Hydrography.—Drainage basins of North America: Atlantic; St. Lawrence; Hudson Bay; Arctic; Bering Sea; Pacific; Gulf of Mexico. Harbors of North America: conditions necessary for good harborage. Nature and origin of harbors: delta harbors; drowned river harbors; lagoon harbors; moraine harbors; coral reef harbors. Geological actions which tend to improve or depreciate harbors. Harbors of North America: for a discussion of this topic see 13th Annual Report, United States Geological Survey, pp. 160–209. Lakes of North America: lakes of Glacial origin; coastal lagoon lakes; river lagoon lakes; closed basin lakes; lakes formed by mountain movements.

LECTURE III.

SUBJECT.—CONTINENTAL GROWTH OF NORTH AMERICA.

Geologic Time.—Subdivisions of the time scale; age of the earth.
Evolution of life.
Pre-Cambrian Time.—Beginning of geologic history; Algonkian land masses; life in pre-Cambrian Time.
North America in Paleozoic Time.—Cambrian; Silurian; Devonian; Carboniferous.
North America in Mesozoic Time.—Triassic; Jurassic; Cretaceous.
North America in Cenozoic Time.—Eocene; Miocene; Pliocene; Pleistocene.
Conclusion.—Permanency of the North American Continent.

LECTURE IV.

SUBJECT.—MINERALS AND SOILS OF NORTH AMERICA.

Nonmetallic minerals.—Coal; petroleum; natural gas; phosphates; origin, geologic and geographic distribution.
Metals.—Placer deposits: chemical deposits: unstratified deposits; veins—origin, structure, dip, strike.
Modification of deposits by earth movement.
Geographic distribution of metals.—Gold; silver; copper; lead; zinc; tin; nickel.
Origin of soils.—Wind; rain; rivers; frost; glaciers; animals.
Soil texture.
Soil structure.
Distribution of soils.

PHYSIOGRAPHY.

LECTURE I.

SUBJECT.—THE GEOLOGICAL WORK OF THE ATMOSPHERE.

Geologic circulation.—Uplift; erosion; transportation; sedimentation.
Atmospheric agencies.—Physics of atmosphere: upward extent of atmosphere; weight of atmosphere; composition of atmosphere; heat in atmosphere—source, variation; absorption in atmosphere—absorption of moisture, condensation of moisture; moisture in atmosphere—convection, circulation, storms.
Weathering effects of atmosphere.—Changes of temperature: mechanical effects of wind: on land—removal, etching; on water—waves, currents, change of level.
Transporting effects of atmosphere.—Arid regions.
Sedimentation from atmosphere.—Dunes; ponded rivers; formation of soil; loess.

LECTURE II.

SUBJECT.—GEOLOGICAL WORK OF RAIN.

Cause of rain.
Erosive effects of rain.—Chemical work; caverns; mechanical work; impact; earth pillars.
Transporting effects of rain.—Material carried in solution; material carried in suspension; landslides.
Sedimentation due to rain.—Fossilization; spring deposits; cave deposits.

LECTURE III.

SUBJECT.—GEOLOGICAL WORK OF RIVERS.

Sources of supply.
Avenues of loss.
Erosive effects.—Chemical action; mechanical action.
Kinds of erosion.—Filing; pot holes; recession of falls; ox bows; recession of cliffs.
Transporting effects of rivers.—Substances carried in solution; substances carried in suspension.
Sedimentation of rivers.—Cause of deposition; alluvial cones; deltas; flood plains; terraces.

LECTURE IV.

SUBJECT.—GEOLOGICAL WORK OF RIVERS.

Cycle of a river.—Youth; adolescence; maturity; old age.
Antecedent.
Revived.
Superimposed.
Resurrected.
Adjusted.
Beheaded.
Captured.
Drowned.
Diverted.

THE BAROMETER AS USED AT SEA.

Ever since the first International Meteorological Congress at Vienna, in 1873, there has been a steady movement toward the full recognition of the general principle that atmospheric pressure is not correctly expressed by the height of a column of mercury unless that height be corrected for the effect of the variations in gravity as well as variations in temperature. The correction for gravity was early adopted by the Weather Bureau, by an order of General Hazen, so far as concerns observations at land stations, and probably at the present time no national service would do violence to modern science by neglecting this. On the other hand all must admit that if the effect of a change of gravity is important for the land, it is equally so for the ocean; it must be perceived that in this matter uniformity of practise is best and that the reduction to standard gravity ought to be applied to all mercurial barometers and to the isobars of all charts.

We are very glad to see that the United States Hydrographic Office has taken the proper stand in this matter, and is preparing to issue on its pilot chart isobars of standard pressures. We print the following extract from a recent instruction by Capt. C. C. Todd, Hydrographer, U. S. N., addressed to all branch hydrographic offices, and relating, as we understand, not only to the daily international simultaneous observations at 1 p. m., Greenwich time, but also to all other barometric work:

The adoption of a new form of barometer comparison card renders necessary the following instructions as to the use of the cards. Attention is also called to those paragraphs of Hydrographic Office Publication, No 119, referring to the subject of barometer comparisons.

* * * * * * *

Upon receipt of each card see that the character of the ship's barometer, whether mercurial or aneroid, is indicated in the appointed place.

If the ship's barometer is mercurial the reading given by the observer should be corrected by you for temperature, using for this purpose Table 3 of the "Barometer Correction Card" and reduced to standard gravity according to the Table 2 given below. The result is to be neatly entered in red ink in column 2 of the card.

If the ship's barometer is aneroid, neither of these corrections is necessary and column 2 should be left blank.

You will ascertain the reading of the office standard barometer at the given time of observation aboard ship. If the standard is mercurial the reading must be corrected for temperature, initial error, height above sea level, and reduced to standard gravity. If the standard is aneroid, it must be corrected for initial error and height above sea level.

The reduction to sea level is additive, and amounts to one hundredth inch (0.01) for each ten (10) feet of elevation. (See Table 1.) Enter the reading of the standard thus corrected in the third column of the card in red ink.

In column 4 enter, in red ink, the difference between the corrected reading of the ship's barometer and the corrected reading of the office standard, prefixing a plus (+) sign if the ship's barometer reads lower than the standard, a minus sign (—) if the ship's barometer reads higher than the standard. Divide the algebraic sum of these differences by the total number of readings and enter the result at the foot of the column, prefixing the proper sign.

All readings should be to the nearest hundredth of an inch and no further. Promptly forward the completed cards to the main office.

Comparisons should be made on several different days; not several on the same day. Readings on at least three (3) different days are necessary for a satisfactory determination of the error of the ship's barometer.

The standard barometer (both mercurial and aneroid) of the branch office should be compared once a week with the local standard of the United States Weather Bureau. In case of any discrepancy the latter

should be adopted as final, and the difference as the initial error of the office standard.

In comparing the office standard with the 8 a. m. (seventy-fifth meridian time) readings given on the Daily Weather Map, it should be remembered that the latter have been reduced to standard gravity. The reading of the office standard, if mercurial, must therefore also be so reduced before comparing.

If a self-recording aneroid is employed care should be taken to see that the times indicated on the barograph are correct. At local noon of each day the box should be tapped with sufficient force to slightly disturb the index hand. The exact point on the curve corresponding to local noon will thus be recorded.

If the ship's barometer gives the atmospheric pressure in millimeters the readings of the standard should be converted to millimeters before entering upon the card, using for this purpose Table 4 of the "Barometer Correction Card."

TABLE 1.—*Reduction of the barometer to sea level.*

Height.	Correction.
Feet.	*Inch.*
20	+0.02
140	0.14
160	0.17
300	0.31

TABLE 2.—*Reduction of the mercurial barometer to standard gravity (calculated for pressures between 29 and 31 inches).*

Latitude.	Correction.	Correction.
	Inch.	*Millimeters.*
0°	−0.08	−2.0
40	−0.01	−0.4
45	0.00	0.0
50	+0.01	+0.4
90	+0.08	+2.0

TABLE 3.—*Temperature correction (calculated for mercurial column of 29.50 inches).*

Attached thermometer.			Correction to be applied to reading.
Fahr.	Cent.	Réau.	
°	°	°	*Inch.*
5	−15.0	−12.0	+.06
6	−14.4	−11.6	
7	−13.9	−11.1	
27	− 2.8	− 2.2	.00
28	− 2.2	− 1.8	
29	− 1.7	− 1.3	
30	− 1.1	− 0.9	
95	35.0	28.0	−.18
96	35.6	28.4	
97	36.1	28.9	
98	36.7	29.3	

TABLE 4.—*Conversion of millimeters to inches.*

Mm.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
700	27.56	27.56	27.57	27.57	27.58	27.58	27.58	27.59	27.59	27.60
701	.60	.60	.61	.61	.61	.62	.62	.63	.63	.63
702	.64	.64	.65	.65	.65	.66	.66	.67	.67	.67
703	.68	.68	.69	.69	.69	.70	.70	.71	.71	.71
704	.72	.72	.72	.73	.73	.74	.74	.74	.75	.75
795	31.30	31.30	31.31	31.31	31.32	31.32	31.32	31.33	31.33	31.34
796	.34	.34	.35	.35	.35	.36	.36	.37	.37	.37
797	.38	.38	.39	.39	.39	.40	.40	.41	.41	.41
798	.42	.42	.43	.43	.43	.44	.44	.45	.45	.45
799	.46	.46	.47	.47	.47	.48	.48	.48	.49	.49

Especially do we note that the above instructions make full provision for a very important matter, viz, the determination of the initial error, or the error of zero point, or the general relation of the ship's barometer to the international standard adopted by the Weather Bureau and the Hydrographic Office.

When barometers are brought from vessels to the shore and hung alongside of a station instrument for comparative readings, it is usually found that the ship's barometer needs a correction in order to make it agree with the standard. Now a barometer is a comparatively delicate and complex instrument, and there is no assurance that this correction has not been changed or perhaps even wholly caused by some accident in bringing the instrument from the ship to the station; there is also no assurance that it will not again change when carried from the station back to the ship. It is, therefore, far better not to remove the barometer from its permanent place on shipboard. The correction that is desired can be just as well determined by simultaneous readings taken on the ship and at the land station of the Weather Bureau. The navigator has simply to reduce the ship's readings to standard temperature by Table 3, standard gravity by Table 2, and sea level by Table 1, and compare the result with the observations on land, or the isobars of the daily chart, which are also reduced to sea level, gravity, and temperature. The regular observations at 8 a. m. and 8 p. m., standard eastern time (which is the same as 1 p. m. and 1 a. m., Greenwich time), can be used for this purpose day after day. This is the method adopted and recommended by the Editor in 1871 for the voluntary marine work of the Signal Service, and continued when he took charge of the reduction and publication of the international simultaneous work in 1875. The Hydrographic Office very properly recommends that readings for comparative purposes should be made on at least three different days when the vessel is in port, but the Editor would hope that vessels may be able to maintain their record when in port as regularly as when at sea, so that there may be no breaks in the record.

It is highly important that all mariners should cooperate in this effort to attain the highest accuracy in their barometric observations. The little additional labor means a greater addition to meteorology. It is simply doing things in the right way instead of in a slipshod, wrong way.—*C. A.*

WHAT IS A STORM WAVE?

The following query was recently received by the Chief of the United States Weather Bureau:

The Standard Dictionary's definition of storm wave reads "A wave on the ocean surrounding a cyclonic area: caused by a difference in pressure." In the number for December, 1900, of Science and Industry, Mr. Ernest K. Roden published an article entitled "Revolving Storms." In this article he states that the storm wave is at the center of the storm area, and gives a sketch showing how it is formed. Would you be so kind as to favor us with your judgment as to the accuracy of these statements; which would you think is correct?

A board was appointed by the Chief of Bureau for the purpose of considering the definition of the term storm wave. The Chief also submitted to the board the following additional queries:

Does centrifugal force cause the water to be scooped out under the center of the cyclone, and to bank up in a ridge around its outer periphery; or does the decrease in air pressure, that is the result of centrifugal force, acting upon the water cause the water under the center of the cyclone to bulge up like an inverted soup plate?

A brief review of the literature on this subject will be of interest, not only on account of its bearing upon the significance of the term storm wave, but because it also gives us a full discussion of the meteorological conditions that produce this phenomenon.

In Piddington's Sailor's Hornbook, 1848, p. 127, we read:

Every seaman has also seen that under a waterspout the sea is boiling and foaming, and rising up, and traveling along with the spout, in a space of perhaps some two hundred yards or more in diameter, and he can suppose that, if a boat could live within it, it might be carried