ART. II.—ABSTRACT OF THE METEOROLOGICAL JOURNAL, KEPT AT CAPE DIAMOND, QUEBEC, FROM THE 1st OF JANUARY, 1824, TO THE 31st DECEMBER, 1831, WITH SOME REMARKS ON THE CLIMATE OF LOWER CANADA.—BY WILLIAM KELLY, M. D. SURGEON, R. N.

READ BEFORE THE SOCIETY ON THE 3D MARCH, 1832.

THE journal, from which the accompanying tables were extracted, has been kept with great attention and accuracy by Mr. Watt, in the citadel of Quebec. The citadel is elevated upwards of 300 feet above the level of the tide waters of the St. Lawrence, from which the rock it stands on rises almost perpendicularly. Two mercurial thermometers are used in making the observations. They are placed outside the windows of Mr. Watt's house, one of which has a north-eastern, and the other a south-western aspect. They are about five feet from the ground, and as much detached as possible in such a situation. In clear weather, one of them is always in the shade for some hours before the temperature is noted; and in the absence of sunshine, the temperature is taken from the one on which the wind blows. Both are always examined, and the lowest noted. From the attention and intelligence of Mr. Watt, I am induced to think that the temperature recorded is as free from the effects of communicated and radiated heat, as such a position of the thermometers would admit of. Besides the position is not without its advantages; for the facility of examination, in the winter, of this climate, insures an accuracy as to time, which could scarcely be expected, if

the observer had to leave his house for the purpose in seasons of intense cold.

The hours of notation are 6, and 9, A. M. noon, and 3, 6, and 9, P. M. I have selected 9, A. M. as coming nearest to the average temperature, from which I think it will only differ in a very trifling degree. I am not aware that any experiments have been made on this continent for ascertaining the hour, the temperature of which corresponds with the average temperature of the day. At Leith, it was found to be a little after 9, A. M. but it is probable the same hour may not exactly suit in other climates. At Quebec, it would seem to be a little before 9, A.M. if I can trust to a comparison I made between the temperature of that hour, for the last two years, and the average of all the temperatures observed for the same time.

If the temperature had been noted every third hour during the night, as well as during the day, the average would be sufficient for affording the mean. To supply the want of the two night observations, I doubled that of 6, A.M. to make it represent 3, A. M. also; and that of 9, P. M. for midnight. In this way I hoped a balance might be obtained; for as 6, A. M. is generally colder than 3, A. M. in the winter months, so 9, P.M. is not so cold as midnight. But in summer I feared this mode would give too great heat, especially during the period when the sun rises some time before 6 o'clock; as then 3, A. M. ought to be colder; and there is no balance during this period in the relative states of 9, P. M. and midnight; on the contrary, the estimating the latter by the former would increase the error. Though the results of the annual mean thus obtained, and the mean of 9, A.M. correspond so very nearly, yet, contrary to what I expected, I found that in the winter months the average

at 9, A.M. was lower than the average thus obtained, whilst in summer it was above it. Taking the mean of the two years, the annual temperature at 9, A. M. is 0,25 higher. And as I think whatever error may exist in the assumed temperatures, would rather tend to raise than depress the averages, it seems probable that it is at least so much higher than the general annual mean.

In the article on Climate, in the Library of Useful Knowledge, after stating that the mean for the day is at or about 8, A. M. the mean average temperature of the year, at Quebec, is given at 41°, which is considerably above what we find it to be at 9, A. M.

The remark of Humboldt, that Quebec has the winter of Petersburg, with the summer of Paris, conveys a good general idea of the climate, though it is not, and probably was not, intended to be, strictly accurate. Taking the mean temperature of Petersburg, as given in Malte Brun's Geography (and I can at present find no better source of information) at 3°,8 Centigrade, or 38°,84 F.* it seems to correspond very nearly with that of Quebec. But the winters are not, in general, near so severe, nor the summers so hot. The mean maximum cold at Petersburg, for 17 years, was —22 F.; at Quebec for the last 8 years, —31 ,37. In 1791, the greatest cold in the winter at Petersburg did not exceed 4,24 F. a mildness of season which I believe is never witnessed in Canada.

The mean temperatures of the months of June, July and August coincide very nearly in Paris and Quebec. That of Quebec at 9, A. M. by the present tables, is 63°,51; the average got in the manner already mentioned would make

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* Vol. vi. p. 62—504, Trans.

it about 0°,9 less. In Malte Brun's table, vol. vi. p. 69, the mean temperature of Paris, given for the same months, is 17°,39 C. or 63°,30 F. Dr. James Clarke, however, in his treatise on the influence of climate on chronic diseases, states the summer temperature of Paris at 64,47. But Paris is not, I believe, subject to the sudden and extreme fluctuations of temperature that occur in Quebec. In the last year (1831) the thermometer at 3, P. M. on the 8th July, stood at 92°; on the morning of the 10th it was as low as 33°. Perhaps there is no part of the globe, where the range of the thermometer, either for a year or a week, is greater than in Canada. In the instance given above, the fall in the course of 36 hours was 59 degrees; in winter, changes to a still greater extent in the course of a day are not unfrequent. It has been known at Quebec to be from 36° to 40°, with rain during the day, and fall during the succeeding night to many degrees below zero. On other days, the change has been from a thermometer much below zero, to rain. I have been informed by Captain Bayfield, R.N. that at Penetanguishene he has known the temperature to be 40°, with rain during the day, and fall to —33° at night. The sudden arrest of the streams down the hill, on which the town is situated, had a curious and beautiful appearance.

In May and June, 1829, an early hot summer followed close on an unusually severe winter. Immense masses of snow still lay in the ravines towards the end of May, when the air in the shade was above 80°. At this time, being kept by circumstances on shore, I had an opportunity of marking the state of the air during its fluctuations, and perhaps what was then observed will apply generally. The heat began with a light wind from the westward, a high state of the barometer, and the dew point of Daniell's

hygrometer very low; for some days the heat gradually increased, in one instance to 91° in the shade. In the mean time the barometer was falling equally gradually, and the dew point of the hygrometer rising. The air, in fact, from being very dry, was becoming charged with moisture. At length in one case a thunder storm; in another, a gale from the eastward with heavy rain, reduced the temperature between 30 and 40 degrees. The intense heat, occasionally felt during the summer at Quebec, rarely continues many days, without an interruption from one or the other cause just described.

In like manner the intense cold of winter, which is always accompanied by a westerly or land wind, and a clear sky, is seldom of more than three or four days uninterrupted continuance. The more temperate intervals may be longer, or shorter, in different years or seasons, but they always, to a greater or less degree, moderate both the heat and the cold. They are the sure accompaniments of the easterly wind, when it blows from the sea; but when it does not extend so far, as often occurs in fine weather, its characteristics do not differ materially from the westerly.

The winds very frequently take the general direction of the valley of the St. Lawrence, that is S. W. or N. E. The westerly winds blow on an average 100 days in the year more than the easterly. The former seem to prevail most in January, July, September, October and December; the latter in March, April, May and June.

The westerly winds, blowing over an immense extent of land, bring the greatest heat in summer, and the most intense cold in winter. The easterly, when it comes from the sea, is of course more temperate in both seasons. It is supposed here, as in the eastern continent, to cause lassitude

and other uncomfortable sensations, perhaps in consequence of its being more moist. The cold of this wind in summer is often much greater than would be expected ; sometimes bringing down the thermometer at Quebec between 40 and 50 degrees. This is owing to the mass of the waters of the æstuary and gulf of St. Lawrence being always cold. The surface sometimes acquires a heat of 60° from the fresh water keeping upwards, as is proved by its less specific gravity, and perhaps from the direct influence of the sun's rays. But the deep waters are always cold, and are brought to the surface when the water is agitated by a fresh breeze, particularly from the eastward, as the sea is open in that direction, and the swell consequently greater. The observations and experiments, from which this inference is drawn, are already before the Society. In addition to these I will only state, that at Tadousac, in September 1829, we more than once found the surface water as low as 36° after easterly gales, while we have reason to believe that, at the same time, it was at least 60° at Lake St. Peter.

To this constant coldness of the waters of the St. Lawrence, more than to any change of latitude, I am disposed to attribute the great difference in the temperature of the months of June, July and August, when the observations on board our surveying vessel are compared with those made at the same hour in Quebec. The difference is much greater in June and July each year, when we had not proceeded far to the northward, than in August, when we were off the shores of Anticosti, or Mingan. The extent of this difference may be judged by a comparison of the following means of the observations at 9, A. M. at sea and on shore.

	At sea, 1830.	*At Quebec.*	*At sea*, 1831.	*At Quebec.*
June.....	53°	58°	55° 3	66,46
July.....	60	65	58	68,60
August.....	60	62	59° 7	65,40

The greater difference in 1831 seems owing, in part, to the unusual heat of the season at Quebec; and also to greater attention having been given, on board, to prevent the thermometer being influenced by the heat of the vessel, when the observations were made.

The average number of days on which snow fell was 55. The greatest number I find was in 1828–9, when snow fell on 62 days; in the following winter, 1829–30, the days on which snow fell were only 49. These are extremes, but in general the number for any one year differed little from the mean. The quantity of snow, however, that accumulates on the ground in winter, differs very much in the different years, varying in the woods, where it lies most evenly, from 2 feet to 5 feet in depth. As the heaviest falls are with easterly gales; and the least evaporation, when the general temperature is low; a prevalence of these two states in a winter will be attended with the greatest depth of snow. Such was the case in the winter of 1828–9. The falls of snow with westerly winds are always light, and of short continuance.

The average number of days on which rain fell is 94. In 1831 it is 106, in 1825 only 75. Of the quantity, or depth in inches, we have no record. The rainy days were generally fewer on the years when the mean temperature was low.

The days with snow, and with rain, include all those on which the slightest fall of either was noted. Many included under those headings were consequently what is gene

rally considered fine weather. When snow and rain fell on the same day, it was put under both heads; hence the sum of these, and the fair days, is generally greater than the number of days in the year.

The average number of dry days is 222, the greatest was 239 in 1825, when the mean temperature was 36° 80. The least 207 in 1831, when the mean temperature was 39° 43. The mean temperature of the seven months in which rain mostly falls, from April to October inclusive, was 51° 87 in 1825, and 54° 9 in 1831.

The next subject in our tables are the thunder storms, which are very frequent during the summer months, but never occur in winter. They are seldom witnessed before April, or after September. They are in general attended by a depression of the barometer below the average, to a greater or less extent; but distant thunder was often heard with the barometer at, or above the mean. The frequency of these storms in summer, and their total absence during the severity of winter, may perhaps be accounted for in the following way. It is probable that the changes in the electric balance, that require a thunder storm for their adjustment, are in summer the consequence, in the first instance, both of evaporation, and vegetation; whilst the greater proportion of watery vapour in the air, conducts to the upper region the electricity evolved during these processes. In winter every thing is in an opposite state; there is no vegetation, and little evaporation, and the quantity of aqueous vapour diffused through the atmosphere is small. The non-conducting state of the air at this season is shewn by the facility with which sparks are obtained from an electric machine, and the electric phenomena which we frequently witness in our own persons.

The appearance of the Aurora Borealis was not noted during the first years of Mr. Watts' record, and perhaps not particularly attended to in 1828, when I first find it inserted. I have not been able to ascertain satisfactorily whether this might not have been owing to the variety of the phenomenon in those years. It probably occurs however more frequently than is marked in the register; for there is, in general, no notice of any atmospheric phenomena from 9, P. M. to 6, A. M. From personal observation, I think it is seen here more frequently in summer, than in winter; which militates against any idea of its depending on the cold of the climate. In the summer of 1830, during our cruize in the gulf of St. Lawrence, we frequently saw colored Auroras; an effect probably depending on the quantity of vapour in the atmosphere at that season, as we never observed them colored in winter. We did not observe them by any means so frequently, or so brilliant, and never colored, during the summer of 1831.

The notice of the state of the air as indicated by the hygrometer is very imperfect. The observations were made at different places as the surveying party moved, and in the first year the same hour of observation was not observed all through. The difficulty of obtaining a supply of ether here, of sufficient purity for the experiments, obliged me, in both seasons, to suspend the observations without completing them for the year. Besides, Daniell's hygrometer does not seem adapted to very cold climates. For (independent of the disagreeable exposure of the person of the observer) when the air is some degrees below zero, the application of ether to the bulb causes very little increase of cold. The ether seems as if thickened, and flows sluggishly over the silk cover; and the evaporation

is by no means brisk, even though the instrument is exposed to a fresh breeze. The lowest point at which dew formed in my experiments was —8°, with the air —4°. Cold it is true might be applied to the bulb by means of freezing mixtures, but I fear this mode would be found too troublesome for every day use. Captain Parry, by applying a mixture of muriate of lime and snow to one bulb, made the ether freeze in the other, reducing the internal thermometer twice to —46°, and once to —50°, without any dew being formed on the external surface. The temperature of the air in these experiments was —25° 5, —30, and —29°. Even in warm weather, it frequently happened, in a very dry state of the atmosphere, that so much of the fluid within the instruments was transported to the wetted bulb, before dew was formed, that the process of internal evaporation seemed at a stand, for no farther application of ether externally, caused either a greater lowering of the internal thermometer, nor a deposition of dew. I have never been able to carry the reduction of temperature, within the hygrometer, lower than 30 degrees, even with the best of two instruments supplied to the surveying party, and made by Jones.

The average height of the barometer at 9, A. M. for seven years, is 29,42 inches. The range during that time was 2,73 inches—from 27,90 in February 1824, to 30,63 in December 1829. The changes are frequent, and sometimes considerable in a short time: on the 7th of February, 1826, at noon, the barometer stood at 28,22; on the 8th, at 7, A. M. it had risen to 30,00, more than $1\frac{3}{4}$ inch, being 1,78 inches in 19 hours. Between the 7th and 8th of February, 1828, it rose from 28,11 to 29,62 in fifteen hours. The unsteadiness of the barometer to a remarkable extent

occurred only in the winter months. The instrument has been always carefully noted, but our trust in the results is lessened by considering that it is a wheel barometer, and consequently liable to error in proportion to the complexity of its machinery: that the neutral point is not noted, nor is there any record of the temperature of the instrument, at the times of the observations.

It is unnecessary to enter into any discussion as to the reasons why the mean annual heat is so much lower in this part of America, than countries under a similar parallel in Europe: as it is generally admitted to depend on the form of the continent, expanding as it advances to the north; and the prevalence of westerly or land winds. This applies equally to all the eastern coast within the temperate zone. But the places north of Nova Scotia have a source of cold from the sea breezes also, which does not exist to the southward. For the warm gulf stream here leaves the line of the coast, and bending eastward, crosses to the shores of Europe, where its influence is felt as high as Norway. From Mr. Scoresby's observations, it is evident that a current of cold water, bearing floating ice, sets to the southeast, from Spitzbergen to Greenland, as low as Cape Farewell, and the frequent appearance of ice-bergs in the gulf of St. Lawrence, and off the coasts of Newfoundland, prove a continuance of this current to the southward. The easterly or sea-breeze, which blows over these almost frozen waters, will have a very different temperature from that, which in the more southern latitudes, reaches the coast after crossing the gulf stream.

Captain Golownin, of the Russian Navy, in his Narrative of his Captivity in Japan in the years 1811, 12 and 13, (vol. i. p. 200) says that "the snow fell at Matsmai on the

night of the 14th of October, but it was melted by a thaw a few days afterwards. Towards the middle of November the snow fell very thick, and the winter set in." He does not say at what time in spring the ground is again clear of snow, but I infer, from a passage in his narrative, that it is about the 1st of March. Allowing eleven days for the difference of stile, the snow may be said to have remained on the ground at Matsmai from the beginning of December to the middle of March. This, in latitude 41° in a town on the sea coast, in an island, is a severity of winter beyond what is experienced in similar latitudes on the east coast of America. This difference cannot be owing to the state of cultivation, for Japan is exceedingly populous, and highly cultivated. Is the greater warmth on the east coast of America in the same parallel owing to the influence of the gulf stream?

The influence of the form of continents, and the temperature of adjacent seas, in modifying the climate of any particular place, may be shewn by comparing the account of the mean temperature at 9, A. M. at Port Famine, in the strait of Magalhaens in latitude 53°,38 S. during the six months from February to July 1828 inclusive, as given by Captain King, R. N. with that of Quebec, in lat. 46°,50 N. from August 1828, to January 1829, the months in the northern hemisphere answering to the former. On the difference of the form of the American continent in those two places it is unnecessary to remark. In speaking of the comparative warmth of the surface of the sea at Port Famine, as illustrative of the mildness of the climate, Captain King says, "I have in the month of June, the middle of the winter season, observed a difference of 30°, upon which occasion the sea was covered with a cloud of steam."

Mean temperature at 9, A. M.—Port Famine, February 51° 38, March 49° 87, April 40° 61, May 36° 36, June 31° 83, July 31° 50.

Quebec.—August 64° 30, September 56° 80, October 41° 90, November 28° 76, December 9° 87, January 6° 39.

Mean of autumnal months at Quebec 54° 33. Port Famine 47° 29. Winter months—Quebec 15° 0. Port Famine 33° 23.

Port Famine maximum during the six months 68°. Minimum 12°, 6. Range 55°, 4.

Quebec Maximum during the six months 87°. Minimum 33°. Range 120°.

The contrast will be more striking when we consider that, under similar circumstances, the southern hemisphere is admitted to be much colder than the northern.

It is a matter of some interest to enquire whether the climate of Canada has undergone any material change since the first settlement of the country; and whether we can hope for any amelioration, as clearing and cultivation extends. To the first I fear it will be difficult to obtain a precise answer, from the want of accurate records; and the second can only be correctly inferred, from what is ascertained respecting the first.

The general opinion is, that the climate of a country becomes milder, as it is cleared of forests, and cultivated. The application of this doctrine to Canada is not at all new, for I find it entered into the speculations of a writer on this country towards the end of the 17th century. It is founded on the generally admitted fact, that the climate of Europe is much milder now, than at the commencement of the Christian era.

The asperity of the climate of different parts of Europe

at this period, is inferred from the incidental allusions to it, that are found amongst the Roman writers.

But though the rest of Europe is cleared of most of the forests with which it was then covered, and its population and cultivation are immensely increased, so that the change in the climate of ancient Gaul and Germany might be referred to these causes, yet such is not the case with Italy. There population and cultivation are diminished perhaps in nearly an equal proportion. Nor could the improvements in the other parts of Europe have much influence on the climate of Italy; as it is shut out from them by the Alps to the north, and is bounded generally by the warm waters of the Mediterranean on the other sides. The countries whose relative temperature would most influence it, namely, those along the eastern shores of the gulf of Venice, Albania and Greece, have like itself fallen away sadly in population and agriculture. The explanation seems to have been generally received without a very strict examination into the facts connected with it, and kept for want of a better.

The early accounts of the climate of Canada cannot be free from the general exaggeration of travellers. Some allowance should also be made for the impressions caused by severe cold, against which the discoverers and first settlers were very indifferently guarded. I have not had an opportunity of consulting many of the early writers on Canada, but what is related in the following extracts, respecting the climate at the commencement of the 17th and 18th centuries, may be advantageously compared with what we know of it at the present day.

Champlain came here to settle in 1608, and writes in 1630 or 31. He had wheat sown on the 1st of October after his

arrival, and rye on the 15th: on the 3d there was hoar frost, and the leaves began to fall on the 15th. On the 18th of November much snow fell but only remained on the ground two days. On the 20th of February following some Indians were nearly lost in crossing the river, their canoes being crushed by the ice. He seems to think that they would have been deterred from crossing, if they had not been pressed by hunger; there was consequently no pont at any near point that year. Shortly afterwards he says, the snow remains five months on the ground, from December until towards the end of April.

On the 7th of May, 1612, he arrived at Quebec from France, learned that the winter had not been severe, and that the river had not been frozen over. At the time of his arrival, he says, that the trees began to be reclothed with leaves, and the meadows enamelled with flowers.

On the 19th of March, 1623, there was a storm of thunder, lightning and hail. This early appearance of a thunder storm would seem to be indicative of previous mild weather. In his journal for this year he gives the following general account of the climate, which I have extracted in the author's own words.

"Ayant remarqué qu il n'y a point quinze jours de differens d'une annèe à autre pour la temperature de l'hyver qui est depins le 20 de Novembre jusques en Avril, que les neiges se fondent, et Mai est le printemps. Quelquefois les neiges sont plus grandes en une année qu'en l'autre, qui sont de pied et demis, et trois, et quatre pieds au plus, au plat pays; car aux montagnes du costé du nord, elles sont de cinq a six pieds de haut.

"Le 8 de Mai les cerisiers commencerent à espanouir leur boutons, pour pousser leur feuilles dehors, en ce temps mesme, sortoient de la terre de petites fleurs, de gris de lin, et blanche, qui sont des primes veres du printemps, de ces lieux là.

" Le 9,les framboises commencerent à boutonner,et toutes les herbes à pousser hors de la terre.

" Le 10 ou 11. Le sureau monstra ses feuilles.

" Le 15. Les arbres furent boutonnez, et les cerisiers revestus de feuillage : et le froment monté à un ampan de hauteur : les framboisiers jetterent leur feuilles : le cerfeuil estoit bon là à coupper : dans les bois, l'oisselle s'y void a deux pouces de hauteur.

" Le 18. Les bouleaux jettent leurs feuilles : les autres arbres les suivent de pres : le chesne a ses boutons formez, et les pommiers de France, que l'on y avoit transplantés, comme aussi les pruniers boutonnoient. Les cerisiers y ont la feuille assiz grande, la vigne boutonnoit et fleurissoit,l'oiselle estoit bonne à couper.

" Le cerfeuil des bois paroysoit fort grand : les violettes blanches et jaunes estoient en fleur. Le bled d'Inde se seme, le bled froment croissoit un peu plus d'un ampan de hauteur.

" La pluspart de toutes les plantes, et simples, estoient sortis de terre : il y avoit des journées en ce mois, ou il faisoit grande chaleur.

" Le 29 du dit mois les fraises commencerent à fleurir, et es chesnes à jetter leur feuilles assez grandes en esté.

" Le 30. Les fraises furent toutes en fleur, les pommiers commencerent à espanouir leur boutons, pour jetter leur feuilles : les chesnes avoient leur feuilles d'environ une pouce de long : les pruniers et cerisiers en fleur, et le bled d'Inde commençoit à lever." *

Chevalier Tonti, the companion of the Sieur la Salle, left Fort Frontenac, at the entrance of Lake Ontario, in a vessel of 40 tons, on the 18th November, 1678. From contrary winds he was a whole month in reaching St. Onnontuane, at the other extremity of the lake. He put in here as he could no longer make way against the rapidity of the stream from Niagara, but he says nothing of any impediment from ice. In 1684 he left Qnebec for the Illinois on the 1st of November, but could not proceed beyond Montreal in con-

* Voyages des Champlain. Partie seconde, p. 63 and 67.

sequence of the ice, but he was able to proceed up the river in the beginning of April.

La Hontan, in a letter dated the 8th of November, 1683, immediately on his arrival from France, says they had much difficulty in making their way up from Cape Tourment to Quebec in consequence of the floating ice. This seems strange, for we know that however early the ice may form in the river, the north channel, by which his ship came up, is generally quite free from it. In another letter dated May, 1684, he states the average depth of snow at 3 or 4 feet. He says the river is frozen over every year notwithstanding the tides, but we cannot learn whether he means that this occurs opposite Quebec, or at the narrows higher up.

Charlevoix, who wrote from Canada in 1721, in describing the climate, gives very few dates from which a comparison with its present state could be instituted. He states in round numbers, that the snow continues on the ground for six months, and attains to a depth of six feet in the woods. Influenced probably by the opinion respecting the effects of clearing and cultivation, then generally entertained by the learned, he speaks of a great amelioration having taken place in the climate within the last 24 years, but gives no reason for the assertion. There is however one fact, incidentally mentioned by him afterwards, from which an inference respecting the climate at that time may be drawn; he drank maple juice at the Indian village of St. Francois, between the 9th and 11th of March, and mentions that as the period when it was customary to tap the maple trees.

I have not been able to search deeply into the reports of the climate of Canada by the early visitors, and of the few

I examined none except Champlain gave any definite accounts. La Hontan, and Charlevoix, who both affect to treat of the climate, confine themselves to some general observations; and as these are given in letters dated within the first year after their arrival, they can be considered as little else than first impressions. Champlain's account is very particular, and would bring us to a conclusion that, if there is any change since his time, it is that the winters are a very little longer, and our spring rather later now than when he wrote. Champlain however was establishing a colony at Quebec, and he might perhaps, in his description of the climate, be influenced by a wish of making it appear as little repulsive as possible to the people of France.

The facts mentioned by Tonti would not lead us to suppose that the climate in his day was more severe than at present; neither would the assertions of La Hontan. If Charlevoix's general assertions were true, however, it would lead to a different conclusion. But the early period at which he says it was customary to tap the maple trees shows that the spring in his day was as early as at the present. What are we to think of his assertion of the climate becoming milder within the last 24 years. When from Tonti's letter and La Hontan's, written almost 40 years before, it would seem to be even milder then, than what he describes it to be.

From the little evidence we have here, of which Champlain's, from his long residence, and his entering so fully into particulars, is alone worthy of any attention, the conclusion that the climate has undergone no change, may I think be safely drawn. Indeed if we allow the truth of Champlain's account of it, and I know of no reason for calling it much in question, there can be no doubt of the mat-

ter. Little satisfactory information can be obtained from the general assertions, or the incidental circumstances noted by travellers. The first are influenced by the effect of first impressions on the individual, and the love of exaggeration so natural to the human mind, that causes it to magnify all extremes, whether of heat, or of cold, or any thing else. Men were more likely to give way to such impressions in this case, as they had no instruments for measuring the temperature. Again very little can be inferred from incidental occurrences, as there is often a considerable difference in the rigor of even two succeeding seasons. Of this few years pass without giving us proofs. In some years the snow is all gone from the streets of Quebec, and the fields in the neighbourhood, early in April; in others, it remains until after the first of May. In 1830 December was mild with frequent rains; in December 1831 the thermometer was below zero more than every second day on an average. The time at which a vessel may have arrived in spring, or sailed in the fall, in like manner conveys little satisfactory information respecting the climate generally. In 1826, a vessel sailed from Quebec on the 14th of December, and I am informed, by Mr. Thompson of the Exchange, that the river was sufficiently open for navigation for at least a fortnight longer. In 1827, the Ottawa and Kingfisher sailed from Quebec on the 23d of November, and were stopped by the ice at Crane Island. Besides the general time for vessels sailing in the fall, would probably be much earlier formerly than at present; as the vessels were much smaller, the river less known, and probably the sailors less expert. The trade, too, was small, and the cargoes, consisting chiefly of furs acquired during the preceding winter, were ready early: whilst at present from the

immense lumber, and potash trade, the freight on which generally rises very much towards the close of the season, ship masters are induced to wait as long as possible.

To conclude, it seems probable that no material change has taken place in the climate of Canada for the last 200 years at least; or if any has occurred, we have no precise means of estimating its amount. If this conclusion is correct, the inference, that we have little amelioration to expect in the future, seems to follow, however disagreeable, and contrary to our prejudices it may be to admit it. In this I only allude to the change expected to arise from clearing and cultivation; as such causes only, by being extensive in ther operation, could take their full effect in a comparatively short time. The great changes, that have made the earth, at the depth of a few feet, be now frozen all the year round, in places where formerly tree ferns, and other productions of the tropical regions grew, may again in the progress of time change the climate of North America, or of the whole globe: but as long as the continents retain their present forms, the prevailing westerly winds, depending on physical causes not liable to change, will make the climate on their eastern coasts within the temperate zone, much more severe in the winter, and unequal in the summer, than that of the western.

1824.	Barometer.			Thermometer.			Winds.			Weather.			Thunder storms and distant thunder.
	Mean at 9, A. M.	Highest.	Lowest.	Mean at 9, A. M.	Highest.	Lowest.	Westerly.	Easterly.	Various.	Days with snow.	Days with rain.	Dry days.	
				°	°	°							
January	29.22	30.16	28.03	7.76	29	—17	21	8	2	10	...	21	...
February	29.19	30.34	27.90	9.38	50	—40	16	9	4	12	1	16	...
March	29.47	30.10	28.79	22.84	59	—11	12	14	5	8	2	22	...
April	29.17	30.00	28.50	37.43	67	13	17	13	...	3	9	18	...
May	29.20	30.14	28.36	43.74	72	24	19	4	8	5	10	19	1
June	29.15	29.60	28.57	59.00	86	36	11	15	4	...	15	15	6
July	29.22	29.85	28.54	65.10	84	47	25	2	4	...	13	18	7
August	29.41	29.84	28.77	62.70	78	47	19	9	3	...	7	24	2
September	29.50	30.13	28.91	57.47	88	39	19	7	4	...	6	24	...
October	29.21	29.85	28.51	39.50	65	18	25	5	1	3	11	17	...
November	29.60	30.25	28.75	22.00	36	10	19	9	2	10	1	19	...
December	29.49	30.30	28.24	14.6	36	—12	22	7	2	11	3	17	...
Annual	29.32	30.34	27.90	36.80	88	—40	225	102	39	62	78	230	16

1825.	Barometer.			Thermometer.			Winds.			Weather.			Thunder storms, &c.
	Mean at 9, A. M.	Highest.	Lowest.	Mean at 9, A. M.	Highest.	Lowest.	Westerly.	Easterly.	Various.	Days with snow.	Days with rain.	Dry days.	
				°	°	°							
January	29.51	30.42	28.71	8.55	30	—21	18	9	4	11	1	19	...
February	29.59	30.25	28.55	10.14	30	—20	12	12	4	7	1	20	...
March	29.43	30.08	28.70	22.80	41	7	14	14	3	9	...	22	...
April	29.45	30.11	28.75	36.76	60	6	13	12	5	7	4	19	1
May	29.55	30.05	28.95	47.80	80	25	13	9	9	1	7	23	1
June	29.34	29.75	28.65	62.40	85	47	19	7	4	...	9	21	4
July	29.39	29.71	29.02	65.74	87	46	20	7	4	...	14	17	7
August	29.50	30.07	28.65	61.29	79	43	15	10	6	...	10	21	2
September	29.50	29.85	28.97	50.06	68	31	21	8	1	...	11	19	...
October	29.55	30.25	28.68	39.02	73	21	21	9	1	3	9	21	...
November	29.70	30.40	28.75	26.73	55	4	20	6	4	3	7	21	...
December	29.43	30.37	28.39	11.80	34	—23	18	11	2	14	2	16	...
Annual	29.49	30.42	28.39	36.92	87	—23	204	114	47	55	75	239	15

1826.	Barometer.			Thermometer.			Winds.			Weather.			Thunder storms.
	Mean at 9, A. M.	Highest.	Lowest.	Mean at 9, A. M.	Highest.	Lowest.	Westerly.	Easterly.	Various.	Days with snow.	Days with rain.	Dry days.	
				°	°	°							
January	29.17	30.04	27.80	10.10	37	—36	19	9	3	12	1	18	...
February	29.50	30.17	28.20	8.30	42	—42	19	8	1	11	1	16	...
March	29.57	30.52	28.70	20.90	39	— 5	15	12	4	9	4	20	...
April	29.39	30.05	28.65	31.55	52	1	19	8	3	2	4	24	...
May	29.45	29.90	28.82	52.61	86	30	14	12	6	...	13	18	3
June	29.45	29.92	28.87	62.96	91	44	18	10	2	...	11	19	2
July	29.47	29.90	29.03	67.80	95	50	21	4	6	...	14	17	15*
August	29.58	29.91	29.02	66.77	92	46	15	13	5	...	7	24	7*
September	29.56	30.10	29.00	55.43	77	37	18	9	3	...	11	19	...
October	29.49	30.21	28.80	39.53	66	22	20	6	5	1	10	20	...
November	29.36	30.18	28.43	25.96	41	11	16	10	4	6	8	17	1
December	29.39	30.02	28.35	12.19	39	—22	21	8	2	12	2	7	1
Annual	29.45	30.52	27.80	37.84	95	—42	213	109	45	53	86	229	27

1827.	Barometer.			Thermometer.			Winds.			Weather.			Thunder storms.
	Mean at 9, A. M.	Highest.	Lowest.	Mean at 9, A. M.	Highest.	Lowest.	Westerly.	Easterly.	Various.	Days with snow.	Days with rain.	Dry Days.	
				°	°	°							
January	29.45	30.10	27.61	7.90	33	18.5	15	11	5	8	1	23	...
February	29.29	30.10	28.25	10.90	41	—29	16	5	7	13	2	13	...
March	29.38	30.19	28.29	23.80	51	— 7	16	7	8	8	3	21	...
April	29.26	30.06	28.55	36.07	58	16	15	12	3	4	12	14	1
May	29.34	29.96	28.86	50.32	82	31	9	17	5	1	8	22	1
June	29.42	29.85	28.62	60.13	90	37	16	10	4	...	15	15	5
July	29.49	29.83	29.00	64.66	92	49	16	11	4	...	10	21	4
August	29.54	30 03	29.00	61.68	83	40	21	5	5	...	10	21	2
September	29.61	30.20	28.97	53.66	77	40	15	13	2	...	12	18	1
October	29.34	29.90	28.28	42.16	66	21	17	9	5	5	9	17	...
November	29.18	30.30	28.10	20.20	41	[illegible]	24	4	2	[illegible]	2	20	...
December	29.62	30.50	28.47	8.77	35	—16	22	6	3	12	1	18	...
Annual	29.41	30.50	27.61	36.69	92	—29	202	110	53	59	85	223	14

* Thunder often distant, and unaccompanied by rain.

1823.	Barometer.			Thermometer.			Winds.			Weather.				
	Mean at 9, A. M.	Highest.	Lowest.	Mean at 9, A. M.	Highest.	Lowest.	Westerly.	Easterly.	Various.	Days with snow.	Days with rain.	Dry days.	Thunder storms.	Aurora Borealis.
January	29.51	30.35	28.37	8.21	37	—24	19	9	3	10	3	18	...	1
February	29.22	30.37	28.09	15.32	41	—18	18	8	3	9	2	18	...	...
March	29.63	30.30	28.84	22.74	51	—14	18	11	2	7	2	22	...	1
April	29.47	29.98	28.80	31.90	57	— 1	15	14	1	5	6	21	...	5
May	29.37	30.08	28.34	50.03	76	27	17	14	...	...	12	19	2	...
June	29.45	29.94	28.65	62.66	90	46	13	15	2	...	15	15	9	...
July	29.23	29.59	28.85	62.35	81	49	16	12	3	...	19	12	7	2
August	29.47	29.95	28.82	64.30	87	45	17	7	7	...	15	16	10	3
September	29.57	30.04	28.82	56.80	74	37	19	7	4	...	11	19	3	2
October	29.46	30.10	28.45	41.90	63	21	23	5	3	2	9	20	1	2
November	29.37	30.20	28.30	28.76	54	6	18	8	4	8	6	16	...	...
December	29.39	30.13	28.35	9.87	34	—24	21	7	3	16	...	15	...	3
Annual	29.44	30.37	28.09	37.90	90	—24	214	117	35	57	100	211	32	19

1829.	Barometer.			Thermometer.			Winds.			Weather.				
	Mean at 9, A. M.	Highest.	Lowest.	Mean at 9, A. M.	Highest.	Lowest.	Westerly.	Easterly.	Various.	Days with snow.	Days with rain.	Dry days.	Thun. storms and dis. thun.	Aurora Borealis.
January	29.48	30.20	28.72	6.39	38	—33	18	11	2	17	1	13	...	2
Fbruar	29.12	29.77	28.18	8.22	32	—16	20	5	3	6	...	22	...	...
March	29.22	29.71	28.30	20.84	48	— 8	22	8	1	8	4	19	...	1
April	29.24	29.80	28.60	38.03	60	22	12	14	4	4	8	18	1	2
May	29.45	30.06	28.35	53.84	91	34	14	12	5	1	11	20	3	3
June	29.27	30.15	28.61	62.63	88	43	17	6	7	...	10	20	7	4
July	29.37	29.95	28.51	62.97	81	47	24	7	...	...	15	16	7	3
August	29.45	29.74	28.85	62.39	85	42	22	3	6	...	11	20	7	1
September	29.34	29.95	28.70	49.30	73	27	23	3	4	1	15	14	1	1
October	29.65	30.40	28.69	42.90	66	22	20	10	1	2	10	19	...	5
November	29.27	30.10	28.15	27.20	40	2	17	10	3	6	11	14	...	...
December	29.62	30.63	28.06	18.95	37	— 9	17	9	5	8	3	20	...	6
Annual	29.37	30.63	28.06	37.81	91	—33	226	98	41	53	93	215	26	28

1830.	Barometer.			Thermometer.			Winds.			Weather			Thunder storms, and distant thunder.	Aurora Borealis.
	Mean at 9, A. M.	Highest.	Lowest.	Mean at 9, A. M.	Highest.	Lowest.	Westerly.	Easterly.	Various.	Days with snow.	Days with rain.	Dry Days.		
January	29.32	30.30	28.54	1.36	31	—33	19	9	3	13	...	18	...	4
February	29.36	30.32	28.29	7.86	37	—25	18	4	6	6	...	22	...	7
March	29.41	30.12	28.00	23.48	44	— 8	15	12	4	10	4	17	...	6
April	29.71	30.15	28.85	41.33	70	24	10	17	3	2	5	23	2	9
May	29.39	29.95	28.83	51.10	81	29	19	8	4	1	12	18	4	7
June	29.28	29.74	28.50	58.00	79	42	12	14	4	...	17	13	5	3
July	29.45	29.83	29.07	65.80	94	50	12	17	2	...	9	22	9	3
August	29.43	29.81	28.90	62.52	82	44	19	10	2	...	12	19	7	10
September	29.56	30.03	28.72	50.97	67	31	17	8	5	...	14	16	...	7
October	29.54	30.15	28.70	42.42	65	27	19	8	4	...	8	23	3	9
November	29.68	30.25	28.95	34.37	55	18	7	21	2	3	5	22	...	2
December	29.24	30.11	28.00	19.70	46	—13	18	12	1	15	5	11	...	4
Annual	29.44	30.32	28.00	38.24	94	—33	185	140	40	50	91	224	30	71

1831.	Thermometer.			Winds.			Weather.			Thunder storms, and distant thunder.	Aurora Borealis.
	Mean at 9, A. M.	Highest.	Lowest.	Westerly.	Easterly.	Various.	Days with snow.	Days with rain	Dry days.		
	°	°	°								
January	3.94	32	—22	26	4	1	10	...	21	...	6
February	12.40	39	—16	21	5	2	9	1	19	...	2
March	27.36	44	— 4	14	16	1	10	3	19	...	7
April	35.90	55	12	12	17	1	7	11	12	...	4
May	52.00	86	29	15	14	2	1	16	14	4	6
June	66.46	87	44	15	12	3	...	13	17	6	1
July	68.60	92	33	25	6	...	...	11	20	8	4
August	65.40	88	34	22	7	2	..	11	20	6	1
September	54.30	83	30	20	9	1	1	15	14	3	2
October	41.55	65	27	15	14	2	2	17	13	...	1
November	32.13	44	11	20	9	1	7	8	16	...	1
December	1.13	24	—23	26	5	...	9	...	22	...	...
Annual	38.43	92	—23	231	118	16	56	106	207	27	35

MEAN OF EIGHT YEARS' OBSERVATIONS AT QUEBEC,

FROM 1824 TO 1831.

	Barometer. Mean of 7 years.			Thermometer.			Winds.			Weather.				
	Mean at 9, A. M.	Highest.	Lowest.	Mean at 9, A. M.	Highest.	Lowest.	Westerly.	Easterly.	Various.	Days with snow.	Days with rain.	Dry days.	Thunder, &c. Mean of 5 years.	Aur. Bor. Mean of 4 years.
				°	°	°								
January.....	29.38	30.42	27.61	6.78	38	—36	19	9	3	11	1	19	... ...	3
February....	29.34	30.37	27.90	10.32	50	—42	17	7	4	9	1	18	... ...	2
March.....	29.44	30.52	28.00	23.10	59	—14	16	12	3	8	3	20	... ...	4
April.....	29.38	30.15	28.50	36.12	70	— 1	14	13	3	4	7	19	0.63	5
May.....	29.39	30.14	28.34	50.18	91	24	15	11	5	1	11	19	2.50	4
June.....	29.33	30.15	28.50	61.78	91	36	15	11	4	.....	13	17	5.50	2
July.....	29.37	29.95	28.51	65.38	95	33	20	8	3	.....	13	18	8	3
August.....	29.48	30.07	28.65	63.38	92	34	19	8	4	.....	10	21	5	4
September..	29.52	30.20	28.70	53.50	88	27	19	8	3	0.25	12	18	1	3
October.....	29.46	30.40	28.28	41.12	73	18	20	9	2	2	10	19	0.50	4
November...	29.45	30.40	28.10	27.17	55	2	18	10	2	6	6	18	0.125	1
December...	29.45	30.63	28.00	12.13	46	—28	21	8	2	12	2	17	0.125	3
Annual.....	29.42	30.63	27.61	37.58	95	—42	213	114	38	53	89	223	23.5	38

Dew point of the Air at Quebec, and in different places of the River and Gulf, in the years 1829 *and* 1831.

1829.	Time of Observ.	Temp. of Air.	Dew Point.	1831.	Time of Observ.	Temp. of Air.	Dew Point.	Remarks.
		°	°					
April.....	2, P.M.	43.8	31.0	River and Gulf. Quebec	9, A.M.	38.7	29.5	In 1829 the observations were made at Quebec during the months of April, May and June; in different places of the river and gulf in July, August, September, and the first half of October; the remainder of the year at Quebec.
May.....	10, A.M.	63.0	44.6		.....	53.8	46.0	
June.....	.....	67.8	51.0		.....	55.3	49.3	
July	9, A.M.	59.5	54.0		.....	58.0	52.6	
August ...	.....	57.2	51.5		.....	59.7	51.0	
Sept.....	.....	49.0	42.5		.....	53.0	48.0	
October..	.....	45.8	37.7					
Nov.....	10, A.M.	31.2	25.6					
Dec.....	.....	23.1	17.0					

A Comparison of the mean temperature at 9, *A. M. in the years* 1830 *and* 1831, *with the mean of eight daily observations (six real and two supposed) for the same period.*

	1830.		1831.	
	Mean at 9, A. M.	Mean of 8 observ.	Mean at 9, A. M.	Mean of 8 observ.
	°	°	°	
January.....	1.36	2.27	3.94	5.31
February.....	7.86	9.09	12.40	12.80
March.....	23.48	23.04	27.36	26.56
April.....	41.33	40.95	35.90	34.64
May	51.10	49.56	52.00	51.86
June.....	58.00	56.97	66.46	63.80
July	65.80	65.57	68.60	67.70
August..	62.52	61.92	65.40	65.20
September.....	50.97	51.25	54.30	52.83
October.....	42.42	42.08	41.55	41.23
November.....	34.37	34.53	32.13	31.91
December.....	19.70	20.09	1.13	2.73
Annual.....	38.24	38.11	38.43	38.05