MONTHLY AEROLOGICAL RECORD - SYNOPTIC OBSERVATIONS

This reference manual was prepared for use with punched card deck 281, MAR Synoptic Observations, produced from United States Navy Monthly Aerological Record, source 999. The Monthly Aerological Record consists of from six to twenty-four pages per month, but cards are punched from only the first six pages. Each of these pages contains observations for all days of the month for the same hour. Normally, hourly observations were taken, but only six observations per day were recorded on the MAR. This recording form was abandoned in favor of the WBAN forms, in 1945.

All observations made by qualified aerographers under routine watch conditions were entered in black ink. Observations made by other than qualified aerological personnel were entered in red ink. Whenever entries were made from estimated data, due to instrument failure or other causes, such entries were also made in red ink.

Weather Elements Recorded

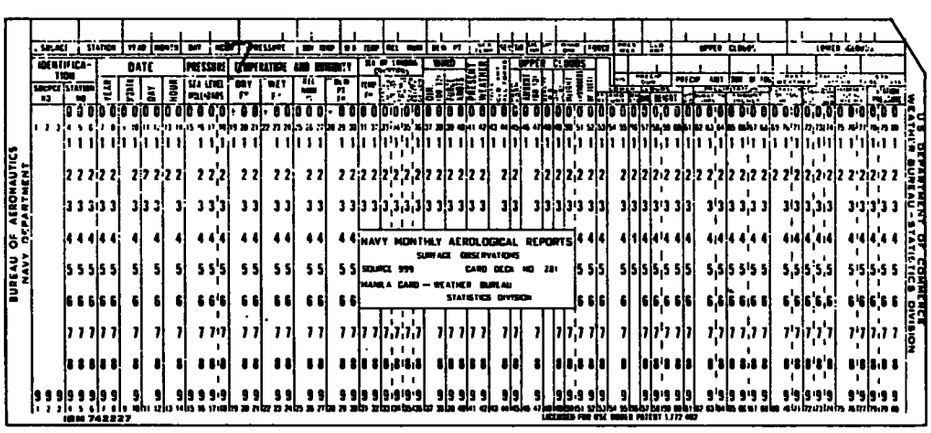
The following weather elements, when reported, were punched: sea level pressure, air temperature, wet bulb temperature, relative humidity, dew point temperature, sea temperature, state of sea, direction of swell, condition of ground, safety of landing conditions, wind velocity, present weather, total cloud amount, upper cloud type, amount, density, and direction of movement, middle cloud height, lower cloud type, amount, density, direction, and height, visibility, precipitation duration and amount, duration of fog, past weather, hours of favorable flying weather, and ceiling height.

General Practices

Cards were punched with the station number, year, month, day, and hour, and the rest of the card left blank when an observation was missing, unless the station did not report for the whole month. Columns for which data were missing or obviously in error were left blank. In the early stages of punching, each observation was coded onto special code sheets for punching, but in later days, cards were punched directly from the Monthly Aerological Records. All cards were punched by the USWB Tabulating Unit, or the Navy Tabulating Section, in New Orleans.

Form of Punched Card Used

A standard 80 column punch card designed with special headings for punching MAR observations was used. Although columns 78-80 are imprinted with station pressure headings, ceiling height is actually punched in columns 78-79, and column 80 was left blank. A sample of the punch card is shown below.



CARD CONTENT					SOURCE CONTENT	
Columns	Item	Code	Code Definition	Remarks	Units or Symbols	Reporting and Coding Practices
1-3	Source No.	999	Navy M. A. R.			United States Navy Monthly Aerological Record.
4-6	Station No.			A three-digit number formulated by the U.S. Navy, Bureau of Aeronautics, to designate the station, was punched in columns 4-6. Lists of these numbers, with names, coordinates, and periods of record, are maintained by the Bureau of Aeronautics, Navy Tabulation Section.		
7-8	Year	20-45	1920 - 1945			
9-10	Month	01-12	January - December			
11-12	Day	01-31	Day of month			
13-14	Hour	01-24	0100 - 2400			Six hours usually reported: 04, 08, 12, 16, 20, and 24. Each observation taken on the hour, and reflects conditions during the past hour. All entries recorded in Standard Zone Time.
15-18	Sea Level Pressure	0000-0999	1000.0 to 1099.9 mb		millibars to 1/10	
		9000-9999	900.0 to 999.9 mb			
		Blank	Unknown			
19	Dry Bulb or Air Temperature Indicator	0	0° to 99° F	Columns 20-21 punched 00-99.		
		1	100° to 199° F	Columns 20-21 punched 00-99.		
		X	-1° to -99° F	Columns 20-21 punched 01-99.		
		Blank	Unknown	Columns 20-21 left blank.		
20-21	Dry Bulb or Air Temperature	00-99	0° to 99° F	Column 19 punched 0.	Whole or half degrees Fahrenheit	Usually recorded to nearest half degree Fahrenheit. Rounded to whole degrees before punching.
		00-99	100° to 199° F	Column 19 punched 1.		
		01-99	-1° to -99° F	Column 19 punched X.		
		Blank	Unknown	Column 19 left blank.		
22	Wet Bulb Temperature Indicator	0	0° to 99° F	Columns 23-24 punched 00-99.		
		X	-1° to -99° F	Columns 23-24 punched 01-99.		
		Blank	Unknown	Columns 23-24 left blank.		
23-24	Wet Bulb Temperature	00-99	0° to 99° F	Column 22 punched 0.	Whole or half degrees Fahrenheit	Usually recorded to nearest half degree Fahrenheit. Rounded to whole degrees before punching.
		01-99	-1° to -99° F	Column 22 punched X.		
		Blank	Unknown	Column 22 left blank.		
25-27	Relative Humidity	000-100	0 to 100 percent		Whole percent	
		Blank	Unknown			
28	Dew Point Temperature Indicator	0	0° to 99° F	Columns 29-30 punched 00-99.		
		X	-1° to -99° F	Columns 29-30 punched 01-99.		
		Blank	Unknown	Columns 29-30 left blank.		
29-30	Dew Point Temperature	00-99	0° to 99° F	Column 28 punched 0.	Whole °F	
		01-99	-1° to -99° F	Column 28 punched X.		
		Blank	Unknown	Column 28 left blank.		
31-32	Sea Temperature	00-99	0° to 99° F		Whole °F	Reported by ships. Some land stations reported sea and/or soil temperature. Soil temperature was not coded nor punched. Sea temperature obtained by standard sea water thermometer.
		Blank	Unknown			
33	State of Sea	0	Calm, no swell	Height of wave, crest to trough: 0 Less than 1 foot	0-9	Reported by ships, and by shore stations with water landing areas.
		1	Smooth, moderate swell	1 to 3 feet		
		2	Slight, heavy swell	3 to 5 feet		
		3	Moderate, no swell	5 to 8 feet		
		4	Rough, moderate swell	8 to 12 feet		
		5	Very rough, heavy swell	12 to 20 feet		
		6	High	20 to 40 feet		
		7	Very high	Over 40 feet		
		8	Precipitous			
		9	Confused			
		Blank	Unknown			
34	Direction of Swell	0	Calm		C	Reported by ships, and by shore stations with water landing areas.
		1	Northeast		NE	
		2	East		ENE, E, ESE	

CARD CONTENT					SOURCE CONTENT	
Columns	Item	Code	Code Definition	Remarks	Units or Symbols	Reporting and Coding Practices
34	Direction of Swell (continued)	3	Southeast		SE	
		4	South		SSE, S, SSW	
		5	Southwest		SW	
		6	West		WSW, W, WNW	
		7	Northwest		NW	
		8	North		NNW, N, NNE	
		X	Unknown			
		Blank	Unknown			
35	Condition of Ground (Airfield)	0	Solid (dry or frozen)	Condition of field considered fit for landing.	0-9	Reported by shore stations only.
		1	Solid (dew)			
		2	Solid (light frost)			
		3	Solid (heavy frost)			
		4	Solid (snow or water in spots, parts of field usable)			
		5	Solid (snow covered)			
		6	Soft (from rain or thaw)			
		7	Soft (from rain or thaw)	Condition of field considered unfit for landing.		
		8	Flooded			
		9	Covered (snow in deep drifts, or heavy snow cover, 10 in. or more)			
		Blank	Unknown			
36	Safety of Landing Conditions (Seaplane)	0	0 to 9 percent		Whole percent	Reported by ships, and by shore stations with water landing areas. Never refers to landplane facilities. Based on estimate of observer, dependent upon condition of sea, character of swell, and the angle between the direction of the wind and the direction of the swell.
		1	10 to 19 percent			
		2	20 to 29 percent			
		3	30 to 39 percent			
		4	40 to 49 percent			
		5	50 to 59 percent			
		6	60 to 69 percent			
		7	70 to 79 percent			
		8	80 to 89 percent			
		9	90 to 100 percent			
		Blank	Unknown			
37-38	Wind Direction	00	Calm		Letter Directions	True wind velocity entered for both ship and shore stations.
		02	North Northeast			
		04	Northeast			
		06	East Northeast			
		08	East			
		10	East Southeast			
		12	Southeast			
		14	South Southeast			
		16	South			
		18	South Southwest			
		20	Southwest			
		22	West Southwest			
		24	West			
		26	West Northwest			
		28	Northwest			
		30	North Northwest			
		32	North			
		Blank	Unknown			
39-40	Wind Speed	00-99	0 to 99 knots	No X-overpunch in Column 39.	Whole knots	
		00-99	100 to 199 knots	X-overpunch in Column 39.		
		Blank	Unknown			

CARD CONTENT					SOURCE CONTENT	
Columns	Item	Code	Code Definition	Remarks	Units or Symbols	Reporting and Coding Practices
41-42	Weather Conditions	00	Cloudless	Less than 1 tenth cloud cover.	b	In early years of record, Beaufort notation was used in recording weather. Later, the "ww" code table of the International Code was used. If no weather was reported, total cloud amount was coded as present weather, using codes 00-05. When visibility was reported in International Code 4 to 6, and no weather symbol was reported, weather was coded as light fog (02) if the dew point spread was 3° F. or less: if the dew point spread was greater than 3° F., weather was coded as haze (05). If the visibility was 7 miles or less, and no weather symbol was reported, weather was coded as fog (40) if the dew point spread was 2. F. or less: if the dew point spread was more than 2° F. weather was coded as haze (05). These decisions were made by experienced meteorologists, who also considered other factors, such as wind velocity and cloud cover, in each individual case. In all cases, the highest applicable code was used.
		01	Partly cloudy	1 to 5 tenths cloud cover.	bc	
		02	Cloudy	6 to 9 tenths cloud cover.	c	
		03	Overcast	Over 9 tenths cloud cover.	o	
		04	Low fog		fg	
		05	Haze	Visibility 1100 yards or more. See Coding Practices.	z	
		06	Dust devils			
		07	Distant lightning		l	
		08	Light fog	Visibility 1100 yards or more. See Coding Practices.	m	
		09	Fog at distance		fg	
		10	Precip in sight		ip	
		11	Thunder, but no precip		t	
		12	Duststorm in sight			
		13	Ugly, threatening sky		u	
		14	Squally weather		q	
		15	Heavy squalls	In last 3 hours.	QQ	
		16	Waterspouts	In last 3 hours.		
		17	Smoke			
		18	Blowing dust	Visibility 1100 yards or more.		
		19	Signs of hurricane			
		20	Precipitation	Precipitation occurred in last hour, but not at time of observation.		
		21	Drizzle			
		22	Rain			
		23	Snow			
		24	Rain and snow			
		25	Rain showers			
		26	Snow showers			
		27	Hail, or rain and hail showers			
		28	Light or moderate thunderstorm			
		29	Heavy thunderstorm			
		30	Duststorm or sandstorm			
		31	Duststorm or sandstorm	Has decreased.		
		32	Duststorm or sandstorm	No appreciable change.		
		33	Duststorm or sandstorm	Has increased.		
		34	Line of duststorms			
		35	Storm of drifting snow		ks	
		36	Storm of drifting snow	Light or moderate, generally low.		
		37	Storm of drifting snow	Heavy, generally low.		
		38	Storm of drifting snow	Light or moderate, generally high.		
		39	Storm of drifting snow	Heavy, generally high.		
		40	Fog	Visibility less than 1100 yards. See Coding Practices.	f	
		41	Moderate fog	In last hour, but not at time of observation.		
		42	Thick or dense fog			
		43	Fog, sky discernible	Has become thinner during last hour.		
		44	Fog, sky not discernible			
		45	Fog, sky discernible	No appreciable change in last hour.		
		46	Fog, sky not discernible			
		47	Fog, sky discernible	Has begun or become thicker in last hour.		
		48	Fog, sky not discernible			
		49	Fog, in patches			
		50	Drizzle		d	
		51	Drizzle, intermittent	Light.		
		52	Drizzle, continuous			
		53	Drizzle, intermittent	Moderate.		
		54	Drizzle, continuous			

CARD CONTENT					SOURCE CONTENT	
Columns	Item	Code	Code Definition	Remarks	Units or Symbols	Reporting and Coding Practices
41-42	Weather Conditions (continued)	55	Drizzle, intermittent	Heavy.		
		56	Drizzle, continuous			
		57	Drizzle and fog		df	
		58	Drizzle and rain	Light or moderate.		
		59	Drizzle and rain	Heavy.		
		60	Rain		r	
		61	Rain, intermittent	Light.		
		62	Rain, continuous			
		63	Rain, intermittent	Moderate.		
		64	Rain, continuous			
		65	Rain, intermittent	Heavy.		
		66	Rain, continuous			
		67	Rain and fog		rf	
		68	Rain and snow	Light or moderate.	rs	
		69	Rain and snow	Heavy.		
		70	Snow		s	
		71	Snow, intermittent	Light.		
		72	Snow, continuous			
		73	Snow, intermittent	Moderate.		
		74	Snow, continuous			
		75	Snow, intermittent	Heavy		
		76	Snow, continuous			
		77	Snow and fog		sf	
		78	Snow grains			
		79	Sleet or ice crystals			
		80	Showers		p	
		81	Rain showers	Light or moderate.	pr	
		82	Rain showers	Heavy.		
		83	Snow showers	Light or moderate.	ps	
		84	Snow showers	Heavy.		
		85	Showers of light or moderate rain and snow		psr	
		86	Showers of heavy rain and snow			
		87	Showers of snow pellets			
		88	Showers of light or moderate hail, or rain and hail		ph	
		89	Showers of heavy hail, or rain and hail			
		90	Thunderstorm with precip	At time of observation.		
		91	Rain and thunder in last hour	Rain, but no thunder, at time of observation.		
		92	Precipitation and thunder in last hour	Snow, or rain and snow, but no thunder at time of observation.		
		93	Thunderstorm, light	With rain or snow, but no hail.	tr, ts	
		94	Thunderstorm, light	With small hail.	th	
		95	Thunderstorm, moderate	With rain or snow, but no hail.		
		96	Thunderstorm, moderate	With small hail.		
		97	Thunderstorm, heavy	With rain or snow, but no hail.		
		98	Thunderstorm, with duststorm			
		99	Thunderstorm, heavy	With hail.		
		Blank	Unknown			

CARD CONTENT					SOURCE CONTENT	
Columns	Item	Code	Code Definition	Remarks	Units or Symbols	Reporting and Coding Practices
43-44	Total Cloud Amount	00-10	0 to 10 tenths			Obtained by adding amounts of upper and lower clouds. If sum of upper and lower cloud amounts exceeded 10/10, 10 was punched. If sum was 10/10 or less, that amount was punched, although it was impossible to determine whether the two layers combined actually covered that amount of the sky or a lesser amount. Few or 1- was coded as 00, and 9+ was coded as 10.
		Blank	Unknown			
45	Predominate Upper Cloud Form	0	No upper clouds		—	Any cloud type reported with Nb in parentheses, indicating precipitation occurring, was punched as if the (Nb) had not been reported.
		1	Cirrus		Ci	
		2	Cirrostratus		Ci-St, Cs	
		3	Cirrocumulus		Ci-Cu, Cc	
		4	Altocumulus		A-Cu, Ac	
		5	Altostratus		A-St, As	
		6	Altocumulus castellatus		Acc	
		Blank	Unknown	Left blank if 10/10 lower clouds reported.		
46-47	Upper Cloud Amount	00-10	0 to 10 tenths		—, f, 1-10	This cloud amount applies to all upper clouds, and is not necessarily restricted to the predominating type reported. Few was punched as 00, and 9+ as 10.
		Blank	Unknown			
48	Density of Upper Clouds	1	Transparent		1-5	Density of predominating upper clouds.
		2	Semi-transparent			
		3	Medium			
		4	Dense			
		5	Very dense			
		X	No upper clouds			
		Blank	Unknown			
49	Direction of Upper Clouds	0	Calm		C	Direction from which clouds are moving.
		1	Northeast		NE	
		2	East		ENE, E, ESE	
		3	Southeast		SE	
		4	South		SSE, S, SSW	
		5	Southwest		SW	
		6	West		WSW, W, WNW	
		7	Northwest		NW	
		8	North		NNW, N, NNE	
		X	No upper clouds			
		Blank	Unknown			
50-52	Height of Predominate Intermediate Clouds	000-999	0 to 99,900 feet	X-overpunch in column 50 indicates that height was obtained by some reliable means, within hour preceding observation.	Feet	Reported in feet, but coded and punched to the nearest hundred feet. Estimated heights were entered on the reporting form in red; measured heights in black, which were X-overpunched. Heights of Ci, Cs, or Cc were never entered.
		XXX	No intermediate clouds			
		Blank	Unknown			
53	Predominate Lower Cloud Form	0	No low clouds		—	Any cloud type reported with Nb in parentheses, indicating precipitation occurring, was punched as if the (Nb) had not been reported.
		1	Fog		Fog	
		2	Cumulus, fractocumulus		Cu, Fc	
		3	Cumulonimbus		Cu-Nb, Cb	
		4	Stratocumulus		St-Cu, Sc	
		5	Stratus, fractostratus		S, St, Fs	
		6	Nimbostratus		Nb-St, Ns	
		Blank	Unknown			
54-55	Lower Cloud Amount	00-10	0 to 10 tenths		—, f, 1-10	This amount applies to all low clouds, including fog, and is not necessarily restricted to the predominating type reported. Few was punched as 00, and 9+ as 10.
		Blank	Unknown			
56	Density of Lower Cloud	1-5	See Column 48.	Column 53 punched 2-6.	1-5	Density of predominating lower cloud type, except fog.
		1	Very thin fog	Column 53 punched 1.	1-5	Density of fog, if fog is reported as predominating lower cloud form.
		2	Thin fog			
		3	Thin in spots, light gray			
		4	Dense fog			
		5	Very dense fog			
		X	No low clouds			
		Blank	Unknown			

CARD CONTENT					SOURCE CONTENT	
Columns	Item	Code	Code Definition	Remarks	Units or Symbols	Reporting and Coding Practices
57	Direction of Low Clouds	0-8	See Column 49.		Letter Directions	Direction from which clouds are moving.
		X	No low clouds			
		Blank	Unknown			
58-60	Height of Low Clouds	000-999	0 to 99,900 feet	X-overpunch in column 58 indicates that height was obtained by some reliable means, within hour preceding observation.	Feet	Reported in feet, but coded and punched to the nearest hundred feet. Estimated heights were entered on the reporting form in red; measured heights in black, which were X-overpunched.
		XXX	No low clouds			
		Blank	Unknown			
61	Visibility (Shore Stations)	0	Less than 1/32 mile	Statute miles.	0-9	For shore stations only.
		1	1/32 mi but not 1/8 mi			
		2	1/8 mi but not 5/16 mi			
		3	5/16 mi but not 5/8 mi			
		4	5/8 mi but not 1 1/4 mi			
		5	1 1/4 mi but not 2 1/2mi			
		6	2 1/2 mi but not 6 mi			
		7	6 mi but not 10 miles			
		8	10 mi but not 30 miles			
		9	30 miles or over			
		Blank	Unknown			
	Visibility (Ship Stations)	0	Less than 50 yards	Nautical miles.	0-9	For ship stations only.
		1	50 yds but not 200 yds			
		2	200 yds but not 400 yds			
		3	400 yds but not 1000 yds			
		4	1000 yds but not 1 mile			
		5	1 mi but not 2 miles			
		6	2 mi but not 5 miles			
		7	5 mi but not 10 miles			
		8	10 mi but not 30 miles			
		9	30 miles or over			
		Blank	Unknown			
62-64	Duration of Precip	000-240	0.0 to 24.0 hours			Recorded in or converted to hours and tenths.
		Blank	Unknown			
65-68	Amount of Precip	0000-9999	0.00 to 99.99 inches	X-overpunch in Column 65 indicates estimated amount. Precipitation amounts from midnight to 6 AM are punched on the 0800 observation, amount from 6 AM to 6 PM on the 1200 observation, and the amount from 6 PM to midnight on the 1600 observation. No precipitation amounts are punched for the other hours.	In. to 1/100	Estimated amounts were entered on the recording form in red, or were underlined or encircled in red; measured amounts were entered in black. On ships and stations where raingage was not available, the following precipitation table was used for the purpose of estimating amount of rainfall:
		000X	Trace			
		Blank	Unknown or not reported			

RATE	AMOUNT PER HOUR	RATE	AMOUNT PER HOUR
Trace	0.01 inch	Heavy	0.50 inch
Light	0.10 inch	Very heavy	1.00 inch
Moderate	0.30 inch	Extremely heavy	2.00 inches

69-71	Duration of Fog	000-240	0.0 to 24.0 hours			Recorded in or converted to hours and tenths. Includes only fog with visibility less than 1100 yards, visibility code 3 or less.
		Blank	Unknown			
72	Past Weather Obstruction to Vision	0	None			Recorded in early years in Beaufort notation, later in symbols of International Code.
		1	Exceptional Visibility		V	
		2	Drifting snow, light or moderate		ks, k/s_o s_o/k	
		3	Drifting snow, heavy		K/s, S/k	
		4	Haze		z, Z	
		5	Low fog		fs, fg	
		6	Mist		m_o	
		7	Light fog		m, M	
		8	Fog		f	
		9	Fog		F	
		Blank	Unknown			
73	Past Weather Precip	0	None			
		1	Precip in sight		jp	
		2	Thunder, no precip		t	
		3	Drizzle		d, D	
		4	Showers		p, P	

CARD CONTENT					SOURCE CONTENT	
Columns	Item	Code	Code Definition	Remarks	Units or Symbols	Reporting and Coding Practices
73	Past Weather Precip (continued)	5	Rain		r, R	
		6	Snow		s, S	
		7	Rain and snow		rs, RS	
		8	Hail		h, H	
		9	Thunderstorm, with precipitation		t	
		Blank	Unknown			
74	Past Weather Misc. Weather	0	None	Total cloud amount less than 1/10.		
		1	Clear	Total cloud amount 1/10 to 3/10.	b	
		2	Partly cloudy	Total cloud amount 4/10 to 6/10.	bc	
		3	Cloudy	Total cloud amount 7/10 to 9/10.	c	
		4	Overcast	Total cloud amount more than 9/10.	o	
		5	Ugly, threatening sky		u	
		6	Lightning		l	
		7	Gale		Gale	
		8	Squally weather		q, Q	
		9	Heavy squalls		KQ	
		Blank	Unknown			
75-77	Duration of Favorable Flying Weather	000-240	0.0 to 24.0 hours			Reported in or converted to hours and tenths. Favorable flying weather must meet the following criteria: Sky partly cloudy or cloudy with ceiling 1000 feet or above, with surface wind speed less than 20 knots, with visibility 2 nautical miles (2 1/2 statute miles), or better.
		Blank	Unknown			
78-79	Height of Ceiling	00-97	0 to 9700 feet	Height of ceiling punched in these columns, despite printing of "Station Pressure" on the card form.		Height of low clouds, if below 9751 feet, provided more than 5/10 clouds exist. Not punched for early record.
		99	Unlimited (ceiling above 9750 feet, or clear to 5/10 clouds)			
		Blank	Unknown			
80		Blank	Not used.			