FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Third Report of Meteorological Observations made at Frankford Arsenal, near Philadelphia. By Captain ALFRED MORDECAI, of the Ordnance Department.

The results of the meteorological observations, made at Frankford Arsenal, during the three years ended on the 30th April, 1838, have been given in two previous reports, published in the Journal of the Franklin Institute, vol. xix, p. 7, and vol. xxii, p. 30. By the care and attention of Mr. Pigott, the clerk of the Arsenal, observations of the thermometer and rain gauge have been continued up to the end of the year 1843; and in order that they may be made available, for reference and comparison with other observations of a like character, a general abstract, or synopsis, of the whole series of observations, during eight years, is now presented.

I.—Of the Temperature.

Since 1838, only two daily observations of the thermometer have been made, viz.,

For the Maximum, at 2h. 30m. P. M. For the Minimum, in January, February, and March, at 6 A. M.; in April, September, October, November, and December, at 5 A. M.; in May, June, July, and August, at 4 A. M.

The general results of the observations, for eight years, are given in the following tables, No. I, to No. IV.

Table I, shows the mean temperature, or half the sum of the daily extremes, for each month, as well as for each season, and for the whole year; also the general mean for eight years.

Table II, shows the mean daily range of temperature, or the mean of the daily differences of extremes, for the same period as in Table I. By combining the numbers in these two tables, it will be easy to deduce the mean daily maximum, or minimum, for any stated period, since the first table gives half the sum, and the second table the difference, of the mean maxima and minima; and half the difference of two numbers added to half the sum, gives the greater, and subtracted from half the sum, gives the less.

Table III, shows the greatest daily range of temperature in each month, that is to say, the greatest change of temperature which has been observed in any day during the month; it will be remarked that the interval of time, during which this change of temperature has occurred, is from $8\frac{1}{2}$ to $10\frac{1}{2}$ hours, and that the change, during that time, has been, in several instances, as great as 39° . Further evidence of the great transitions of temperature in our climate, is afforded by Table IV, exhibiting the highest and the lowest temperatures observed in each month, and in each year.

TABLE I.

Mean Temperature of each Month, and of each Season.

Period.	1836	1837	1838	1839	1840	1841	1842	1843	8 years.
January,	27.72	27.40	36.80	31.44	27.21	34.14	34.79	39.48	32.37
February,	22.72	31.86	24.58	35.15	40.36	31.93	39.11	29.38	31.89
March,	33.54	38.80	40.72	43.61	45.16	44.07	47.65	32.38	41.74
April,	48.30	47.98	46.16	55.25	56.18	49.76	53.46	51.40	51.06
May,	61.51	59.53	57.95	64.30	62.31	59.91	60.51	59.91	60.74
June,	64.61	67.63	73.38	67.90	68.61	73.80	68.87	70.65	69.43
July,	73.49	72.41	79.99	76.68	72.81	76.30	76.65	75.26	75.45
August,	68.32	71.08	77.07	71.62	73.77	74.64	73.34	74.27	73.01
September,	67.38	62.50	66.30	65.56	62.08	68.13	68.07	68.88	66.11
October,	48.36	54.36	52.58	57.71	56.23	49.98	58.52	54.03	53.97
November,	40.78	45.85	42.20	41.28	45.37	41.77	39.74	42.30	42.41
December,	32.47	35.30	31.05	36.10	31.80	35.27	32.24	35.71	33.74
Spring,	47.78	48.77	48.28	54.39	54.55	51.25	53.87	47.90	51.18
Summer,	68.81	70.37	76.81	72.07	71.73	74.91	72.95	73.39	72.63
Autumn,	52.17	54.24	53.69	54.85	54.56	53.29	55.44	55.07	54.20
Winter,	27.64	31.52	30.81	34.23	33.12	33.78	35.38	34.86	32.66
Year,	49.10	51.23	52.40	53.88	53.49	53.31	54.41	52.80	52.66

TABLE II.

Mean daily range of Temperature.

Period.	1836	1837	1838	1839	1840	1841	1842	1843	8 years
January,	11.73	10.40	13.74	14.37	12.36	9.66	11.65	14.23	12.27
February,	16.04	12.12	10.38	12.24	15.71	13.72	12.73	11.63	13.07
March,	17.92	14.52	14.60	14.97	18.00	16.70	14.53	14.56	15.73
April,	18.50	16.81	13.18	22.55	19.55	15.45	15.52	16.53	17.26
May,	20.00	15.39	13.06	19.10	18.42	20.56	19.92	11.79	17.28
June,	12.43	12.28	15.79	17.20	20.56	18.66	16.08	10.71	15.46
July,	12.53	12.42	16.15	17.43	15.61	18.43	14.53	12.71	14.98
August,	11.31	11.34	15.11	12.98	14.47	15.93	14.16	9.84	13.14
September,	9.77	14.72	13.83	13.80	19.53	12.93	16.58	9.92	13.88
October,	12.73	13.98	11.61	14.53	16.95	13.58	20.77	13.61	14.72
November,	11.71	13.93	12.01	12.73	14.02	8.88	13.82	10.33	12.18
December,	10.60	11.98	12.19	9.60	11.40	9.61	8.87	10.27	10.57
Spring,	18.81	15.57	12.61	18.87	18.66	17.57	16.66	14.29	16.76
Summer,	12.09	12.01	15.68	15.87	16.88	17.67	14.92	11.09	14.53
Autumn,	11.40	14.21	12.48	13.67	16.83	11.80	17.06	11.29	13.59
Winter,	12.79	11.50	12.10	12.07	13.16	11.00	11.08	12.04	11.97
Year,	13.77	13.32	13.47	15.12	16.38	14.51	14.93	12.18	14.21

TABLE III.

Greatest daily range of Temperature in each month.

Month.	1836	1837	1838	1839	1840	1841	1842	1843	Average of eight years.
January,	27.5	27.50	25.5	32.50	22.50	19.00	24.00	25.50	25.50
February,	28.5	22.	22.	21.50	34.00	25.00	24.50	27.00	25.56
March,	29.5	26.	24.	30.00	32.50	39.00	33.50	29.00	30.44
April,	32.75	30.	29.	39.00	31.00	31.50	29.00	29.00	31.41
May,	33.50	26.	27.00	31.50	28.00	8.00	30.50	20.50	29.38
June,	27.00	21.50	28.50	28.50	30.00	36.00	31.50	21.00	28.
July,	22.00	18.5	22.00	25.00	24.00	30.00	23.50	22.00	23.38
August,	22.00	22.	24.00	27.00	25.00	23.00	25.50	17.00	23.19
September,	18.50	23.5	32.00	27.00	33.00	21.00	26.00	18.00	24.88
October,	24.00	29.5	22.50	27.00	33.00	24.00	39.00	27.00	28.25
November,	23.5	28.	24.00	23.50	27.50	25.00	24.00	25.00	25.06
December,	33.	26.50	23.00	25.00	25.	32.00	16.00	24.00	25.56

TABLE IV.

Extreme range of Temperature in each month, and in each year.

		1836	1837	1838	1839	1840	1841	1842	1843	Average of eight years.
January,	{ Max.	48.50	47.5	61.5	56.	50.	61.	56.	66.5	55.88
	{ Min.	2.50	6.	18.	6.	5.	5.	14.	11.	8.44
February,	{ Max.	48.	49.5	55.	52.	70.	54.	61.	47.	54.56
	{ Min.	-7.	10.5	10.	13.	3.	4.	15.	7.	6.94
March,	{ Max.	53.5	61.	63.	77.	72.	77.	69.	57.5	66.25
	{ Min.	11.5	7.	18.	16.	20.	21.	26.	15.	16.81
April,	{ Max.	77.25	79.5	73.5	81.	85.	73.	77.	77.	77.91
	{ Min.	26.	30.	27.	32.	30.	30.	28.	29.	29.
May,	{ Max.	87.	81.25	82.	86.	86.	94.	83.	79.	84.78
	{ Min.	39.	32.	40.	40.	40.	32.	43.	45.	38.88
June,	{ Max.	88.5	84.	90.	87.5	89.	95.	88.5	87.	88.69
	{ Min.	48.	53.	56.	49.	47.	51.	42.	42.	47.75
July,	{ Max.	89.	86.5	96.	92.	90.	97.5	92.5	94.	92.19
	{ Min.	57.	60.	60.	59.	56.	56.	61.	58.	58.38
August,	{ Max.	84.5	89.	92.	87.	89.	90.	86.5	85.5	87.94
	{ Min.	49.	55.5	55.	55.	56.	58.	55.	61.	55.56
September,	{ Max.	86.	79.5	86.	84.5	84.	88.	86.	86.	85.
	{ Min.	43.	44.	50.	43.	35.	55.	40.	42.	44.
October,	{ Max.	73.	77.5	75.	75.	75.	65.	86.	73.	74.94
	{ Min.	30.	31.	35.	34.	29.	30.	37.	35.	32.63
November,	{ Max.	67.	70.	64.	68.5	66.	72.	62.	66.	65.69
	{ Min.	24.	23.	18.	18.	27.	20.	18.	23.	21.38
December,	{ Max.	56.	62.5	48.	58.5	52.	50.5	47.	49.5	53.
	{ Min.	10.	19.	10.	14.	14.	15.	15.	15.	14.
Year,	{ Max.	89.	89.	96.	92.	90.	97.5	92.5	94.	92.60
	{ Min.	-7.	6.	10.	6.	3.	4.	14.	7.	5.38
	{ Extreme range.	96.	83.	86.	86.	87.	93.5	78.5	87.	87.12

II.—Of the Rain.

The observations on the rain have been, since 1838, confined to the station on the ground, the position of which is described in the second report above referred to. The gauges for measuring the snow, as well as the rain, have been used at this station, and the general results of the observations are given in Table V.

Table VI, shows the number of days in which the quantities of rain and snow, recorded in Table V, have fallen.

Table VII, shows the average quantity of rain which has been received from different quarters of the compass. From this statement it appears, that in the summer season about *one-half*, and in each of the other seasons *two-thirds*, of the whole quantity of rain comes from the N.E.; of the remaining quantity about one-half comes from the S.W.

The slight discrepancies which may be remarked, in comparing the general averages in Tables V and VII, arise from the circumstance that the observations during the last eight months of 1835, (being the beginning of the series,) are included in the averages of Table VII, but not in those of Table V.

The following cases of remarkably heavy rains, which have occurred during the period of these observations, are considered worthy of special notice:—

In 1838, September 12th and 13th, there fell, in 25 hours, 5.174 inches of rain, wind N.E.

In 1840, April 11th and 12th, there fell, in 17½ hours, 3.381 inches of rain, wind S.W.

In 1840, August 12th and 13th, there fell, in 24 hours, 3.137 inches of rain, wind S.W.

In 1841, August 10th and 11th, there fell, in 17 hours, 5.330 inches of rain, wind S.W.

In 1842, July 15th and 16th, there fell, in 13½ hours, 3.179 inches of rain, wind N.E.

In 1843, August 5th, there fell, in 14½ hours, 4.080 inches of rain, wind N.E.

In 1843, August 7th, there fell, in 1 hour, 1.018 inches of rain, wind S.W.

In the city of Philadelphia the fall of rain, on the 5th of August, 1843, was 4.5 inches in 1½ hour, and about Chester, in Pennsylvania, twenty miles south of Philadelphia, the rain was still heavier.

TABLE V.

Quantity of Water fallen in Rain, or Snow, in each Month, and in each Season.

Period.	1836	1837	1838	1839	1840	1841	1842	1843	Mean of 8 years.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
January,	5.138	1.745	1.721	4.163	1.886	6.600	1.221	2.056	3.066
February,	2.498	2.809	1.549	2.531	2.808	2.001	3.704	2.146	2.506
March,	1.420	3.425	2.242	1.015	2.304	3.797	2.766	3.921	2.611
April,	3.019	1.969	2.841	1.434	6.649	5.277	4.133	3.471	3.599
May,	1.929	4.351	3.220	5.519	2.086	2.744	4.421	2.132	3.300
June,	7.665	2.814	4.192	3.818	4.723	5.359	3.202	4.157	4.491
July,	1.917	3.677	1.865	2.025	4.704	3.425	8.381	4.276	3.784
August,	2.356	4.579	1.199	4.566	6.352	9.762	3.309	9.048	5.146
September,	1.906	2.228	8.492	2.865	1.970	2.674	1.062	4.780	3.247
October,	2.929	0.569	3.667	2.369	3.765	2.338	1.564	3.484	2.586
November,	2.921	2.386	2.787	3.198	2.360	5.030	2.986	4.186	3.232
December,	3.850	2.367	0.686	5.173	2.549	4.784	3.560	3.319	3.286
Spring,	6.368	9.745	8.303	7.968	11.039	11.818	11.320	9.524	9.510
Summer,	11.938	11.070	7.256	10.409	15.779	18.545	14.892	17.481	13.421
Autumn,	7.756	5.183	14.946	8.432	8.095	10.042	5.612	12.450	9.065
Winter,	11.486	6.921	3.956	11.867	7.243	13.385	8.485	7.521	8.858
Year,	37.548	32.919	34.461	38.676	42.156	53.790	40.309	46.976	40.854

TABLE VI.

Number of Days in which Rain, or Snow, fell in each Month, and in each Season.

Period.	1836	1837	1838	1839	1840	1841	1842	1843	Average.
January,	15	9	9	9	7	14	7	9	10
February,	13	9	8	7	11	7	11	9	9
March,	9	13	10	7	11	11	16	9	11
April,	12	9	10	7	8	19	15	13	12
May,	11	9	17	14	9	15	16	10	12
June,	15	16	8	14	8	13	14	6	11
July,	6	9	6	12	10	7	11	9	9
August,	12	8	3	14	9	11	12	10	10
September,	11	8	9	9	8	7	5	10	8
October,	8	5	8	7	10	9	8	10	8
November,	8	9	7	7	9	14	10	13	10
December,	8	8	7	14	10	11	10	11	10
Spring,	32	31	37	28	28	45	47	32	35
Summer,	33	33	17	40	27	31	37	25	30
Autumn,	27	22	24	23	27	30	23	33	26
Winter,	36	26	24	30	28	32	28	29	29
Year,	128	112	102	121	110	138	135	119	120

TABLE VII.

Average quantity of Rain, or Snow, annually, from each quarter of the compass in eight years.

1836 to 1843	N. E.	S. E.	S. W.	N. W.	Total.
	Inches.	Inches.	Inches.	Inches.	Inches.
January,	2.159	0.394	0.263	0.250	3.066
February	1.936	0.050	0.453	0.068	2.507
March,	2.050	0.165	0.334	0.062	2.611
April,	2.115	0.673	0.479	0.332	3.599
May,	2.160	0.219	0.443	0.355	3.177
June,	2.135	0.512	1.245	0.570	4.462
July,	1.960	0.103	1.515	0.469	4.047
August,	2.043	0.159	1.786	0.864	4.852
September,	2.202	0.248	0.485	0.273	3.208
October,	1.715	0.149	0.257	0.307	2.428
November,	2.076	0.196	0.279	0.639	3.190
December,	2.272	0.219	0.225	0.516	3.232
Spring,	6.325	1.057	1.256	0.749	9.387
Summer,	6.138	0.774	4.546	1.903	13.361
Autumn,	5.993	0.593	1.021	1.219	8.826
Winter,	6.367	0.663	0.941	0.834	8.805
Year,	24.823	3.087	7.764	4.705	40.379

Mr. Austin's Apparatus for Fitting Ships' Boats as Life Boats, in cases of shipwreck, and for raising Sunken Vessels.

Mr. Austin, formerly harbor-master at the island of Heligoland, suggests the following plan as sufficiently simple to be within the reach of every vessel in such emergencies:—

When a vessel is driven on the rocks, sand, or shore, or founders at sea, in getting the boats over the side they are frequently stove alongside the wreck before the tackles can be unhooked, and, even if cleared off the tackles, it too often occurs that they are stoved, swamped, or upset, when brought alongside to receive the passengers and crew. To avoid such calamities, Mr. Austin recommends that every boat, before she is launched over the side, should be fitted as a life boat, with canvas cases on each side, of the whole length of the boat, having a round head at either end marled on to a good hawser, or small chain, and secured round her at light water mark, tautened up by nettles to the gunwale. The cases may be cut out of good topsails, or courses, and made from two to three feet in diameter; another case of lighter cloth of duck, or even of calico, should be made, rather larger in dimensions, and placed within the stout canvas case, each case having three flexible tubes, or pipes, inserted at the bottom part, one near to each head, and one in midships, made of raw hide, India rubber cloth, or several thicknesses of canvas, about a fathom in length, and half an inch in diameter, with a mouth piece, or pipe, to be blown into, and stopped, or corked. The long boat and skiff should be placed on two spars projected over the side, for the purpose