The surface temperatures agree with the results of previous observations for the same seasons and latitudes. It is to be regretted that no temperatures below the surface were obtainable, on account of the absence of deep-sea thermometers; but as the Enterprise is a cruising ship of war, and is not fitted especially for this kind of work, Commander Barker and the officers are deserving of great commendation for the valuable results accomplished. When the specimens of the bottom arrive, they will be sent to the Smithsonian institution for examination and discussion.

J. R. BARTLETT.

U. S. hydrographic office, March 8.

THE DISTRIBUTION OF RAINFALL IN NEW ENGLAND, FEB. 10–14, 1886.

THE rainstorm which occurred in the eastern part of the United States between the 10th and 14th of February of the present year was very severe in the southern part of New England. The amount of rain surpassed that of any preceding storm on record in that portion of New England where it was the greatest. In addition, there was a large quantity of snow and ice upon the ground, which was melted, and swelled the amount of water pouring into the rivers, thus causing most disastrous floods.

The meteorological conditions which attended this remarkable rainstorm are deserving of attention. On the morning of Feb. 11, the pressure in the eastern part of the United States was unusually high. At Anticosti Island the barometer (reduced to sea-level) indicated 30.01 inches; in New England the pressure ranged from 30.9 inches on the eastern border, to 30.6 on the western; while a trough of relatively low pressure, 30.0 inches, extended from the Gulf of Mexico to the lake region. Light rains were falling along the eastern front of this trough in the central states, heavy rains upon the Middle Atlantic coast, and the storm was just beginning in New England. During the day a centre of depression gradually developed in the central states, and the pressure began to fall. The fall was very rapid on the 12th; and on the morning of the 13th the pressure ranged from 29.8 to 29.6 inches in New England, with the centre of the depression, 29.45 inches, over Lake Ontario. During the 13th the storm-centre advanced rapidly down the St. Lawrence valley, but the rainfall had ceased to be excessive. On the 12th, the day on which the greatest rainfall was noted, the pressure conditions were peculiar. A careful charting of the barometric observations made by the U. S. signal service shows that in the morning a well-developed centre of low pressure existed in Indiana, moving northerly. In the afternoon a secondary depression formed on the Atlantic coast, which at ten P.M. was central at Washington. At seven A.M. of the 13th but one centre existed,—over Lake Ontario. The heaviest rainfall, therefore, occurred simultaneously with the development of a secondary barometric depression, south-west of New England. In its development the barometer fell rapidly. Between seven A.M. of the 12th and seven A.M. of the 13th, the fall was 0.54 of an inch at New York, 0.57 at New London, and 0.60 at Boston.

No peculiarities were noted in the other conditions. The temperature remained very nearly stationary during the 11th and 12th at a few degrees above the freezing-point, but rose on the night of the 12th and the morning of the 13th to above 50° F.

The region covered by the greatest rainfall includes the states of Connecticut, Rhode Island, and the eastern portion of Massachusetts. As there are many observers of rainfall in this region, it has been possible to determine the distribution of the rainfall with considerable approach to accuracy. The special reports collected by the New England meteorological society from one hundred and thirty-two observers show, that, in a region covering more than one-half of Rhode Island and the south-eastern part of Connecticut, over eight inches of rain fell. The amount diminishes rapidly west and east of this region, about two and one-half inches having fallen on Cape Cod, and less than one inch in the north-western part of Massachusetts. The region of heaviest rainfall is situated about two hundred miles north-east of the position of the centre of barometric depression on the afternoon of the 12th.

In order to give a general idea of the extent of territory covered by the rainfall, the following estimate has been made by the help of the accompanying map. The estimate includes the land-surface only.

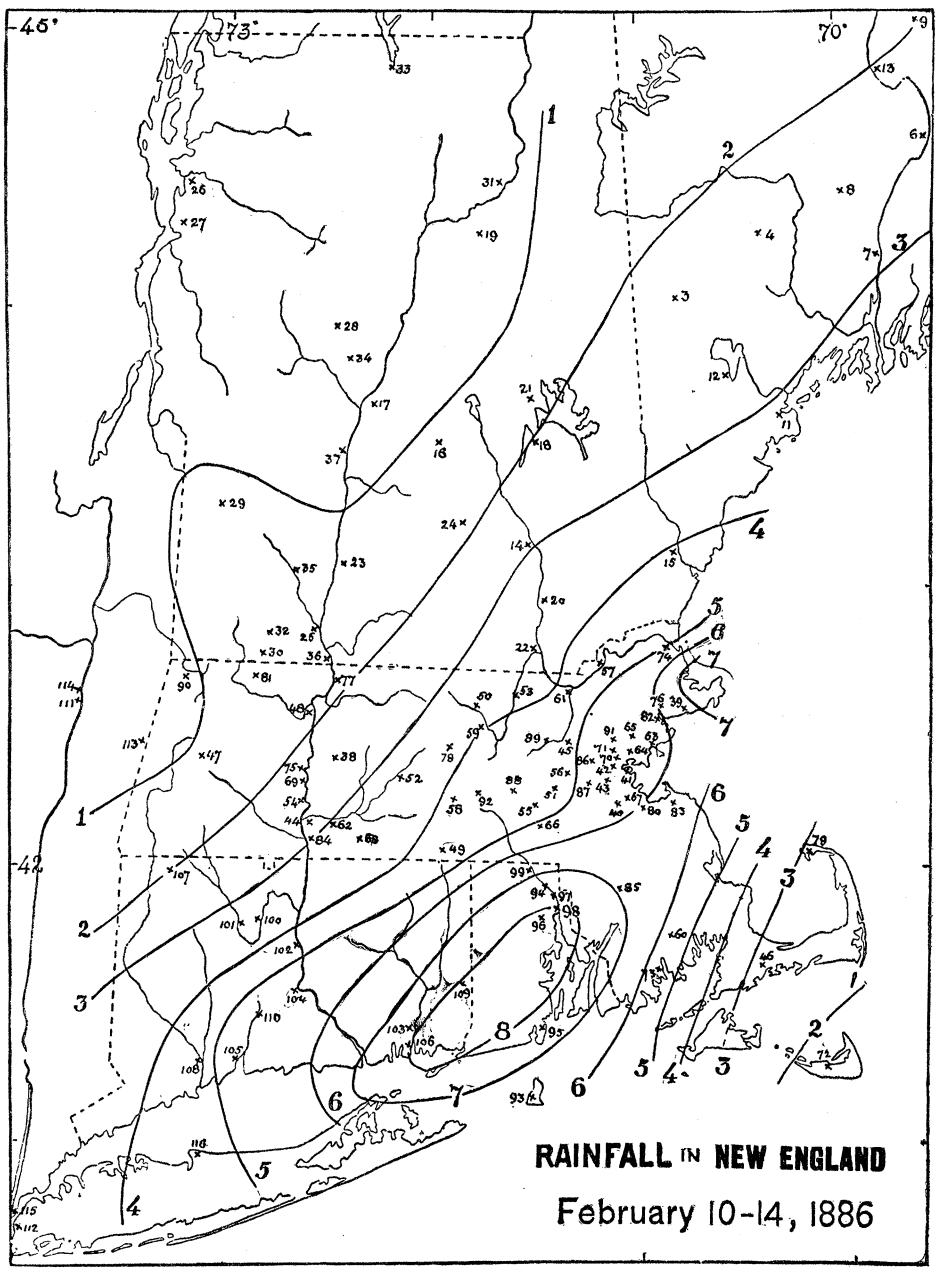
Amount of rainfall.	Area in square miles.
Over 8 inches	750
Between 7 and 8 inches.....	750
" 6 " 7 "	1,500
" 5 " 6 "	1,850
" 4 " 5 "	2,750

The above embraces about five-ninths of the total area of the states of Massachusetts, Rhode

Island, and Connecticut. If we assume that the rainfall increased uniformly within the limits of this area, the total amount of water which fell

report of Desmond Fitz Gerald, C.E., referring to the Boston water-works: —

"The water passing over our lowest dam in the



from the clouds upon this portion of New England exceeded 750,000,000,000 gallons. In this connection the following may be quoted from the

first four days (12th–15th) was 5,120,000,000 gallons, the equivalent of four inches of rain over the whole watershed. The maximum flow was

on the 13th, viz., 2,000,000,000 gallons in twenty-four hours, on seventy-eight square miles of watershed. We have no records showing a greater amount: the nearest approach was March 26, 1876, when the freshet was nearly as great."

The form of precipitation was almost wholly rain, a little snow or hail having occurred at its beginning at a few places only. The rainfall was nearly continuous for about two days and a half, but was not of equal severity. Indeed, the greater part of the fall occurred in twenty-four hours, as is indicated by the following table, which contains the times of beginning and ending of the rain, the total amount, and the amount during a specified interval of twenty-four hours. Similar records could be given from many other stations.

Station.	Time of beginning.	Time of ending.	Total Rainfall.	Interval of 24 hours during heaviest rainfall.	Rainfall in 24 hours.
			Inches.		Inches.
New York.....	11th, 10.30 A.M.	13th, noon	3.41	11th, 11.00 A.M. to 12th, 11.00 A.M.	2.99
New London	11th, 6.00 A.M.	13th, 4.20 P.M.	8.93	11th, 11.00 P.M. " 12th, 11.00 P.M.	6.66
Providence.....	11th, 1.00 A.M.	13th, 11.30 P.M.	8.13	12th, 7.00 A.M. " 13th, 7.00 A.M.	5.65
Boston	11th, 7.45 A.M.	13th, 2.45 P.M.	5.62	11th, 11.00 P.M. " 12th, 11.00 P.M.	4.45
Newburyport.....	10th, 5.30 P.M.	13th, 10.30 P.M.	4.78	11th, 9.00 P.M. " 12th, 9.00 P.M.	3.30

The immense amount of water which thus fell in a few hours was of itself amply sufficient to cause disastrous freshets, but it was largely augmented by the snow and ice on the ground. The depth of the snow at the beginning of the rain has been variously estimated. In a few places there was none on the ground, but in the greater part of the region it was found to a depth of from two to fifteen inches. This was wholly melted, and added to the rain as it forced its way over the frozen ground to the rivers. The amount thus added can only be conjectured; for the snow was in many places quite compact, and at the ground there was a thick layer of ice. Several persons have independently estimated that the equivalent of two inches of water was obtained from the snow and ice. This estimate is not excessive, and may be adopted for the region where the rainfall was greatest.

An amount of water, therefore, exceeding ten inches in depth in the maximum area, sought the streams and caused their overflow, with disastrous results. No attempt need be made to estimate the damage to railways, public highways, manufactories, and private property, the details of which were duly chronicled by the daily press; but it is worthy of note, that, from the geographical position of the flooded region, the damage was confined to a relatively small area. The rivers were affected only near their mouths, while a similar rainfall in the northern portion of New England would have caused wide-spread destruction.

The meteorological records of former years have been consulted for similar instances of excessive rainfall. At Providence, which is in the area of maximum rainfall, there are continuous records since 1832, kept until 1876 by the late Rev. Dr. Caswell, and since that time by the city engineer. There is no instance on record of a rainfall of eight inches, though one exceeding seven inches was noted in July, 1834; and during the week March 20–26, 1876, the amount of 7.66 inches was recorded. It is probably safe to say that in Rhode Island no rainfall has been heretofore recorded of so large amount in a single storm, but there may be records of equally severe storms in other parts of New England; and one which occurred in Connecticut Oct. 3 and 4, 1869, was still more severe.[1] In this storm there were reported at Hartford 8.43, Colebrook 8.44, Middletown 9.37, and Canton 12.35 inches.

The following table contains the total amounts recorded by observers who have kindly responded to the request for their observations. The accompanying map contains the lines of equal rainfall drawn from the observations. The numbers upon the map correspond with those of the several stations in the table. It was found impracticable to print the amount of rainfall at each station on account of the small size of the map. The lines have been drawn freely, and do not follow closely every individual record. In charting rainfall records, which depend so largely upon the location of gauges and the local topography, this is impossible; but it will be seen, from a comparison

[1] See paper by James B. Francis, C.E., in Transactions of the American society of engineers, August, 1878.

of the values of the table with the lines upon the map, that in this case the individual records are quite fairly represented.

Station.	Rainfall.	Station.	Rainfall.
NEW BRUNSWICK.		58.	....
1 St. John	2.46	59. Leominster	3.50
MAINE.		60 .Long Plain	5.88
2 { Bar Harbor, *a*.	3.50	61 { Lowell, *a*.	4.36
{ Bar Harbor, *b*	3.70	{ Lowell, *b*	4.54
3. Bridgeton	2.40	62. Ludlow	2.78
4. Buckfield	2.75	63. Lynn	5.68
5. Eastport[1]	1.54	64. Medford	5.58
6. Fairfield	2.51	65. Melrose	5.60
7. Gardiner	3.27	66. Milford	4.04
8. Kent's Hill	2.47	67. Milton	5.60
9. Mayfield	2.05	68. Monson	3.80
10. Orono	1.85	69. Mount Nonotuck	2.31
11. Portland[1]	3.07	70. Mystic Lake	5.64
12. Sebago Lake	2.38	71. Mystic station	5.11
13. Solon	1.65	72. Nantucket	1.82
NEW HAMPSHIRE.		73. New Bedford	4.51
14. Concord	2.80	74. Newburyport	4.78
15. Dover	3.50	75. Northampton	2.46
16. Grafton	1.08	76. North Beverly	7.66
17. Hanover	0.67	77. Northfield	1.71
18. Lake Village	2.40	78. Princeton	4.07
19. Littleton	0.46	79. Provincetown	2.65
20 { Manchester, *a*.	3.47	80. Quincy	5.54
{ Manchester, *b*.	3.65	81. Rowe	0.70
21. Meredith Centre	1.75	82. Salem	6.21
22. Nashua	3.71	83. South Hingham	6.51
23. Walpole	1.12	84. Springfield	2.97
24. Warner	1.95	85 { Taunton, *a*.	6.83
VERMONT.		{ Taunton, *b*.	6.53
25. Brattleboro'	1.57	{ Taunton, *c*.	6.91
26. Burlington	0.33	86. Waltham	6.08
27. Charlotte	0.60	87. Wellesley	5.70
28. Chelsea	0.99	88. Westborough	4.63
29. Dorset	1.12	89. Westvale	4.93
30. Jacksonville	1.61	90. Williamstown	0.99
31. Lunenburgh	0.35	91. Winchester	5.45
32. Marlborough	1.39	92 { Worcester, *a*	4.72
33. Newport	0.71	{ Worcester, *b*	5.29
34. Strafford	0.90	RHODE ISLAND.	
35. Townshend	1.41	93. Block Island[1]	6.22
36. Vernon	1.50	94. Lonsdale	7.69
37. Windsor	0.95	95. Narragansett Pier[1]	7.95
MASSACHUSETTS.		96. Olneyville	8.30
38 { Amherst, *a*.	2.66	97. Pawtucket	7.92
{ Amherst, *b*.	2.35	98 { Providence, *a*	8.13
39. Beverly Farms	6.60	{ Providence, *b*	9.04
40. Blue Hill	6.13	99 { Woonsocket, *a*.	6.74
41 { Boston, *a*[1]	5.62	{ Woonsocket, *b*.	6.38
{ Boston, *b*	5.76	CONNECTICUT.	
42 { Cambridge, *a*	5.70	100. Canton	3.08
{ Cambridge, *b*	5.63	101. Collinsville	3.28
43. Chestnut Hill	6.09	102 { Hartford, *a*.	4.32
44. Chicopee	3.24	{ Hartford, *b*	4.63
45 { Concord, *a*	4.90	103. Lake Konomoc	6.17
{ Concord, *b*	4.59	104. Middletown	5.80
46. Cotuit	2.79	105. New Haven[1]	3.84
47. Dalton	0.50	106. New London[1]	8.93
48. Deerfield	2.06	107. Norfolk	1.68
49. Dudley	3.88	108. Shelton	4.86
50 { Fitchburg, *a*.	3.42	109. Voluntown	8.00
{ Fitchburg, *b*	3.52	110. Wallingford	5.85
51. Framingham	4.64	NEW YORK.	
52. Gilbertville	3.38	111. Albany[1]	0.77
53 { Groton, *a*.	3.62	112. Brooklyn	3.39
{ Groton, *b*.	3.54	113. Lebanon Springs	0.84
54. Holyoke	2.62	114. Menands	0.87
55. Hopkinton	4.76	115 { New York, *a*	3.41
56. Lake Cochituate	4.95	{ New York, *b*[1]	4.10
57. Lawrence	4.31	116. Setauket	4.76

WINSLOW UPTON.

SOME WORK OF THE GOVERNMENT SURVEYS.

THE work of the topographical department of the geological survey during the past fiscal year shows an increase of thirty-nine per cent over that of the previous season, — a result due mainly to the increased experience and efficiency of the men engaged in its prosecution. The following statement presents in brief form the progress made during the past year, the area being given in square miles: Appalachian section, 22,080; Missouri, 20,000; Cascade, 10,400; Texas, 8,000; Arizona, 8,000; Yellowstone Park, 3,600; Gold Belt, 2,400; Massachusetts, 2,500; New Jersey, 1,500; total, 78,480. Of the maps intended to show the topographic survey of the United States, 88,000 miles have already been completed, and the proof-sheets issued, giving the results in Alabama, Missouri, Texas, Utah, and Montana. Additional work of the department, covering 82,000 square miles, is now in the engraver's hands, embracing the following states: Virginia, West Virginia, Tennessee, Missouri, Kansas, New Mexico, Arizona, Utah, and Nevada. The scale of publication of the survey of Massachusetts and New Jersey is about one mile to the inch; in the South Appalachian section, Gold Belt, Yellowstone National Park, Kansas, Missouri, and Texas, two miles; and in Arizona, Oregon, and northern California, four miles. The draughtsmen of the office have been mainly employed upon work of the originally compiled map of the United States, and the compilation of the map of New York to serve as a basis for the geologic map.

Major Powell has just received a collection of objects illustrating the character of the Oraibi Indians of north-eastern Arizona, consisting of ancient pottery, war-clubs, ancient clothing, musical instruments, and the wooden implements used by them in making fire in connection with their religious rites. There is also a large collection of bone, horn, and stone implements, among the last being many fetiches and carved animals employed in their religious ceremonies. There are also several objects used by these Indians in their marriage and funeral rites, the uses of which have been previously unknown. The material gathered is especially valuable and interesting, as so little is known of these Indian tribes who were first visited by Major Powell about ten years ago.

In the archeological investigations in the south-west, about the ruins of Cañon de Chelly in Arizona, among the curious things unearthed by an exploring party of the geological survey were several fragmentary ears of corn, with one complete and well-developed ear. The latter was found in a grave with a mummified child. It resembles a common ear of red corn, although somewhat smaller; and the grains, even at the present time, are well developed, and fit closely over the entire cob. The antiquity of this corn can be determined as far back as six hundred years. The ruins in which the corn was found are in the same state of preservation as they were when Coronado first visited this country in 1540.

[1] Station of U. S. signal service.