modifications which are deemed necessary by the climate of some areas or by the governments concerned. The fact that such observations are recorded simultaneously at many locations, or stations, for transmission in collectives and for the purpose of analyzing the weather conditions over an area, defines such a group of observations as "synoptic". Similar codes are used for reporting observations from ships.

The earliest form of the International Synoptic Code from which observations in Data Family 13 were derived is the one agreed upon at the conference in Rome, in 1913. No source of data appearing in this family included observations precisely in the Rome code, but vestiges of that form remain in the coding of some elements. The basic form of that code was arranged as follows:

Observations at 1800 GMT: I_nI_n BBBDD Fw'TTW'

Observations at 0700 GMT: I I BBBDD Fw'TTC βbbRR MMmmu

The letters in the code form above, singly or in combination, represent symbolically the meteorological elements contained in the observation. In actual use, digits replace the letters. For elements which may be represented numerically, such as temperature, where "TT" is shown above, 15 would be a report of "temperature, 15 degrees". For elements where discrete definitions are required, code tables are utilized; thus corresponding to "w'" in the code form, a report of 5 would indicate "rain occurring". The meanings of symbols in the Rome code are as follows:

BBB	Corrected barometric pressure in tenths of millimeters
bb	Amount of barometric tendency in tenths of millimeters (50 is added to the wind direction number if the tendency is negative)
β	Characteristic of barometric tendency
C	Direction of motion of upper clouds
DD	Direction of the wind (to 32 points)
F	Strength of the wind on Beaufort Scale
I_nI_n	Index number of the reporting station
MM	Maximum temperature) - From 07h of preceding day to 07h of current day
mm	Minimum temperature)
RR	Rainfall in millimeters for past 24 hours
TT	Temperature in whole degrees Celsius (50 added when negative)
u	Sea disturbance (now called state of sea)
W'	Characteristic of past weather
w'	State of the sky (combining cloud cover with present weather)

In 1921, at London, the convention of delegates decided to revise the synoptic code, whereupon it took the forms below:

Observations at 0100 and 1300 GMT: I_nI_n BBBDD FwwTT cbWVH AlaNh [C_1ddVV]

Observations at 0700 and 1800 GMT: I_nI_n BBBDD FwwTT cbWVH ALaNh RRjjr [C_1ddVV]

where "jj" in the fifth group is replaced as follows:

	Inland Stations	Coastal Stations
at 0700 GMT	mm	SV_s
at 1800 GMT	MM	SV_s

The group C_1ddVV, containing cloud observations by nephoscope, is omitted entirely if no such observations are available.

New elements were added, and code tables for some were revised. Many observations contained in Data Family 12 for the years before 1930 were derived from publications in which the format followed closely the arrangement of the London code. The symbols represent the elements below.

A	Form of predominating low cloud layer
a	Form of predominating higher cloud layer when more than one type of cloud exists
BBB	Pressure in millibars and tenths or millimeters and tenths, corrected
b	Amount of barometric tendency during past three hours, in half-millibars or half-millimeters. For tendencies 10-19, the second figure only was reported and 33 was added to the wind direction number. For tendencies 20-29 the second figure only was reported and 67 was added to the wind direction number. Tendencies greater than 29 were reported as 29.
C_1	Form of cloud observed by nephoscope; usually one of the two highest layers present
c	Characteristic of barometric tendency
DD	Direction of wind near the ground (to 32 points)
dd	Direction of wind in the upper air, or of cloud movement (to 36 points)
F	Force of the wind on the Beaufort Scale
H	Relative humidity of the air
h	Height of base of lower predominating cloud present
I_nI_n	Index number of the reporting station
jj	Meaning varies according to time of observation and classification of station
L	Amount of sky covered by cloud form "A" and all forms of the same layer (i.e., low, medium or high) as "A", if "a" refers to a different layer
MM	Maximum temperature for 11 hours ending at 1800 GMT) - variations allowed
mm	Minimum temperature for 13 hours ending at 0700 GMT)
N	Total amount of sky covered with cloud
RR	Rainfall at 0700 GMT for preceding 13 hours and at 1800 GMT for preceding 11 hours
r	Time of commencement of precipitation
S	State of the sea and swell
TT	Temperature of the air in whole degrees Fahrenheit or Celsius
VV	The relative speed of clouds as determined by nephoscope and such that the actual speed of the cloud will be given in kilometers per hour by the equation $vv = \frac{h}{1000} \times VV$, if "h", the height of the cloud, is expressed in meters. This unit is the "radian per hour". The symbol "vv" is the speed in kilometers per hour.
V	Visibility or distance at which objects can be seen
V_s	Horizontal visibility towards the sea
W	The weather in the interval preceding the time of observation
ww	The actual weather at the time of observation

With the rapid advances of radio communication during the next decade and the consequent desirability of greatly increasing the network of reporting stations, combined with changing requirements in the field of meteorology, the International Code was again revised by a conference of directors of the meteorological services at a meeting in Copenhagen, in September 1929. It was actually put into use at various times during 1930. The great bulk of weather observations in Data Family 12 were derived directly from publications of collectives of data in this form, or from observations published in other forms, but encoded into the Copenhagen Code before being punched. This code, with but minor modifications, remained in use throughout the world for almost twenty years. Its main symbolic form is shown below:

$$IIIC_LC_M \quad wwVhN_L \quad DDFWN \quad BBBTT \quad UC_Hbb \quad RRJJJ \; [CddVV]$$

where "JJJ" represents $\frac{MM}{mm}E$ for inland stations

t_gKD for lightship stations

SV_sE for coastal stations

and where again the last group was omitted in the absence of a nephoscope observation.

For some elements the same symbols as were used in the London Code were retained, although their code tables may have been revised; for other elements, new symbols were adopted. The new symbols are shown below:

a	Characteristic of barometric tendency
bb	Amount of barometric tendency in past three hours, in millibars and tenths
C_L	Form of low clouds

C_M Form of middle clouds
C_H Form of high clouds
D Direction of sea swell
E State of the ground
III International Index Number of the reporting station
K Sea swell
N_L Amount of sky covered by low clouds
td Difference between temperature of the air and water
U Relative humidity of air

The Copenhagen code was modified by a conference held in Warsaw in 1935, but the changes were mainly restricted to the altering of symbols, revisions of code tables, and the addition of optional groups, so that the reporting form continued to be known as the Copenhagen Code. The original form remained in use for stations at middle and high latitudes, but an additional form was adopted for use by tropical stations. The nephoscope group was deleted and made a separate reporting form. Complete representation of the land code is shown below:

1) $IIIC_LC_M$ wwVhN$_h$ DDFWN PPPTT UC_Happ

2) $IIIC_LC_M$ wwVhN$_h$ DDFWN PPPTT UC_Happ RRjjj - (jjj - T_xT_xE / jjj - T_nT_nE / jjj - SV_sE / jjj - T_dKD_K)

3) $IIIC_LC_M$ wwVhN$_h$ DDFWN PPPTT UURRt_w (DDF_xGG)

4) $IIIC_LC_M$ wwVhN$_h$ DDFWN PPPTT UURRt_w (DDF_xGG) $D_LC_HD_{H/M}jj$ - (jj - T_xT_x / jj - T_nT_n)

Note that the symbols for pressure and pressure tendency were replaced by "PPP" and "pp" respectively, "N_L" by "N_h", "MM" by "T_xT_x", "mm" by "T_nT_n", "td" by "T_d", and "D" by "D_K" to allow an expanded use of the symbol "D". For use at low latitudes (codes 3 and 4) coding of relative humidity allowed two digits and "t_w", time of commencement of past weather, was introduced. A group to report maximum wind (DDF_xGG), direction, force, and time, was made optional, as was a group to report low cloud direction (D_L) and direction of high or middle clouds ($D_{H/M}$).

Millions of observations in the Warsaw version of the Copenhagen Code are contained in Data Family 12 and some in Data Family 13. Throughout this manual the reader will discover code changes taking place early in 1937, which was the date of implementation of this revision. To as large a degree as is possible, the conversion from cards to tape has allowed re-modification of the two versions into a common form.

An abbreviated code form was also adopted for radiogram collectives for an entire continent or a similar region and for use by ships at sea:

III DDFww PPVTT

where the symbols have the same meanings as in the full code, but pressure is reported in whole millibars. Some observations in this data family were originally reported in the abbreviated code, which was a modification of the code form previously used for these purposes: IIwwD FBBTT.

After World War II, the International Meteorological Committee met in Paris, in 1946, and more formally organized the entire system of weather reporting codes, including upper air and surface observations. The "F" system of numbering codes was adopted, so that all messages of surface observations from land stations appeared in the following forms:

F 1	$IIIC_LC_M$	wwVhN$_h$	DDFWN	PPPTT			
F 11	$IIIC_LC_M$	wwVhN$_h$	DDFWN	PPPTT	UC_Happ		
F 111	$IIIC_LC_M$	wwVhN$_h$	DDFWN	PPPTT	UC_Happ	RRT_xT_xE	
F 112	$IIIC_LC_M$	wwVhN$_h$	DDFWN	PPPTT	UC_Happ	RRT_nT_nE	
F 113	$IIIC_LC_M$	wwVhN$_h$	DDFWN	PPPTT	UC_Happ	RRSV_sE	
F 114	$IIIC_LC_M$	wwVhN$_h$	DDFWN	PPPTT	UC_Happ	RRT_dKD_K	
F 115	$IIIC_LC_M$	wwVhN$_h$	DDFWN	PPPTT	UC_Happ	$C'_LH'H'N'_L$	
F 116	$IIIC_LC_M$	wwVhN$_h$	DDFWN	PPPTT	UC_Happ	RRT_xT_xE	$C'_LH'H'N'_L$
F 117	$IIIC_LC_M$	wwVhN$_h$	DDFWN	PPPTT	UC_Happ	RRT_nT_nE	$C'_LH'H'N'_L$

F 12	$IIIC_LC_M$	$wwVhN_h$	DDFWN	PPPTT	$UURRt_w$	
F 121	$IIIC_LC_M$	$wwVhN_h$	DDFWN	PPPTT	$UURRt_w$	$D_LC_HD_HT_xT_x$
F 122	$IIIC_LC_M$	$wwVhN_h$	DDFWN	PPPTT	$UURRt_w$	$D_LC_HD_HT_nT_n$
F 123	$IIIC_LC_M$	$wwVhN'_h$	DDFWN	PPPTT	$UURRt_w$	$D_LC_HD_HT_xT_x$ DDF_xGG
F 124	$IIIC_LC_M$	$wwVhN_h$	DDFWN	PPPTT	$UURRt_w'$	$D_LC_HD_HT_nT_n$ DDF_xGG
F 13	$IIIC_LC_M$	$wwVhN_h$	DDFWN			
F 15	III		DDFww	PPVTT		
F 150	$IIIJ_1J_1$		DDFww	PPVTT		
F 151	IIIAW		DDFww	PPVTT		
F 153	IIIAW		DDFww	PPVTT	$3C_LC_MC_HN$	

Other specialized land codes were also adopted, but their use has had no influence on Data Family 13.

Symbols used in the above codes which have not previously been described are:

- A — Value and characteristic of the barometric tendency
- C'_L — Form of low clouds whose base is below the level of a mountain station
- H'H' — Height in hectometers of the tops of a cloud layer whose base is below the level of a mountain station
- J_1J_1 — Symbols fixed by regional agreement, preferable "AW"
- N'_L — Amount of sky covered by clouds whose base is below the level of a mountain station

As can be seen from the symbolic forms as the codes evolved, two digits were at first sufficient for station identification, although combinations of letters as well as numbers were used. Later three digits were required, the world being subdivided into major areas to which a thousand numbers were assigned. Size of networks increased, supplemental methods of numbering were devised, but finally the three digit number had to be abandoned. This was done with the adoption of the "block system", whereby two digits were assigned to countries or areas, and three digits to the individual stations. A fuller discussion of station numbers is given on page 3.14.

The worldwide revision of station numbers took place with the introduction of the third great change in the form of synoptic code. The Conference of Directors, meeting in Washington in 1947, recommended a new form, which was adopted by all the free world in January, 1949. Nations under the influence of the Soviet postponed adoption of the code until 1950, and the USSR did not implement the revised numbering system until February 16, 1953.

The concept of using specific digits for indicator numbers, to identify groups of data within the code, which had barely been introduced in the 1946 revisions, but which had been used by a few national modifications of the 1929 code, was greatly enlarged in the 1949 version. The basic observations consisted of five 5-digit groups, which were universally used:

FM 11 SYNOP 999II (when necessary)

$iiiT_dT_d$ Nddff VVwwW PPPTT $N_hC_LhC_MC_H$

where the symbols largely have meanings similar to those of earlier codes. New symbols introduced were:

- dd — Wind direction (to 36 points)
- ff — Wind speed in knots
- II — Block number (for area identification)
- iii — Station number (Iliii comprises the International Index Number)
- T_dT_d — Dew point temperature (replacing relative humidity)
- VV — Visibility

Code tables by which the remaining elements were encoded were drastically revised, in most cases.

However, to the basic observation above, extra data were allowed to be reported in the so-called supplemental data groups. These groups were always preceded by a numeric indicator in the first position, thus allowing four digits of meteorological information to be reported. Although four such groups were recommended for international usage, considerable latitude was given to regional or national deviations to meet individual requirements. The recommended groups were:

$6Japp$ $7RRJJ$ $8N_sC_{hs}h_s$ $9S_pS_{ps}p_{ps}p$

The meanings of the symbols of the 6th, 7th, 8th and 9th groups are explained on pages 3.6-3.10. The symbols "$5P_5P_sp_sp$" represent "special phenomena", by a complicated series of code tables; none of which are contained in Data Family 12 but which are possible in TDF 13. The 8th group, reporting data for a cloud layer, could be repeated as many times as necessary to properly define the entire state of the sky. A number of regionally adopted supplemental data groups are shown on page 3.103, and need not be repeated here. The use of these specialized groups, however, made the International Code completely flexible to meet the meteorological needs of any nation or climatic region. It also complicated it to a very large degree, from the standpoint of deriving a standard code form for tape use.

Minor revisions to the 1949 code were implemented at the beginning of 1955, by most of the world, USSR again postponed adoption for a while, until July 1955. The form presently in use is

FM 11.A SYNOP (II)iii Nddff VVwwW PPPTT $N_hC_LhC_MC_H$ $T_dT_dJ_aJ_pJ_p$

(7RRjj) ($8N_sCh_sh_s$) ($9S_pS_Ps_ps_p$),

where "6j" was dropped and the sixth group was made a part of the basic observation. The term "$J_aJ_pJ_p$" indicates that either "app" or "jjj" may be reported. Minor revisions to some code tables also occurred at the same time.

Throughout the historical use of the International Code, however, it must be remembered that the entire system has been based upon mutual cooperation among nations. Sublimation of national to international interests has been more noteworthy in the field of weather than in many other directions, but it has never been complete. Many countries have delayed implementation of new codes from the scheduled times, or have arbitrarily modified portions of the codes in use. Thus, a great variety of forms exist which are not fully documented. This data family consists largely of observations which were actually transmitted in International Code, or which were published in daily bulletins in columnar arrangement closely akin to the code form. In a few cases, card decks derived from other types of data have been included in this family for reasons of expediency or because the codes used can be easily molded into the international form. Furthermore, the period of time over which these observations were originally recorded brings into use all the versions of the International Code described above. The "Standard Form" of this data family is in fact an amalgamation of all these forms, requiring the use of many indicators and code tables, which are fully described in further sections of this manual.

The history of the International Code, as shown above in its entirety, is for informational purposes, as Data Family 13 is concerned largely with the 1949 and later versions of the code. Some data from earlier versions may be included, particularly those decks which were converted to TDF 12, and later consolidated into TDF 13.