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## Variations in the Level of the Lakes.

The annual fluctuations in the level of the water of Lake Ontario appear nearly simultaneous and commensurate with the fluctuations which have been observed to take place in the Upper Lakes. Whatever conclusions are deduced from this phenomenon in Lake Ontario, the same will evidently hold good with respect to Lakes Erie and Huron. Mr. Hall, in his *Geology of the 4th District of the State of New York* says, that a single individual informed him that about the year 1788 or 1790, the Lakes were as high as in 1838; associating this fact with the observations which have been recorded on pages 26 and 62 of this *Journal*, in the absence of more detailed information, we obtain the following table:

MAXIMUM LEVEL.	MINIMUM LEVEL.
1788 or 90	1819
1838	1848
1853	
Or from Maximum to Minimum.....	31 years.
“ “ .....	10
From Minimum to Maximum.....	19
“ “ .....	7

It seems scarcely possible to discover any relation between these figures which would indicate periodicity in the occurrence of the fluctuations, or in any recorded phenomena of the kind beyond the rise of the Lakes in the Spring and their fall in the Autumn of the year. We are therefore thrown back upon those enquiries which would lead us to imagine that the annual variations in the levels of the Lakes are due to an unequal amount of rainfall, and an inconstant degree of evaporation. Whatever apparent regularity may be deduced from observed phenomena appears to be altogether dependent upon those climatic changes which distinguish, in a greater or less degree, every extensive region.

The chief source of supply is the Niagara River, which joins Lake Ontario with Erie. The quantity of water flowing down this stupendous cataract has been estimated, by Mr. Barret, at Black-rock. The result of three separate observations, made during the high water of 1838 and 1839, gave 19,500,000 cubic feet, or nearly 600,000 tons per minute.\* If we assume 20,000,000 cubic feet per minute to represent the maximum quantity passing into Lake Ontario from Lake Erie, the whole volume from that source alone would be sufficient to raise the waters of Lake Ontario 62 feet during one year, or about 2 inches in one day, if there were no outlet, and no waste by evaporation. At the same rate of discharge, Lake Erie would be drained in about two years and four months. The elevation of the waters of the Lakes above their present mean level cannot have taken place to an extent beyond a few feet during the last geological era. A curious confirmation of this physical fact is given by the Provincial Geologist in his Report for the years 1845-6. "Lake Ontario is stated to be about nine feet above the St. Lawrence at the Gallops; so that any stoppage in the river below the Gallops,

which would raise the surface of Ontario beyond twenty-one feet over its present level, would send a broad sheet of its waters, with a violent current, down the valley of the Petite Nation, an accident which, judging from the apparently undisturbed condition of its clay banks, has not happened since the country rose from beneath a tertiary ocean."

There is no reason to suppose that the level of Lake Ontario has risen many inches even, above its present high elevation, for many ages. The existence of an occasional sand bank, supporting a growth of heavy timber on the shores of both the Upper and Lower Lakes, sufficiently confirm this fact. It is, however, to be remarked that the inroads made by the waters during the last two years have far exceeded those made in 1838. It has been found, as was previously stated, (page 25) that on the Eastern shores of Lake Simcoe, many hundred acres of land are now submerged, and in part denuded of their forest growth by the waters which have covered them during the past summer. Lake Simcoe, an inland body of water, 128 feet above Lake Huron has exhibited precisely the same phenomena as the larger Lakes into which its waters ultimately flow. The same rapid breaking down of its banks and cliffs have constantly occurred during the memory of the oldest settlers on its eastern shores, as are universally witnessed on the clay cliff shores of Lakes Erie and Ontario. This denuding action, coupled with the detritus of rivers, cannot fail to exercise an influence upon the general level of the bottom of the Lakes during the lapse of years.

It is well known that a very large portion of the water which falls to the earth in the form of rain or dew becomes again dissipated by the process of evaporation. Accurate experiments have been made by competent persons with a view to ascertain the relation existing between rainfall and evaporation, not only from the surface of the soil under different circumstances, but also from the surface of water.

The following table\* shows that the quantity annually passing off from the surface of water may often equal, and occasionally exceed, the precipitation even in temperate climates. The clear skies and hot sun of Canada West would favor the supposition that the annual results of evaporation from the surface of its great lakes really exceed, in general, those of precipitation.

Name of place.	Evaporation in In.	No. of years ob.
London.....	23.98	3
Kendal.....	25.75	3
Tottenham.....	30.47	8½
Glasgow.....	32.41	2
Liverpool.....	36.73	3
Paris.....	38	
Boston, U. S.†.....	58	
Ogdensburg†.....	49.30	1

The amount of evaporation from open plains varies from one half to one-third of the rainfall in this climate. In forest-clad regions a much greater proportion escapes as drainage.

The month of May of this year was distinguished not only by the large quantity of rain which fell, but also on account of the number of rainy days, and hence the cloudiness of the sky. In a note attached to the Monthly Meteorological Register of the Provincial Observatory for May, we find the following:—"The depth of rain for this month is much above the average and has been exceeded only in two years, 1844-49; but the number of rainy days is the greatest that has been known throughout the whole series of years, being only equalled in August in 1844." It must be borne in mind that a cloudy sky of a few days longer duration than usual during the warm months of the year, will arrest evaporation to such a degree from the surface of water, as

\* Hall's *Geology of the State of New York*.  
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† Thompson, *Introduction to Meteorology*. † Dr. Hale. † J. H. C. M.