REVISED INSTRUCTIONS

FOR

KEEPING THE SHIP'S LOG-BOOK,

AND FOR

COMPILING THE NEW METEOROLOGICAL RETURNS.

ISSUED BY THE HYDROGRAPHIC OFFICE:

Commodore R. H. WYMAN,

UNITED STATES NAVY, HYDROGRAPHER.

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NAVY DEPARTMENT, WASHINGTON, D. C.,
September 30, 1877.

Approved, and respectfully submitted to the Department; if approved, that the necessary indorsement be given to carry the within instructions into effect.

DANIEL AMMEN,
Chief of Bureau of Navigation.

Approved by the Department, and these instructions will be issued and carried into effect from this date, October 11, 1877.

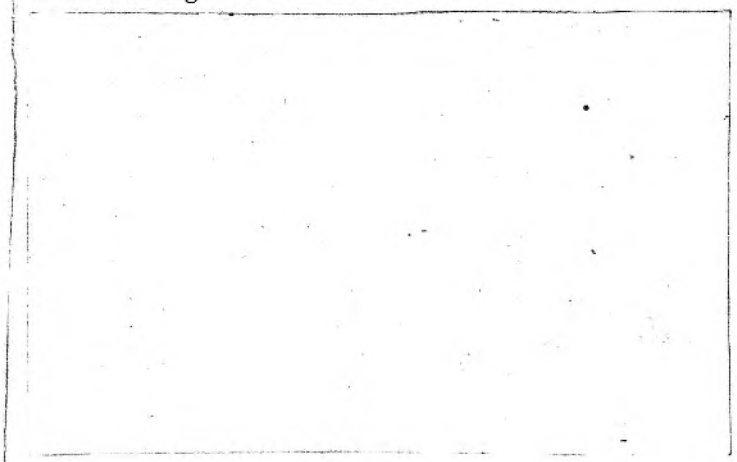
R. W. THOMPSON,
Secretary of the Navy.

HYDROGRAPHIC OFFICE,

Washington, D. C., September 30, 1877.

On September 1st, 1876, work was begun at the Hydrographic Office on a new edition of meteorological charts. It is the intention to continue this work until charts of the whole ocean-surface are completed. The first set of the series is now in press, and when printed, a sample-sheet will be sent to each ship, so that the project may be understood by the officers of the service, as their coöperation is essential to its success.

The charts that are finished cover that part of the Pacific Ocean between the equator and 45° north latitude, and from the American coast to the 180th meridian. The data for the charts have been taken chiefly from the logs of United States vessels of war.



Pages 7 and 8 are missing from the original.

I.

The log-books will be completely filled before transmission to Washington.

This is to avoid a waste of about ten per cent. (unfilled pages) of each log, which occurs under the custom of sending the books on the 1st of January and July.

II.

The officer of the deck is responsible for the correctness of his log, both the remarks and data in the columns.

As, however, instances are frequent in which both himself and the officer of the forecastle are so engaged as to be unable to note the instruments at the hour, and as it is very

desirable to have the records of these continuous, this object can be attained by **constituting the orderlies at the cabin-door the observers.** Their whole training cultivates the quality of accuracy, and if good men be selected for this duty, the Navigator can teach them the construction of the instruments and how to read them, and then no more trustworthy observers could be found.

The Orderly should enter in the rough log the readings of the **mercurial** barometer, attached thermometer, and psychrometer, (always being particular to see that the wick of the wet bulb is moist; the bulb itself must not be immersed in water,) and then show the log to the officer of the deck, who either fills the other columns or has the officer of the forecastle do it.

No hour should pass without having its columns entirely filled.

The names of the makers of the barometer and psychrometer, together with a description of the location of the instruments and the names of the orderlies who have observed them, shall be given in the front of every log-book.

At least once a watch the officer of the forecastle should be sent to observe all the instruments and report their readings to the officer of the deck.

Immediately upon being relieved, the officer who has just finished his watch shall examine the columns, write his Remarks, and sign them.

Every day the navigator shall examine the rough log of the previous day before it is copied, and if he notices anything apparently erroneous in either the columns or remarks, he shall call the watch-officer's attention to it, so that, if really an error, it may be corrected before being entered in the smooth log.

[redacted]

III.

In all the columns intended for figures, never use ditto-marks; in those intended for letters, always use ditto-marks for observations that are consecutively the same.

IV.

Winds. Only very light airs, flying all round the compass, are to be designated as "**variable**;" when the wind has any appreciable force, and can possibly be averaged for the hour, then **its magnetic direction is to be recorded to the nearest whole point.** The indefinite phrase **Sd. & Wd., for example, or any fraction of a point. must never be entered in the log.**

In judging the wind's force, the scale in the front of the log is to be intelligently—not literally—followed.

That scale was devised with an old-time frigate, close-hauled by the wind, in view: but with the recent models of various degrees of speed; with a ship running free, or before the wind; with sail carried—not according to what the wind will permit, but the prudence of the commanding officer;—with these various circumstances to be considered, it is evident that much discretion must be exercised in order to use the scale accurately.

V.

Barometer. **The readings of the mercurial barometer ONLY shall be entered in the log.**

VI.

Wet and dry bulbs. Where the psychrometer of the signal service is not furnished to ships, the method of mounting a wet and a dry bulb thermometer in a lattice case, such as that recommended by Rear-Admiral Jenkins, in a pamphlet on the Barometer, etc., will be adopted. The pamphlet will be found among those issued to navigators. The case can be made by the ship's carpenter, and mounted on springs in some safe place on the **spar-deck**.

The signal service psychrometer, when furnished, is to be kept in such a case.

VII.

Temp. of sea-water. **The permanent temperature of the sea-water is the object sought**; and to attain this, freed from all accidental changes, such as heating by the sun, friction of wind on the waves, settling of rain-water on the surface, etc., the bucket in which the water is drawn should be weighted and sunk to at least a fathom below the surface; **the thermometer should remain about one minute in the water before reading.**

VIII.

State of weather by symbols; forms of clouds; prop. of clear sky. These columns are very important; the symbols in the front of the log are ample for fully and accurately describing every phase of weather, and if a careful selection of them be made, these columns, in connection with the others, leave nothing to be desired as a meteorological record.

IX.

Record of sail. In this column, state at the top whether under sail or steam, or both; if under sail, its amount. When a change is made, such as setting, reefing, or taking it in, enter it opposite the hour of its occurrence. Otherwise, do not encumber this column with more entries.

X.

Daily position. The position by account must always be entered, and that by observation, whenever taken; the word "North" or "South" is to precede the latitude, and East or West the longitude, as the case requires.

XI.

Currents. This is probably the most difficult item of all to give correctly. **It is information regarding the permanent currents of the ocean that is sought**, and in order to discriminate between the permanent and the temporary, the following probable causes of currents in general may be briefly glanced at:

1. **Temperature.** Of two contiguous bodies of water—one hot, the other cold—the latter being specifically the heavier, will displace the former, and hence a permanent current is established.

2. **Evaporation.** Since no salts are taken up in the vapor, a body of salt water from which great evaporation takes place, will be specifically heavier than an adjoining one that gives off less vapor, and so a continuous flow from the dense to the light fluid will be maintained.

3. **Winds.** In a gale, the waves roll one after another in huge volumes toward the point to which the wind blows: the friction of the wind upon the water produces a temporary surface set to leeward. In the zone of trade-winds this set is no doubt constantly to the westward.

In the region of monsoons the set should be *with* the monsoon—changing when that changes.

4. **Difference of barometric pressure.** In gales of wind it is common for the barometer to fall from, say, 30.20 to 29.70—half an inch in less than a day and while the ship is passing over a comparatively small extent of ocean.

Take a very extreme case, merely for illustration: Suppose two contiguous square miles of ocean, the barometer standing 30.20 over one of them, and 29.70 over the other. This difference of half an inch in the barometer is equal to a difference of about one-quarter of a pound pressure per square inch of surface, or 36 pounds per square foot.

Taking 6,086 feet as the side of a square mile, it will contain 37,039,396 square feet: each square foot sustains a difference of pressure of 36 pounds, so that there are, in all, 1,333,418,256 pounds more pressure on the square mile over which the barometer stands 30.20 than on the one over which it stands 29.70. It is evident, that in order to attain an equality of level, a very decided set must take place from the former square mile toward the latter.

Now, instead of confining the case to the impossible small area of two square miles, let us suppose a gradual fall of barometer from one part of the ocean to the other—such a fall, in fact, over such an area, as comes often within the experience of every naval officer, and it seems reasonable that waves of the ocean, like those of the air, only smaller and more sluggish, are consequent upon every change of the barometer. These, however, are all temporary currents.

5. **Rotation of the earth.** First, suppose the earth at rest: then conceive it to revolve from west to east, as at present. On starting, the water of the ocean would, owing to its inertia, recede from the western shores of all the continents, and, as the earth continued to revolve, it would flow to the westward; for two reasons, however, it would be confined to equatorial regions: 1, the centrifugal force there being greatest; and, 2, because the meridians converge as we near the poles.

This second reason will appear the more forcible, if we suppose a body of water of five degrees area and any depth to set out from the Equator toward either pole. At every remove it would find fewer miles, feet, and inches, less linear breadth and width, in a surface of five degrees square. The depth remaining constant, its volume would be too great for an area of five degrees square in latitude 30°; still more so for one in latitude 60°, and so on. This constant crowding in extra-tropical zones would therefore constitute an opposing force sufficient to confine the flow of the water to a zone where its volume would undergo no change of shape, that is, the equatorial zone. Arriving, then, at the eastern shores of the continents to the westward of those from which it started, at the North and South American shores, for instance, having started from Europe and Africa, and being banked up by constantly arriving volumes, it would be forced to the northward and to the southward along the coast-line of each continent; it would then flow to the eastward in high latitudes until reaching the western shores of the continent from which it started, where, owing to the divergence of the meridians toward the Equator and the greater centrifugal force there, it would flow from the north and the south along the shore lines of the continents until reaching the equatorial zone, where it would again start westward on its circuit. Imagine this system of circulation once set up, and nothing is more natural than that it should continue while the earth revolves. Indeed, glance at any current chart of the world, and in a most striking way is this general system of circulation presented to the view.

It will now be seen how important a part the thermometer and hydrometer play in the discovery of currents: by the first a difference of temperature, and by the second a difference of density, is quickly detected; and, if a decided difference of either nature is found, a permanent current may be fairly inferred. A consideration of the winds, whether an accidental gale, the constant trades, or the seasonal monsoon, may lead us to deduce intelligently whether a set that may have been experienced for days is a temporary surface flow or a permanent current. So, also, keeping in view the range of the barometer for a few days—the locality and amount of its rise or fall—may help us in deciding whether a certain set be due to its extreme range or not.

A consideration of the rotation of the earth is of assistance only in determining the general direction of the great ocean currents.

The usual practice among Navigators is to ascribe to current the whole difference between the position by observation and that by account. But nothing can be more erroneous. Consider the errors in observing and calculating to which the position by observation is liable; consider, also, the gross errors which affect the position by account—the frequent incorrectness of the log-lines and sand-glasses; the inaccuracy of steering; the number of deck officers that judge of the speed, the course, and the leeway—and would it not be most strange if the position by the two methods *did* coincide? In addition to these reasons, if a ship be close-hauled by the wind, it is evident that the liability to inaccuracy in her reckoning is very much greater than when steering a course with the wind free.

The Navigator should always insure the absolute accuracy of the log-lines and sand-glasses before leaving port—**the length of a knot should be rigorously the proportional part of a mile that the sand-glass is of an hour**—the watch officers should agree upon a uniform method of heaving the log and estimating the speed, and great care be taken in the steering.

Even with these precautions, it must be remembered that there is still some inaccuracy in both the position by observation and that by account; and, besides, that one of the causes heretofore enumerated as producing temporary currents, may be at play; so, when a difference of even 5′ in the latitudes, in the longitudes, or in both, occurs, it may be safe to attribute it to accidental causes.

When the difference exceeds 5′, and is quite regular in both direction and amount, especially if this evidence of a current be corroborated by a change in the temperature or density of the water, then, **and only after carefully weighing all the circumstances,** should the Navigator enter in the log that there is a current. It is to be given in knots and tenths of a knot per hour, and its set to a definite whole point.

XII.

Variation of the compass.

The deviation of the compass shall be determined by swinging ship before leaving port. [P. 60, par. 13, Navy Reg., 1876.] When the compass error is determined

at sea by azimuths or amplitudes—and this must be done whenever possible—the deviation for the particular course the ship was heading at the time, shall, in all instances, be separated from the whole compass error, **and only the variation proper shall be entered in the log.** Write before the variation the latitude and longitude in which it was determined.

XIII.

Heading of log.

This must show the names of the ports between which the passage is making, and the day of the week, as well as the day of the month.

XIV.

Tides.

Instead of writing "At anchor" in the column "Courses steered," write opposite each hour the nearest whole point of the compass which the ship was headed by the tide, and at the beginning of each tide, the word "Flood" or "Ebb," as the case may be. When moored head and stern, state it so, at head of column "Courses steered." When the ship heads practically the same point during a whole tide, enter this point at the beginning of the tide, and ditto marks for the other hours. Enter in the "Remarks" the exact time of change of tide, and how long it took the ship to swing from one tide, to the other. Once a watch, when the tide is strongest determine its velocity by heaving the log, and enter it in the "Remarks." Each day, the Navigator shall enter after all the remarks, from the Nautical Almanac, the phase of the moon, and her declination (N. or S.) to the nearest degree, at midnight, local time.

XV.

Marking the log-line.

Previous to marking a new log-line, it is to be soaked in water for a few days, in order to get it in the condition it will be when in use. From fifteen to twenty fathoms will be allowed for "stray-line;" and then the length of a knot shall be determined (for the 28-second glass) by the following proportion, viz: As the number of seconds in an hour is to the number of feet in a sea mile, so is the length of the glass to the length of a knot, or,

$$3600^{s}: 6086 \text{ ft.} = 28^{s}: 47.33 \text{ ft.}$$

: 47 feet 4 inches;

therefore the length of the knot shall invariably be 47 feet 4 inches for the 28-second glass. When the 14-second glass is used, of course double the number of knots run out in order to get the speed.

Hereafter, the velocity of the ship is to be estimated in knots and tenths of a knot; and the word "fathoms" in all log-books will be stricken out and "tenths" inserted in its place.

The limit of "stray-line" will be marked by a piece of red bunting about six inches long, and each length of 47 feet 4 inches after that by a piece of fish-line with one, two, three, etc., knots in it, according to its number from the "stray-line."

Each length of 47 feet 4 inches (the "knot") is to be subdivided into five equal parts, and a small piece of white bunting about two inches long is to be turned into the line at every two-tenth division thus formed. Always, before leaving port, the Navigator will have the line thoroughly soaked for a few days, and then all the marks placed at their proper distances. He will also compare all the sand-glasses with a watch, and, if any should be incorrect, he will make them run the proper time by taking out or putting in sand, as the case requires. The frames must be removed for this purpose. During daylight, especially in very damp weather, it is preferable to use a watch to a sand-glass for noting the time.

XVI.

Remarks. **All meteorological information, such as particulars of wind, weather, etc., shall be the first item entered in the "Remarks" of each watch.** The wind and weather should be more minutely described than has been the custom. The character and frequency of squalls are to be entered in the "Remarks:" all that necessitate clewing down the topsails to be denominated "Heavy;" those to which to'gallant sails are taken in, "Moderate;" and those to which royals, "Light." Also enter the latitude and longitude of meeting or losing the trades, monsoons, or other constant and well-defined winds. State whether steering a course or "full and by."

The watch officers shall always sign the log on the day following that on which the watches were stood; and before signing they shall carefully examine both the remarks and columns and be sure of their correctness.

Finally, the "Directions for keeping the ship's log," which are printed in the front of the book, and to which these instructions are simply supplementary, should be more carefully read and complied with by the officers concerned in making these official records.

METHOD OF COMPILING THE DATA ON FORM B.

The information contained in the Remark Books and Track Charts, sent in by Navigators, lacks that uniformity and system of arrangement that is necessary in order to take advantage of it for any extensive work: and, although often causing much labor and pains to those who send them in, they are in the main of less value than they should be.

The Navigator's Remark Book, the Track Chart, and the Meteorological Journal, are hereby discontinued; the compilation on Form B, which is for sea observations alone, will replace them.

Forms B, E, and H constitute all that will be required of Navigators in the way of meteorological returns.

The compilations on these three forms is simply such an arrangement of the observations in the log-books as will make them directly available for incorporation in the meteorological charts now in course of publication by the Hydrographic Office.

Referring to Form A (the Diagram of Squares), it will be seen that the part of the ocean most frequently traversed, is divided into squares of five degrees of latitude by five degrees of longitude. They are numbered consecutively from 1 to 1667, so that either by its number, or limits in latitude and longitude, the area of ocean covered by any particular square can be designated.

Suppose a ship to sail from Acapulco for San Francisco, intending to take advantage of the winds alone to make the passage. She would cross certain squares, say num-

bers 106, 105, 104, 103, 102, 84, 83, 82, 64, 63, and 45, with the wind generally from the Nd. and Ed.: toward the northern limit of square 45 she would probably get Nw'ly winds and stand in for San Francisco across squares No. 46, 28, 29, and 30. The length of time in each square would vary according to her course across it; but, **however many hours she may be in any square**—whether three or three hundred—**the observations for those hours are to be compiled from the log-book on ONE blank of Form B.**

In order to prepare the log-book for this, the limits of all the squares crossed by the ship must be worked up and entered in the margin of the page. Take the accompanying pages "Z" of a log-book as a sample. The position by observation at noon of January 22d places the ship (by reference to Form A) in square No. 28; it is now necessary to ascertain at what hour she entered the square; so, working back from the noon position by observation (in every instance correcting the courses so as to use only **true courses**), it is found that she crossed the southern limit of the square, viz, the 35th parallel, in longitude 134° 21′ W., between 7:00 and 8:00 a. m. of the 22d. The position by observation at noon of the 23d still places her in square No. 28, and a glance at the courses steered between the two noon positions, shows the ship to have been in square No. 28 during the whole time. At noon of the 24th, she was in latitude 36° 21′ N., longitude 128° 21′ W.—therefore *out* of square 28 and *in* square 29. The intervening courses show that she must have crossed the eastern limit of square 28. Working forward from the noon position by observation of the 23d, it is found that she crossed the 130th meridian—the eastern limit—in latitude 36° 15′ N., between 11:00 and 12:00 p. m. of the 23d. Now, drawing heavy lines at the hours of entrance and exit, writing the latitude and longitude opposite them, and finally, entering the number of the square in the margin, the preparation of the log-book is complete so far as this square is concerned. The whole of every passage is to be similarly treated; the limits of all the squares traversed to be worked up, heavy lines drawn between the hours where these limits fall, the latitude and longitude written opposite these lines, and the number of each square in the margin.

The statement that only one blank of Form B is to be used for each square is subject to a single exception. Suppose a ship to enter a square on the 30th September, for example, and leave it on the 1st October. In this case, two blanks would be necessary—one for the hours of each month in the square. Thus, the observations on each blank are limited in *space* to one of the squares shown on Form A, and in *time* to the same month of the year. A mere inspection of Form B is almost sufficient to understand the method of making the compilation, but the procedure may be briefly described as follows: By Form A it is seen that the parallels 35° N. and 40° N. and the meridians 130° W. and 135° W. limit square No. 28; by "Z," the date in the square, name of the ship, and the time of beginning and finishing her log-book are seen; also, that the time in the square was 40 hours, viz, from 7:00 a. m., January 22d, to 11:00 p. m. of the 23d. The small chart on Form B is one of the five-degree squares of Form A on a larger scale. It is divided by lines at every whole degree, thus forming 25 sub-squares of one degree each. These are lettered for convenience of reference. The dots on the lines are 30′ marks, to facilitate plotting the ship's track.

The latitudes and longitudes of entrance and exit, together with the intervening noon positions, afford the requisite points for laying down the track, and an arrow-head at its terminus indicates the direction.

As the Navigator works up the position at 8:00 a. m. and 8:00 p. m. he should enter them in the margin of the log-book for additional points in determining the track.

The current arrows are explained by a little note on the blank itself, but instead of the word "*fms*," on the blank, the word "*tenths*" is to be substituted. To compile the wind observations, it is seen that on the 22d the wind was seven hours from N. W., viz, from 8:00 a. m. to 2:00 p. m.; on the 23d it was six hours from the same point, viz, at 6:00 a. m. and from 11:00 a. m. to 3:00 p. m.—making a total of thirteen hours, which is entered on form B, opposite N. W. The force was very variable, however, but a *mean* of the thirteen hourly forces is struck and entered as 6, opposite

N. W. Next, on the 22d, the wind was nine hours from N. W. by W., viz, from 3:00 to 11:00 p. m. It was not again from this point while the ship was in this square, so 9 is entered on the blank opposite N. W. by W., and a mean of the nine hourly forces as 5.

At midnight of the 22d, it was one hour from W. S. W., force 6; at 1 and 2: a. m. of the 23d it was two hours from west, force 7; at 3 and 4: a. m. it was two hours from W. by S., force 7; and at 5:00 a. m. it was one hour from N. by W., force 7; all of which are duly transcribed to the blank. Finally, from 7: to 10: a. m. of the 23d, four hours, the wind was N. W. by N., and, again, from 4: to 11:00 p. m., eight hours, from same point, making a total of 12 hours, with a mean of the forces as 7. The summation of all these hours is 40, which proves the correctness of the work.

Had there been hours of "variable winds" and "calms" interspersed throughout these forty hours, they should have been entered in their proper places on the blank, and then the summation of the winds, variables and calms, should be 40.

To compile the barometric and thermometric observations, add up all the hourly observations for each quantity and divide each sum by the number of hours in the square, carrying the means to hundredths of an inch and tenths of a degree.

For the daily ranges, take the difference between the maximum and minimum of each day, then the sum of these differences, and divide by the number of days in the square. In reckoning the days for this purpose, when the ship has been in a square during the twelve a. m. hours or the twelve p. m. hours of any day, take the difference between the maximum and minimum recorded during the whole 24 hours of that date. For instance, on January 23d, (see Z,) if the maximum or minimum of any quantity had occurred previous to 7:00 a. m., although outside of square 28, still it would be used to get the difference that constitutes the daily range. But if the limit 35° N. fell between 4:00 and 5:00 p. m. of the 22d, then the daily ranges would be used, not for square 28, but for the one in which the greater portion of the day was passed.

The daily ranges are to be carried to hundreths of an inch

and tenths of a degree. For the record of squalls, every hour in which the letter *q* occurs is called an hour of squalls, and whether it is to be called "Heavy," "Moderate," or "Light" must be judged from the "Remarks." Likewise, every hour in which the letter *f* occurs is called an hour of fog, and so entered. So, also, every hour in which the letters *m*, *d*, *p*, or *r* occurs is to be placed under the heading "Rain" or "Mist." Every phase of weather experienced in the square is to be denoted by its proper symbol; also the various forms of clouds by their symbols. The mean of all the hourly observations of clear sky is to be entered.

Only two places are given for magnetic observations, since, in a five-degree square, this quantity is seldom likely to vary so much as to require more. The latitude and longitude in which the variation was determined, is to be entered as in the sample copy of Form B. Where several magnetic observations are taken within a small area, and they do not differ materially, the mean of all is to be given. **In all instances, as heretofore stated, it is the variation alone, separated from the whole compass error by applying the deviation for the particular course the ship was heading when the observation was taken, that must be given on Form B, as well as in the log-book.**

Form B may be regarded as giving the abstract features of a five-degree square of ocean surface, and in order that it may do this accurately, Remarks are essential to complete the outline given in the columns. The nature of the Remarks required will be easily understood by comparing those on the sample of Form B with the sheets "Z" of the log-book from which they are deduced.

It is required to give such a minute account of the wind, weather, barometric and thermometric phenomena, in each sub-square (referring to it by its letter) as will fully illustrate what the ship experienced. For instance, the extreme range of the barometer and the sub-square in which it took place could not be known from the tabulated mean 29.91 on Form B, but the Remarks give it most satisfactorily. So, also, the veering of the wind and its character, and the corresponding changes of weather and temperature, with the locality of their occurrence, are fully given in the Remarks. Besides the foregoing, the following details are to be given

in the Remarks, viz: The latitude and longitude in which a gale began—the veerings of the wind with its duration and force from each point, and the accompanying changes of barometer and thermometer—and the latitude and longitude in which it ceased: also the condition of wind, weather, barometer, and thermometer for at least twenty-four hours previous to such a gale. Tide-rips; discolored water; sea-weed; icebergs; specific gravity of sea-water, and any sudden change in its temperature and density; particulars of currents when such are judged to exist; longitude of crossing the line; latitude and longitude of meeting or losing the trades, monsoons, or any other constant and well-defined winds; distance from shore the land and sea breezes are felt, their strength and time of setting in; and in fact any other matter of information the Navigator deems of value in contributing to a knowledge of the ocean.

When a cyclone or hurricane occurs, a very careful and frequent observation of the instruments, wind, weather, sea, etc., shall be kept by some officer—**by the Navigator himself, if practicable**—so that accurate information regarding these meteors may be collected. After the record of the storm is transferred to the log-book, it will be compiled on Form B in the manner of the one there given. It will be seen that this is a transcript of such parts of the log as are essential to a full history of the storm.

The basis of arrangement in the log is by hours; here it is by the veering of the wind. For instance, the wind was first from the SE. for two hours; it then veered to SE. by E. and was steady one hour; next to S. by E. and was steady one hour; again to ESE. and was steady five hours, and so on. The data in the other columns are given for the periods the wind was from each point. A short account of wind, weather, swell, run of ship, etc., previous to, during, and after the cyclone, should be given, as in the sample, and a little chart with the cyclone plotted should accompany Form B.

The compilation on Form B breaks up the observations of a passage and groups them by squares; this is necessary in order to use them for the meteorological charts for which they are intended. But it is also desirable to have a continuous record of the passage, as by it many phenomena that would otherwise be masked are made apparent.

Therefore, Form E is supplied. It is ruled for a fifteen-day passage—**one line for each day.**

When the passage exceeds this number, two or more blanks are to be used, and parts of two different months, when the passage so occurs, are to be put on the same blank.

A mere inspection of the blank is sufficient to understand it; but, to be entirely explicit, the observations of the two days in the sheets "Z" are filled out for a sample, as follows:

Jan. 22	Sail.	35° 10′ N., 134° 01′ W.	N.W.	4–6–8	Steady in direc., strong q.	30.16 to 29.89.	59° 58°	56° 52°	Boisterous, wet, cloudy.
Jan. 23	Sail.	36° 03′ N., 131° 14′ W.	N. W. by N.	7–6	Veering from W. to N. by W., q.	29.65 to 29.92.	58° 50°	58° 46°	Cloudy and wet, then clearing.

By the "Range" of the barometer in this and Form H is to be understood the daily maximum and minimum attained; but these are to be given in the order in which they occur; for instance, in the above example from Z, on January 22d, the barometer was falling, so the record stands 30.16 to 29.89. On the 23d it was rising, hence it is recorded 29.65 to 29.92; and furthermore, it appears by this method that during the night January 22d–23d, the barometer was falling from 29.89 to 29.65.

Form H is for harbor observations—**one line for each day**, but different months are not to be put on the same blank; and it is so much like Form E that no example for filling it is necessary.

Remarks—whatever their nature, provided they add to a knowledge of the passage, or of the harbor in which the ship was anchored—are to be made on Forms E and H. This gives full scope for imparting a variety of information regarding the ports visited.

No details of the Remarks required for Form H can be given; but if the Navigator will suppose himself approaching a port for the first time, without any information whatever regarding it, and will then write

down such headings as he would like information upon, he can best understand what is needed.

No tracks are to be plotted on Form A; it is simply for reference—to ascertain the numbers and limits of the different squares. For his own convenience, the Navigator might make, on a large scale, a diagram of the probable cruising-ground of the ship, and number the squares as they are on Form A.

The sheets of the log, marked "Z," are written in conformity to the instructions herein given, and in precisely the manner the log-books are to be written hereafter; it is furnished as a sample; many logs are now like it, but the object sought is uniformity among all.

The Navigator shall make all the compilations himself; this work must not be delegated to another.

The compilation on Form B is to be made on the day after passing out of a square, while the weather phenomena of the square are still fresh in the memory. The date at the foot of the form must be that on which the compilation was actually made.

Form E should be filled up from day to day.

On the completion of a passage, all of Forms B and E relating to it are to be wrapped up (not folded, when avoidable) **and sent by the first mail opportunity to Washington, addressed thus:**

["Hydrographic Office Forms B and E (for meteorological data).]

* * * * * *

"*Chief of Bureau of Navigation,*
"*Navy Department, Washington, D. C.*"

Form H is to be sent monthly.

On the receipt of a log-book at Washington, it will be examined at the Hydrographic Office, and classed according to the internal evidence it contains of its value. A sufficient number of each of the compilations that were made from it will be compared with the log itself to ascertain the general accuracy of both the work and the compiler, and then the compilations will be embodied in the meteorological charts. Thus, as the observations in a log are to enter directly and at once into the charts that are

afterward to guide officers in the selection of their routes from port to port, it is hoped that this will be an incentive to a lively interest in the undertaking, and that such a degree of care and accuracy will be bestowed on the observations that they will be always trustworthy.

The Navigators whose compilations are accurate, and who contribute valuable information, will receive due credit for their labors in the Preface to the series of charts for which their work is used.

After the contents of Forms B, E, and H are transferred to the meteorological charts, these forms are not destroyed, but are filed away for future reference; they thus constitute a most valuable collection of meteorological archives; hence a choice of language in the Remarks, neatness of penmanship, durability of ink, etc., are matters of some importance.

Although much deliberate thought has been bestowed on this system, still some points of value may have been overlooked; therefore, if suggestions regarding the work are sent with the forms, they will be gratefully received.

Whenever the supply of any of the blanks is running short, inform the Bureau of Navigation by letter, so that a sufficient number may be sent in time for use.

On receipt of these **Instructions** and the blanks to which they refer, the part of the log-books that is filled with observations, whether at sea or in port, will be compiled on its proper form and transmitted to Washington. When the compilations are thus brought up to date, they will afterward be regularly made and sent as directed.

For convenience of reference, such parts of the "Directions for keeping the ship's log" as relate particularly to meteorology are produced here.

SYMBOLS *to be used in recording the* STATE OF THE WEATHER *in the proper column.*

b.—Clear blue sky.
c.—Cloudy weather.
d.—Drizzling, or light rain.
f.—Fog, or foggy weather.
g.—Gloomy, or dark, stormy-looking weather.
h.—Hail.

l.—Lightning.
m.—Misty weather.
o.—Overcast.
p.—Passing showers of rain.
q.—Squally weather.
r—Rainy weather, or continuous rain.
s.—Snow, snowy weather, or snow falling.
t.—Thunder.
u.—Ugly appearances, or threatening weather.
v.—Variable weather.
w.—Wet, or heavy dew.
z.—Hazy.

SYMBOLS *to be used in recording the* FORMS *and* APPEARANCE OF CLOUDS *in the proper column.*

Cir.—Cirrus .....Primary form.
Cir. Cum.—Cirro-cumulus .....Secondary form.
Cir. Str.—Cirro-stratus .....Secondary form.
Cum.—Cumulus .....Secondary form.
Cum. Str.—Cumulo-stratus .....Secondary form.
Nimb.—Nimbus .....Primary form.
Str.—Stratus .....Primary form.

CLASSIFICATION OF CLOUDS.

PRIMARY CLOUDS.

Cirrus—"Consists of light and feathery-streaked filaments, seen in clear weather."
Cumulus—"Is composed of huge hemispherical masses, apparently resting on a horizontal base; occurring chiefly in summer, and presenting the appearance of heaps of snow."
Stratus—"Is an extended horizontal layer of cloud, increasing from below, and appearing at times, about sunset, of extraordinary brilliancy.
Nimbus, or Rain cloud.

SECONDARY, OR COMPOUND CLOUDS.

Cirro-cumulus—"Forms the transition from *Cirrus* to *Cumulus*, and constitutes the aggregation of small round white clouds, resembling sheep in a meadow."
Cirro-stratus—"Consists of *Cirrus* combined in horizontal or slightly inclined layers of considerable extent."
Cumulo-stratus—"Often gives to the horizon a bluish-black color, frequently seen in great perfection toward night of dry and windy winter weather."

Winds.

Force of wind, nautical scale.	Nautical designation.	Sail that a full-rigged ship may carry, close-hauled by the wind; also her probable speed.	Sail that a full-rigged ship may carry, wind on quarter; also her probable speed.	Force of wind in pounds per square foot.	Velocity of wind in miles per hour.
0	Calm.	All sail.	All sail.	0	0
1	Light airs.	All plain sail and stay-sails; smooth sea; 0.5 to 1 knot per hour.	All plain sail and studding-sails; smooth sea; 1 to 1.5 knots per hour.	0.004 to 0.019	1 to 2
2	Light breezes.	All plain sail and stay-sails; smooth sea; about 2 knots.	All plain sail and studding-sails; smooth sea; 2 to 3.5 knots.	0.08	4
3	Gentle breezes.	All plain sail and stay-sails; smooth sea; 3 to 4 knots.	All plain sail and studding-sails; smooth sea; 4 to 5 knots.	0.36	9
4	Moderate breezes.	All plain sail and stay-sails; smooth sea; 5 to 6 knots.	All plain sail and studding-sails; smooth sea; 6 to 7 knots.	1.0	14
5	Stiff breezes.	Courses, top-sails, to'gallant sails and stay-sails; moderate sea; 6 to 7 knots.	All plain sail and studding-sails; moderate sea; 8 to 9 knots.	1.5	17
6	Fresh breezes.	Courses, single-reefed top-sails, to'gallant sails; moderate sea; 7 to 9 knots.	Courses, top-sails, to'gallant sails, lower and topmast studding-sails; moderate sea; 10 to 12 knots.	2	20
7	Very fresh breezes.	Courses, double-reefed top-sails, fore topmast stay-sail; moderate sea; *about* 7 knots.	Courses, single-reefed top-sails, to'gallant sails; moderate sea; 12 to 14 knots.	3	24
8	Moderate gale.	Single-reefed courses, treble-reefed fore and main top-sails, close-reefed mizzen, fore topmast stay-sail; rough sea; 4 to 5 knots.	Single-reefed courses, double-reefed fore and main top-sails, close-reefed mizzen; rough sea; about 10 knots.	5	30
9	Strong gale.	Close-reefed courses, close-reefed fore and main top-sails, storm stay-sail; rough sea.	Close-reefed courses, close-reefed fore and main top-sails, storm stay-sails; rough sea.	8	40
10	Very strong gale.	Close-reefed fore-sail, close-reefed main top-sail, fore storm stay-sail; very rough sea.	Close-reefed fore-sail, close-reefed main top-sail, fore storm stay-sail; very rough sea.	23	67
11	Violent gale.	Storm-sails, or close-reefed main top-sail and fore storm stay-sail; very rough sea.	Close-reefed fore-sail, close-reefed main top-sail, fore storm stay-sail.	32	80
12	Hurricane, Typhoon, Cyclone.	None; lying to; drifting bodily to leeward.	Scudding under bare poles.	50 and upward.	100 and upward.

The above tabulated sail and speed corresponding to various forces of the wind are but approximations to what really takes place according to particular circumstances, such as model of ship, course steered with reference to the wind, condition of sea, &c.