

LAKE EFFECT SNOWFALLS - AN UPDATE

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PRESENTATION: The entry for the Poster Session was in three (3) main parts:

- a) Several mounted color prints, briefly described below;
- b) Several weather charts, data sheets and episode photos, very briefly described below; and.
- c) Table of Oswego City Area snowfall information covering about 30 years. The table was prepared as an handout. The full table follows, on the next full page.

FRAMED COLOR PHOTOGRAPHS:

- 1) Lake cumulonimbus ('cumulus lacustrinatus') with ice crystal top and showing halo effect to left, out of picture. Acted a 'wall of snow' moving from left to right from time to time; snowfalls up to 3 to 5 cm in 15 min.
- 2) 'Typical' lake effect snowflake of 13 by about 15 mm with included millimeter scale.
- 3) Lake effect snowfall ('snowburst' conditions with up to 120 cm of depth in limited elongated area in 16 hour period). SW Oswego, late Jan., 1974.
- 4) Same event as 3), but about 2½ hours later close to sunset.
- 5) Same episode as 3), but part of appropriate satellite picture showing arching cloud street with inflowing cloud detail reminding a bit of a 'rib cage' and/or the jet stream.
- 6) 'Tea kettle' pattern in low clouds over Lke Ontario, along the south edge of a cloud street which later produced locally heavy lake snow.

MISCELLANEOUS LAKE EFFECT SNOWFALL MATERIALS:

- 1) Color pictures, data sheets and weather charts relating to a January 1982 lake effect snowfall situation and snowburst which produced over a very limited area (Martville, n.y. - about 16km to southwest of SW Oswego) up to about 132cm in about a 12 hour period (i.e., near 55 inches).
- 2) Several barograph charts; data sheets; and, other records and recordings illustrating aspects of lake effect snowfall situations including their meso characteristics. Especially, emphasized was a section (wind data recording) of analog strip from an instrument at close to 10m (34 feet). As reported previously, the high speeds of near 180km/hour for periods of five minutes suggested an active 'low level jet'.

TABLE, OSWEGO CITY AREA SNOWFALL:

- 1) The historical data are in inches. Inches were retained herein.
- 2) Acknowledgements to data sources and, for some information: a) Through 1945/46 data were extracted from the 1945 ANNUAL METEOROLOGICAL SUMMARY, USWB, compiled by E. F. Loveridge. b) Through the 1965/66 season data compiled by Dr. Boyd Pack, State Climatologist. c) After a brief 'mixed' period, snowfall data from the Ferlito Family have been chosen as most representative of conditions prevailing in the City area - without prejudice to others.

different locations in and around the City of Oswego. Exposures varied from city center to open exposure close to the Lake Ontario shoreline. Since closing of the USWB station in 1953 there has been a 'parade' of co-operative observers with consequent variations in 'procedures' and competency as well as capability to observe this, the most treacherous of meteorological variables.

b) For too long, snowfall depths were automatically equated to a 10:1 ratio from collected melt-water in gauges of doubtful exposure, a procedure set forth in the instructions to cooperative observers by the Weather Service itself. The dubious nature of all this was rather sharply illustrated in early February, 1972 when the Eastern Snow Conference was 'snowed-in' at Oswego during a blizzard-burst! Then, some 140 cm (55+inches) of snow fell in under 48 hours.

c) Methodology matters relating to snowfall measurements, especially under the prevailing conditions in our environment have been discussed by this author at ESC meetings for over 20 years.. In short-snowfall data, even from 'first order' places, must be treated with utmost caution since time periods; exposures; overall weather conditions during and after falls; and, methods vary so much. Depth measurements once or twice per day are not in the same league as those made four times per day. Add in mixed weather conditions (sunshine, rain periods, unfrozen ground, etc.) then we can only wonder about how meaningful are most of snowfall available data!

LEGEND:a)Column Headings for the Snowfall Table arrange as follows:

SS Snowfall Season consisting of the two year segments;
S through M letters stand for the months September to May;
TAS means TOTAL ANNUAL SNOWFALL FOR THE Snow Season;
FAY means Five Year Average snowfall for 5 PRECEDING years; and,
TAY means Ten Year Average snowfall for 10 PRECEDING years.

b)Other:

E stands for ESTIMATE or ESTIMATED
I means TRACE
α alongside a monthly number signifies record period all-time HIGH
β alongside a monthly number signifies record period all-time LOW

c)Places where snowfall observations were made, as far as is known:

ci City, center North, probably about 3 locations at or near to
the Post Office (and West Park)
(windiest)co College Area, near Lake Ontario shoreline, NW part of City (2)
cn College and Central City, North
oee City, far to East but central part of City
oe City, East central part of City (Ferlitos)
sw Near Southwest Oswego (Sykes)
un Uncertain, perhaps variable

d)() Indicate periods of special note and/or controversy

FEW MISCELLANEOUS COMMENTS: a) Selection of Recent Representative Data for

Oswego City: Author has chosen the Ferlito location (oe) over the
(* oee) Co-operative Observer*location because of the excellence of the observers. John (the Younger) is a trained meteorologist with considerable observing experience. The combination existing there allows for generally 6-hourly measurements of high quality (depth and water content) with special attention to the unusual as well as to 'starts' and 'stops'. Changes in surface conditions wrought by radiation, wind and other influences on'snowfall'and the different feature 'snowcover,' are handled.

b) Two especially controversial periods were 1965/66 (Jan. 27-31 - the famous Blizzard Period and the following February) and the unusual Storm Period of 10-22 February, 1968. During both of these (as well as during many other intense periods) author made hundreds of observations. Annual totals believed more appropriate follow table figures in ().

d) Special thanks are given to Mr. E. F. Loveridge, still active in weather at 94, who provided valuable historical information until (and after) the USWB facility closed in 1952.

3) The notes following the Table emphasize several of difficulties that plague us when considering snowfall and its measurements.

4) Review of the Table suggests something special about the 1884/85 and 1885/86 seasons. These seem quite out of line. Perhaps they reflect an aftermath of the great volcanic explosion of Krakatoa?

5) Review also suggests that annual snowfall amounts have dramatically increased in recent years. Past use of 10:1 (snowfall to water) ratio may be factor. Other factors may be number of measurements per day, shifts in observing sites, and times of day - if limited observing times are used.

6) In conclusion about the Table: Lake effect snowfall situations can be characterized by: Intense local falls and/or high winds. Two such periods observed in very great detail by the author, were the 27-31 January "Blizzard of '66" episode; and, the chaotic episode from 09 through 22 February, 1968.

a) During both there were very high wind periods combined with snowfalls (true precipitation) of 3 or more inches ($7\frac{1}{2}$ cm/hour) per hour.

b) Thus, 140+ inches and 285+ inches for January, 1966 and the seasonal amount, respectively, are believed much more appropriate.

c) And, 118+ inches instead of 58.3 with corresponding increase in seasonal amount are believed more appropriate, etc. for the 1967/68 season.

7) Likewise, figures chosen to represent the 1971/72 season are believed representative of realistic circumstances.

MONTHLY AND SEASONAL TOTAL SNOWFALLS

NEW YORK STATE, CITY AREA OF OSWEGO

1884/85* SEASON, FORWARD

SS	S	O	N	D	J	F	M	A	M	TAS	FAY
XXXX/XX	0.0	0.0	00.0	000.0	000.0	000.0	00.0	00.0	0.0	000.0	TAY
										000.0	000.0
											000.0
1884/85	0.0	0.4	7.6	12.4	11.2	8.1	3.1	0.8	0.0	43.6	ci
1885/86	0.0	0.0	8.5	8.7	6.4	3.0	2.3	0.5	0.0	29.4	↓
1886/87	0.0	0.0	34.3	29.4	32.5	12.7	16.6	0.2	0.0	125.7	
1887/88	0.0	0.0	13.0	16.2	44.0	11.3	13.7	3.8	0.0	102.0	
1888/89	0.0	0.0	2.2	11.6	25.2	37.2	14.4	1.5	0.0	92.1	
1889/90	0.0	T	10.2	2.7	17.1	10.4	11.3	T	0.0	51.7	
1890/91	0.0	0.0	0.8	26.4	10.6	16.7	13.5	0.7	T	68.7	
										88.04	
1891/92	0.0	0.0	6.7	1.6 ^β	31.7	27.7	27.9	0.5	0.0	95.1	
1892/93	0.0	0.0	15.7	17.4	16.2	11.5	0.5	3.0	0.0	64.3	
1893/94	0.0	4.0	5.5	24.0	18.8	30.4	2.8	1.0	0.0	86.5	
1894/95	0.0	T	9.0	19.5	21.2	19.8	9.8	T	0.0	79.7	
1895/96	0.0	10.3 ^α	2.5	4.1	14.5	20.3	18.2	5.0	0.0	74.9	
										80.10	
										84.07	
1896/97	0.0	0.0	5.6	19.6	52.7	8.5	7.6	1.0	0.0	95.0	
1897/98	0.0	0.0	23.5	12.3	22.6	19.7	T ^β	3.6	0.0	81.7	
1898/99	0.0	0.6	4.4	26.8	18.5	22.3	13.5	0.9	0.0	87.0	
1899/1900	0.1 ^α	T	0.7	30.7	22.8	18.5	30.0	1.6	T	104.4	
1900/01	0.0	0.0	23.2	22.1	16.7	15.5	14.5	7.8	0.0	99.8	
										93.58	
										86.84	
1901/02	0.0	0.0	17.0	30.1	16.0	14.0	2.7	0.9	0.0	80.7	
1902/03	0.0	T	3.6	31.4	27.9	21.0	3.1	0.6	T	87.6	
1903/04	0.0	5.0	8.6	33.8	26.6	19.3	11.4	11.2	0.0	115.9	
1904/05	0.0	0.5	2.2	28.8	26.6	33.0	10.3	0.4	T	101.8	
1905/06	0.0	T	7.7	10.8	13.0	6.0	17.1	1.8	0.0	56.4	
										88.48	
										91.03	
1906/07	0.0	1.4	2.1	20.0	15.7	4.8	12.8	3.5	1.0	61.3	
1907/08	0.0	T	1.1	31.4	12.1	29.0	7.4	0.7	T	81.7	
1908/09	0.0	T	5.8	13.9	25.7	7.8	7.7	4.9	T	65.8	
1909/10	0.0	T	6.6	42.1	27.1	39.6	4.3	1.0	0.0	120.7	
1910/11	0.0	1.1	12.7	25.3	5.6	21.8	11.2	2.1	T	79.8	
										81.85	
										85.165	
1911/12	0.0	T	5.6	2.9	47.4	44.3	12.0	5.5	T	117.7	
1912/13	0.0	0.0	4.2	13.0	7.2	23.5	14.4	T	0.0	62.3	
1913/14	0.0	T	0.5	7.8	10.1	21.6	29.7	5.5	0.0	75.2	
1914/15	0.0	T	13.6	41.7	22.2	6.9	4.2	T	0.0	88.6	↑
1915/16	0.0	0.0	6.0	36.6	15.7	26.7	19.5	0.3	0.0	104.8	ci
										89.72	
										85.785	

(*Beginning of some sort of measurement method. LEGEND at end)

SS	S	O	N	D	J	F	M	A	M	TAS
1916/17	0.0	0.0	7.7	25.7	24.7	39.6	9.1	2.2	T	109.0 ci
1917/18	0.0	T	5.8	21.3	28.3	14.7	8.1	3.5	0.0	81.7 ↓
1918/19	0.0	0.0	1.5	11.4	15.8	12.2	7.5	1.1	0.0	49.5
1919/20	0.0	0.0	0.6	47.2	47.4	29.3	16.5	7.5	T	148.5
1920/21	0.0	T	8.0	30.2	3.9 _B	27.4	1.6	0.2	0.0	71.3
										92.0
										90.85
1921/22	0.0	0.0	6.8	7.7	24.6	17.1	10.5	T	0.0	66.7
1922/23	0.0	T	1.8	38.2	31.8	39.2	17.8	0.8	0.5	130.1
1923/24	T	0.5	4.2	8.8	26.7	29.7	3.8	3.8	T	77.5
1924/25	0.0	T	10.6	22.4	39.3	29.1	7.9	4.5	T	113.8
1925/26	0.0	7.8	5.4	37.3	48.2	31.4	20.3	9.9	T	160.3
										109.68
										100.84
1926/27	0.0	T	13.5	25.4	20.0	34.6	1.3	0.3	0.0	95.1
1927/28	0.0	0.0	2.0	17.1	31.7	18.8	33.0	1.1	0.0	103.7
1928/29	0.0	T	3.0	11.4	48.1	37.9	7.4	T	T	107.8
1929/30	0.0	T	20.5	21.0	14.7	16.3	9.2	0.1	0.0	81.8
1930/31	0.0	3.2	15.7	8.9	41.9	13.9	11.9	T	T	95.5
										96.78
										103.23
1931/32	0.0	0.0	1.0	3.0	15.0	16.6	42.5	6.1	0.0	84.2
1932/33	0.0	0.0	0.6	11.4	4.0	21.2	8.0	2.6	0.0	47.8
1933/34	0.0	T	28.9	17.8	10.8	18.0	11.7	3.5	0.0	90.7
1934/35	0.0	T	0.9	17.6	20.0	12.7	1.9	0.9	0.0	54.0
1935/36	0.0	T	0.6	20.8	21.5	40.5	12.3	4.3	0.0	100.0
										75.34
										86.06
1936/37	0.0	T	13.1	15.6	6.8	13.1	33.5	3.6	0.0	85.7
1937/38	0.0	0.8	1.2	20.3	25.9	7.5	4.1	6.8	0.0	66.6
1938/39	0.0	T	5.6	8.6	33.3	27.9	15.8	2.0	0.0	93.2
1939/40	0.0	T	1.0	5.3	48.7	21.7	15.8	1.1	0.0	93.6
1940/41	0.0	T	7.6	8.2	22.2	27.2	16.5	0.7	0.0	82.4
										84.3
										79.82
1941/42	0.0	T	0.6	14.2	24.3	20.9	8.7	8.0	0.0	76.7
1942/43	0.0	T	8.7	25.5	26.8	13.7	11.5	11.1	0.4	97.3
1943/44	0.0	0.0	2.1	16.5	8.4	19.2	16.6	1.0	0.0	63.8
1944/45	0.0	0.0	7.7	29.3	(50.6)	26.7	1.5	0.2	T	116.0
1945/46	0.0	T	10.0	12.8	20.9	25.1	0.1	0.7	0.0	69.6
										84.68
										84.49
1946/47	0.0	T	2.6	32.4	32.1	37.8	(47.4)	2.9	0.2	155.4
1947/48	0.0	0.0	17.7	20.6	36.1	11.8	15.6	0.3	T	102.1
1948/49	0.0	T	T	20.1	22.6	13.9	7.2	0.2	0.0	64.0
1949/50	0.0	T	4.8	25.3	14.8	34.1	24.6	2.4	0.0	106.0
1950/51	0.0	0.0	3.8	24.1	25.5	10.8	9.6	T	0.0	73.8
										100.26
										92.47
1951/52	0.0	T	6.3	32.4	18.6	29.0	8.0	T	0.0	94.3 ci,un
1952/53	0.0	0.1	5.7	8.6	16.3	10.3	6.7	T	0.3	48.0 co,un
1953/54	0.0	0.0	2.0	9.7	15.6	11.5	26.0	0.0	0.0	64.8 ↓
1954/55	0.0	0.0	6.0E	26.0	18.0	19.0	16.0	T	0.0	85.0E
1955/56	0.0	0.0	4.0	18.0	15.5	31.5	21.0	3.0	0.0	93.0
										77.02
										88.64

SS	S	O	N	D	J	F	M	A	M	TAS	
1956/57	0.0	0.0	13.0	13.5	35.5	2.5 ^B	6.5	5.0	T	76.0	co, cn
1957/58	0.0	0.0	2.0	7.0	25.0	35.0	2.0	1.0	0.0	77.0	"
1958/59	0.0	0.0	11.3	85.8	34.2	26.8	11.5	0.0	0.0	169.6	"
1959/60	0.0	0.0	18.0	8.2	18.4	35.2	19.2	0.0	0.0	99.0	"
1960/61	0.0	0.0	T ^B	22.5	35.3	6.0	10.5	0.2	0.0	74.5	"
										99.22	
										88.64	
1961/62	0.0	0.0	1.0	7.0	22.5	25.0	T ^B	4.0	0.0	59.5	"
1962/63	0.0	T	3.5	30.5	16.0	26.2	4.5	T	0.0	80.7	"
1963/64	0.0	0.0	2.0	75.0	25.0	16.5	12.0	3.5	0.0	134.0	"
1964/65	0.0	T	6.0	15.5	48.0	33.3	20.6	5.0	0.0	128.4	"
1965/66	0.0	T	5.0	14.5	67.0	54.0	7.5	T	T	148.0	c, sw
										110.12	
										104.67	
1966/67	0.0	0.0	0.0	26.0	13.9	45.8	16.1	0.8	0.5	104+	c, sw
1967/68		0.0	25.0	19.0	21.3	58.3	13.7	T	0.0	137+	c, sw,
1968/69		0.0	24.8	23.5	62.5	34.6	13.0	T	T	162.7	oe
1969/70		1.	6.3	45.1	65.1	73.0	7.6	2.	0.0	200+	oe
1970/71	0.0	T	6.8	53.2	50.0	53.0	54.0 ^α	10.0	0.0	227.0	oe
										166.14	
										138.13	
1971/72	0.0	T	20.0	26.0	139.0	100.8 ^α	28.2	10.3	0.0	324.3	oe, sw
1972/73		6.	26.7	36.8	34.7	26.0	3.7	5.3	0.0	138.5	oe
1973/74		0.0	2.9	45.8	74.6	27.2	22.	4.9	0.0	177.4	↓
1974/75		2.2	3.7	23.0	44.6	75.8	26.6	16.1	0.0	192.1	
1975/76	0.0	0.3	2.5	39.1	76.2	29.8	28.6	1.1	0.0	177.3	
										201.92	
										184.03	
1976/77	0.0	2.5	42.3 ^α	42.4	112.9	37.7+	31.6+	2.3-	0.3-	272.0	
1977/78		T	12.0	52.4	156.9 ^α	51.8	12.5	1.1	T	286.7	
1978/79		T	7.3	29.2	66.1	26.4	10.0	11.5	0.0	150.5	
1979/80		0.0	4.5	21.5	36.1	38.6	28.0	1.5	0.0	130.2	
1980/81	0.0	0.0	8.4	81.3	38.9	35.5	24.7	1.2	0.0	190.0	
										205.88	
										203.9	
1981/82	0.0	0.0	2.1	30.2	70.0	50.6	26.9	14.3		194.1	
1982/83		0.0	2.4	17.0	25.9	11.7	7.8	19.2 ^α	T	84.0	
1983/84		T	11.8	44.3	47.6	33.4	38.6	T	T	175.7	
1984/85		0.0	2.	40.7	81.	42.8	10.2	5.	0.0	181.7	
1985/86	T	0.0	8.5	100.7 ^α	60.9	40.2	15.4	2.4	T	228.1	
										172.72	
										189.3	
1986/87	0.0	0.0	8.7	11.9	65.2	12.0	8.0	2.4	0.0	108.2	
1987/88	0.0	T	3.8	16.9	39.1	80.7	10.8	3.5	0.0	154.8	oe
1988/89											
1989/90											
1990/91											
1991/92											

NOTES

GENERAL COMMENTARY: a) Snowfall information in the preceding listing of 104 snowfall seasons ending with the 1987/88 season originated from 9 or 10