

1998

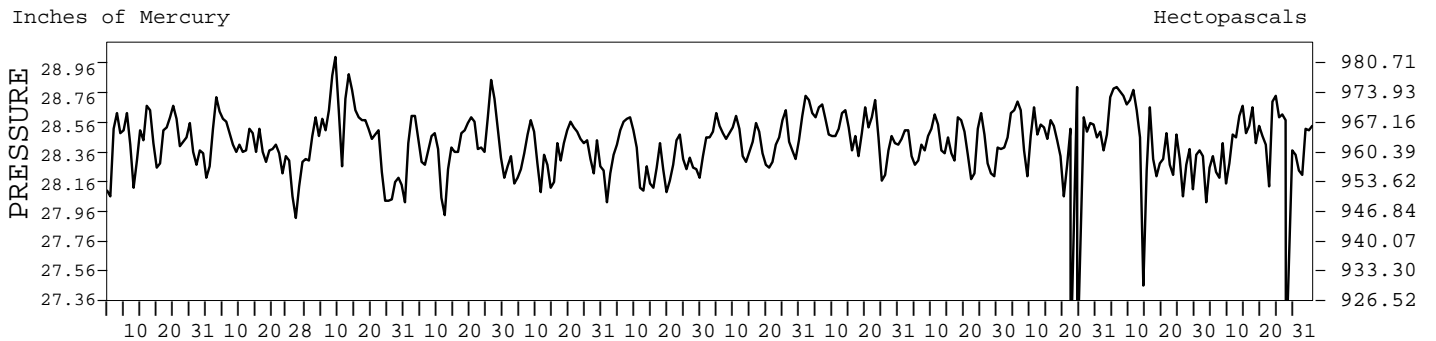
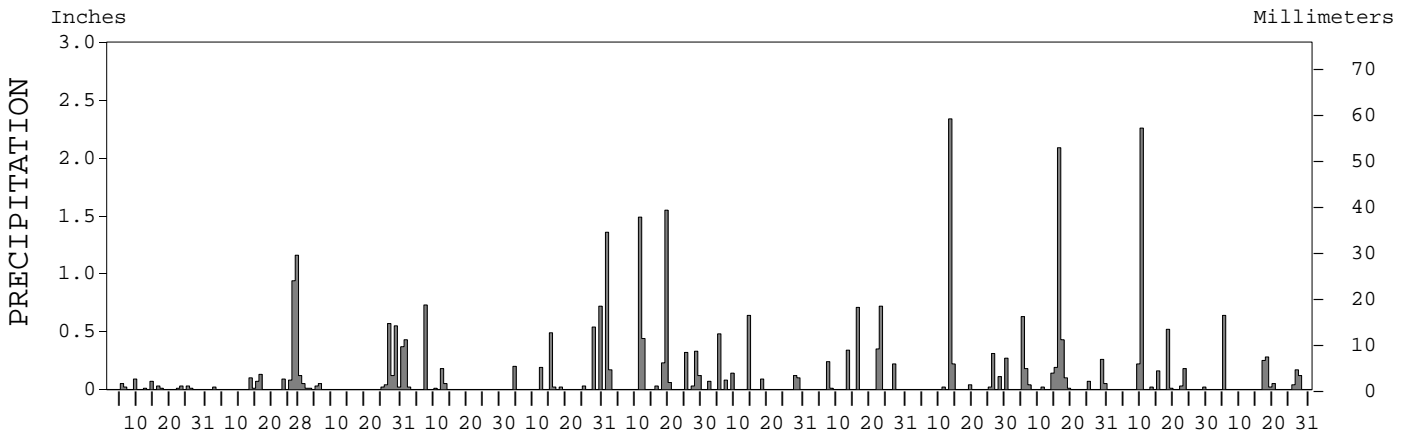
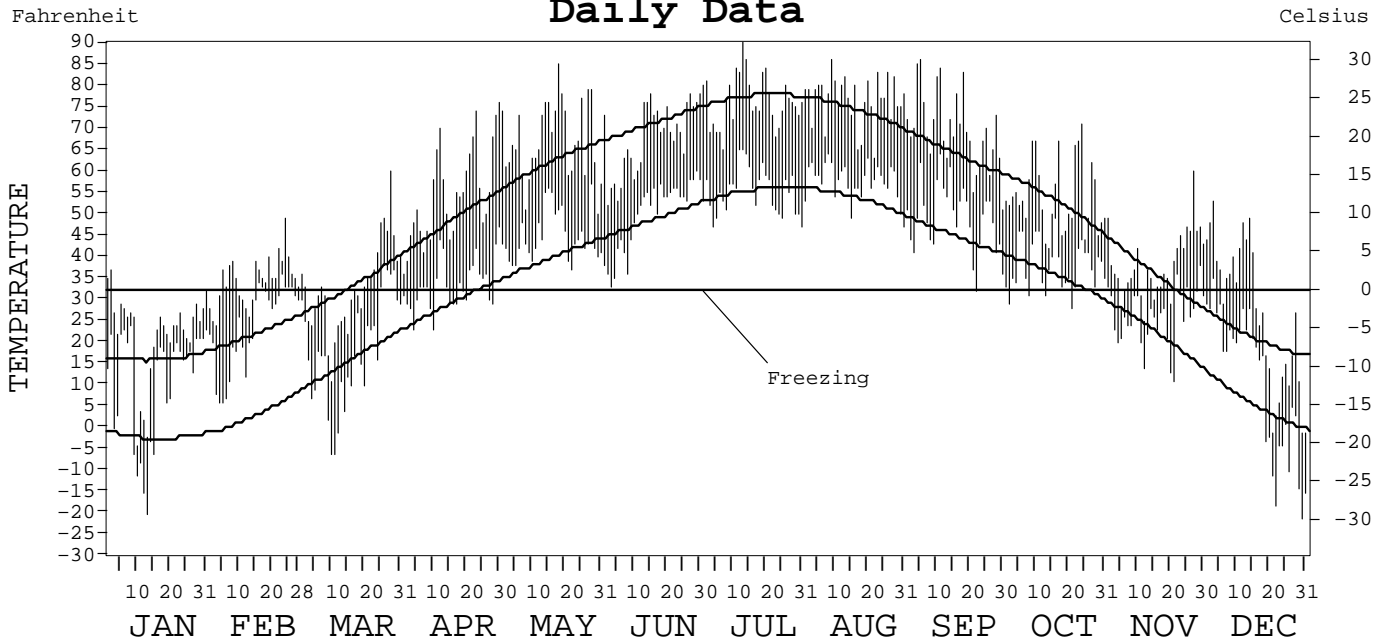
LOCAL CLIMATOLOGICAL DATA  
ANNUAL SUMMARY WITH COMPARATIVE DATA



ISSN 0198-2702

DULUTH,  
MINNESOTA (DLH)

Daily Data



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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	NATIONAL ENVIRONMENTAL AND INFORMATION SERVICE	NATIONAL SATELLITE, DATA, AND INFORMATION SERVICE	NATIONAL CLIMATIC DATA CENTER ASHEVILLE, NORTH CAROLINA	DIRECTOR NATIONAL CLIMATIC DATA CENTER
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# METEOROLOGICAL DATA FOR 1998

## DULUTH, MN (DLH)

LATITUDE: 46° 50' 38" N      LONGITUDE: 92° 11' 39" W      ELEVATION (FT): GRND: 1428      BARO: 1430      TIME ZONE: CENTRAL (UTC+ 6)      WBAN: 14913

	ELEMENT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR	
TEMPERATURE °F	MEAN DAILY MAXIMUM	22.1	34.4	32.7	54.8	67.1	67.7	76.3	76.6	69.6	54.1	38.2	26.7	51.7	
	HIGHEST DAILY MAXIMUM	37	49	60	76	85	78	90	86	86	71	60	53	90	
	DATE OF OCCURRENCE	02	24	28	30	18	30+	13	09	05	24	27	03	JUL 13	
	MEAN DAILY MINIMUM	10.7	23.5	18.1	33.4	44.7	49.8	55.1	57.5	49.0	37.7	25.9	10.6	34.7	
	LOWEST DAILY MINIMUM	-20	6	-6	23	37	33	47	47	32	27	11	-21	-21	
	DATE OF OCCURRENCE	13	05+	11+	10+	22	03	31+	31	22	02	21	30	DEC 30	
	AVERAGE DRY BULB	16.4	29.0	25.4	44.1	55.9	58.8	65.7	67.1	59.3	45.9	32.1	18.7	43.2	
	MEAN WET BULB	16.3	27.6	24.0	37.2	48.5	54.4	60.1	61.3	54.2		29.9			
	MEAN DEW POINT	13.7	24.5	18.8	26.5	40.8	50.8	56.0	57.3	49.8		26.6			
	NUMBER OF DAYS WITH:														
	MAXIMUM ≥ 90°	0	0	0	0	0	0	1	0	0	0	0	0	0	1
	MAXIMUM ≤ 32°	29	9	16	0	0	0	0	0	0	0	6	17	77	
MINIMUM ≤ 32°	31	22	26	14	0	0	0	0	1	4	26	30	154		
MINIMUM ≤ 0°	8	0	3	0	0	0	0	0	0	0	0	10	21		
H/C	HEATING DEGREE DAYS	1498	1001	1218	620	282	193	50	21	196	581	981	1431	8072	
	COOLING DEGREE DAYS	0	0	0	0	8	12	81	93	32	0	0	0	226	
RH	MEAN (PERCENT)	87	84	76	54	60	78	73	74	74	81	82	76	75	
	HOUR 06 LST	90	91	86	69	73	89	88	92	90	91	88	85	86	
	HOUR 12 LST	85	79	67	47	48	66	57	60	58	72	74	67	65	
	HOUR 18 LST	85	78	66	45	50	69	61	62	64	75	80	71	67	
	HOUR 24 LST	89	87	83	59	69	86	84	86	85	86	85	80	82	
S	PERCENT POSSIBLE SUNSHINE														
W/O	NUMBER OF DAYS WITH:														
	HEAVY FOG (VISBY ≤ 1/4 MI)	8	6	4	1	3	9	2	6	5	7	2	2	55	
	THUNDERSTORMS	0	0	0	0	4	3	2	4	3	3	1	0	20	
CLOUDINESS	SUNRISE-SUNSET: (OKTAS)														
	CEILOMETER (≤ 12,000 FT.)														
	SATELLITE (> 12,000 FT.)														
	MIDNIGHT-MIDNIGHT: (OKTAS)														
	CEILOMETER (≤ 12,000 FT.)														
	SATELLITE (> 12,000 FT.)														
NUMBER OF DAYS WITH:															
CLEAR															
PARTLY CLOUDY															
CLOUDY															
PR	MEAN STATION PRESS. (IN.)	28.46	28.41	28.50	28.45	28.37	28.33	28.49	28.54	28.43		28.42			
	MEAN SEA-LEVEL PRESS. (IN.)	30.05	29.97	30.07	29.99	29.88	29.84	29.99	30.04	29.94		30.00			
WINDS	RESULTANT SPEED (MPH)	0.8	4.0	4.0	4.2	3.2	2.3	2.6	0.3	2.0					
	RES. DIR. (TENS OF DEGS.)	10	11	05	09	11	11	30	13	29					
	MEAN SPEED (MPH)	9.5	9.2	10.2	10.8	11.3	9.0	8.5	8.7	9.2	11.3	10.9	11.1	10.0	
	PREVAIL. DIR. (TENS OF DEGS.)	11	09	09	09	09	11	32	11	28	10	32	31	10	
	MAXIMUM 2-MINUTE WIND:														
	SPEED (MPH)	29	33	47	43	39	30	33	31	33	32	44	28	47	
	DIR. (TENS OF DEGS.)	09	08	08	20	28	08	25	32	26	30	08	10	08	
	DATE OF OCCURRENCE	25	17	31	12	16	25+	26	16	20	19	10	05+	MAR 31	
	MAXIMUM 5-SECOND WIND:														
	SPEED (MPH)	34	43	57	57	48	36	39	44	40	40	55	33	57	
DIR. (TENS OF DEGS.)	09	09	08	20	28	34	25	30	27	30	09	01	20		
DATE OF OCCURRENCE	25+	17	31	12	16	01	26	23	20	19	10	29+	APR 12		
PRECIPITATION	WATER EQUIVALENT:														
	TOTAL (IN.)	0.36	2.72	1.84	1.42	2.21	6.13	1.72	2.59	3.33	4.21	3.42	1.57	31.52	
	GREATEST 24-HOUR (IN.)	0.09	1.38	0.68	0.73	0.72	1.60	0.64	0.88	2.34	2.09	2.48	0.64	2.48	
	DATE OF OCCURRENCE	09	26-27	27-28	07	30-31	18-19	14	22-23	13	16	9-10	05	NOV 9-10	
	NUMBER OF DAYS WITH:														
	PRECIPITATION ≥ 0.01	11	10	12	6	8	12	8	7	8	13	9	8	112	
PRECIPITATION ≥ 0.10	0	5	4	3	5	9	5	6	5	8	5	5	60		
PRECIPITATION ≥ 1.00	0	1	0	0	0	3	0	0	1	1	1	0	7		
SNOWFALL	SNOW, ICE PELLETS, HAIL:														
	TOTAL (IN.)	29.9	9.6	14.2	2.3	0.0	T	0.0	T	0.0	T	15.7	12.8	84.5	
	GREATEST 24-HOUR (IN.)	5.1	4.7	4.5	2.1	0.0	T	T	T	0.0	T	7.2	3.3	7.2	
	DATE OF OCCURRENCE	09	27	31	01		01	14	23		13+	10	18	NOV 10	
	MAXIMUM SNOW DEPTH (IN.)	22	16	10	6	0	0	0	0	0	0	3	9	22	
	DATE OF OCCURRENCE	27+	05+	14+	01							22+	30+	JAN 27+	
NUMBER OF DAYS WITH:															
SNOWFALL ≥ 1.0	7	3	4	1	0	0	0	0	0	0	5	6	26		

# NORMALS, MEANS, AND EXTREMES

DULUTH, MN (DLH)

LATITUDE: 46° 50' 38" N      LONGITUDE: 92° 11' 39" W      ELEVATION (FT): GRND: 1428      BARO: 1430      TIME ZONE: CENTRAL (UTC+ 6)      WBAN: 14913

ELEMENT		POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F	NORMAL DAILY MAXIMUM	30	16.2	21.7	32.9	48.2	61.9	71.0	77.1	73.9	63.8	52.3	35.2	20.7	47.9
	MEAN DAILY MAXIMUM	51	16.5	22.3	32.3	47.9	61.7	70.7	76.1	73.9	64.1	52.5	34.6	21.7	47.9
	HIGHEST DAILY MAXIMUM	57	52	55	78	88	90	94	97	97	95	86	70	55	97
	YEAR OF OCCURRENCE		1942	1976	1946	1952	1986	1995	1988	1947	1976	1953	1978	1962	JUL 1988
	MEAN OF EXTREME MAXS.	51	36.1	41.1	50.9	70.5	81.8	85.8	88.6	87.5	81.4	73.3	54.2	39.5	65.9
	NORMAL DAILY MINIMUM	30	-2.2	2.8	15.7	28.9	39.6	48.5	55.1	53.3	44.5	35.1	21.5	4.9	29.0
	MEAN DAILY MINIMUM	51	-1.8	3.3	14.8	28.9	39.7	48.4	54.4	53.2	44.8	35.1	20.9	5.9	29.0
	LOWEST DAILY MINIMUM	57	-39	-39	-29	-5	17	27	35	32	22	8	-23	-34	-39
	YEAR OF OCCURRENCE		1972	1996	1989	1975	1967	1972	1988	1986	1942	1976	1964	1983	FEB 1996
	MEAN OF EXTREME MINS.	51	-27.3	-21.6	-10.2	11.6	26.5	35.6	42.6	40.5	29.5	19.8	-6	-18.2	10.7
	NORMAL DRY BULB	30	7.0	12.3	24.4	38.6	50.8	59.8	66.1	63.7	54.2	43.7	28.4	12.8	38.5
	MEAN DRY BULB	51	7.4	12.8	23.5	38.4	50.6	59.7	65.3	63.6	54.4	43.8	27.7	13.9	38.4
	MEAN WET BULB	14	9.8	14.0	23.1	34.1	45.5	54.6	59.5	59.0	50.7	38.5	23.1	12.9	35.4
	MEAN DEW POINT	14	5.0	7.9	16.6	25.6	37.7	49.8	55.6	55.4	46.8	33.1	18.9	8.8	30.1
	NORMAL NO. DAYS WITH:														
MAXIMUM ≥ 90°	30	0.0	0.0	0.0	0.0	0.1	0.2	1.1	0.8	0.2	0.0	0.0	0.0	2.4	
MAXIMUM ≤ 32°	30	27.9	22.3	15.1	2.0	0.0	0.0	0.0	0.0	0.0	0.6	11.8	26.5	106.2	
MINIMUM ≤ 32°	30	31.0	27.8	28.9	20.2	5.6	0.4	0.0	*	2.6	12.4	25.6	30.8	185.3	
MINIMUM ≤ 0°	30	17.4	12.9	4.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.5	12.4	48.9	
H/C	NORMAL HEATING DEG. DAYS	30	1798	1476	1259	792	445	170	60	113	329	660	1098	1618	9818
	NORMAL COOLING DEG. DAYS	30	0	0	0	0	0	14	94	72	0	0	0	0	180
RH	NORMAL (PERCENT)	30	72	70	69	64	63	70	71	74	76	71	75	76	71
	HOUR 06 LST	30	74	73	74	70	71	79	82	84	84	77	78	78	77
	HOUR 12 LST	30	76	76	78	76	76	81	84	88	87	82	81	79	80
	HOUR 18 LST	30	69	65	63	56	53	59	59	62	64	62	70	74	63
	HOUR 24 LST	30	69	64	62	54	52	58	59	64	68	66	72	74	64
S	PERCENT POSSIBLE SUNSHINE	47	48	53	55	56	57	58	65	61	52	46	35	39	52
W/O	MEAN NO. DAYS WITH:														
	HEAVY FOG(VISBY≤1/4 MI)	50	2.3	2.3	3.6	3.4	5.2	6.6	5.2	6.4	5.6	4.4	3.2	3.2	51.4
	THUNDERSTORMS	56	0.1	0.0	0.6	1.6	3.5	6.8	7.9	6.9	4.0	1.3	0.4	0.1	33.2
CLOUDINESS	MEAN:														
	SUNRISE-SUNSET (OKTAS)	48	5.4	5.2	5.4	5.4	5.3	5.3	4.7	4.7	5.2	5.3	6.0	5.6	5.3
	MIDNIGHT-MIDNIGHT (OKTAS)	32	5.0	5.0	5.2	5.0	4.8	4.8	4.3	4.3	4.7	5.0	5.7	5.4	4.9
	MEAN NO. DAYS WITH:														
	CLEAR	49	7.4	7.3	7.0	6.2	6.2	5.1	6.7	7.2	6.3	6.4	4.4	6.0	76.2
PARTLY CLOUDY	49	7.0	6.2	6.9	7.9	9.6	11.0	12.7	11.9	8.4	7.6	5.5	5.8	100.5	
CLOUDY	49	16.7	14.7	17.0	15.9	15.2	13.9	10.9	11.3	14.6	16.4	19.5	18.6	184.7	
PR	MEAN STATION PRESSURE(IN)	25	28.50	28.50	28.50	28.40	28.40	28.40	28.50	28.50	28.50	27.34	27.40	28.29	
	MEAN SEA-LEVEL PRES. (IN)	14	30.06	30.07	30.06	29.97	29.97	29.94	29.96	30.01	30.01	30.00	28.00	27.93	29.66
WINDS	MEAN SPEED (MPH)	40	11.6	11.6	12.2	12.7	11.9	10.5	9.7	9.5	10.7	11.6	12.2	11.6	11.3
	PREVAIL.DIR(TENS OF DEGS)	24	30	31	09	09	09	11	30	11	30	31	30	31	30
	MAXIMUM 2-MINUTE:														
	SPEED (MPH)	2	31	33	47	43	39	30	33	31	33	36	44	28	47
	DIR. (TENS OF DEGS)		08	08	08	20	28	08	25	32	26	25	08	10	08
	YEAR OF OCCURRENCE		1997	1998	1998	1998	1998	1998	1998	1998	1998	1997	1998	1998	MAR 1998
	MAXIMUM 5-SECOND:														
SPEED (MPH)	2	38	43	57	57	48	36	39	44	40	45	55	33	57	
DIR. (TENS OF DEGS)		35	09	08	20	28	34	25	30	27	25	09	01	20	
YEAR OF OCCURRENCE		1997	1998	1998	1998	1998	1998	1998	1998	1998	1997	1998	1998	APR 1998	
PRECIPITATION	NORMAL (IN)	30	1.22	0.80	1.91	2.25	3.03	3.82	3.61	3.99	3.84	2.49	1.80	1.24	30.00
	MAXIMUM MONTHLY (IN)	57	4.70	2.72	5.12	5.84	7.67	8.04	8.48	10.31	9.38	7.53	5.01	3.70	10.31
	YEAR OF OCCURRENCE		1969	1998	1965	1948	1962	1986	1949	1972	1991	1949	1983	1968	AUG 1972
	MINIMUM MONTHLY (IN)	57	0.14	0.13	0.22	0.24	0.15	0.55	0.97	0.71	0.19	0.13	0.19	0.13	0.13
	YEAR OF OCCURRENCE		1961	1988	1959	1987	1976	1995	1947	1970	1952	1944	1976	1997	DEC 1997
	MAXIMUM IN 24 HOURS (IN)	49	1.74	1.38	2.38	2.27	3.25	4.05	3.68	5.79	3.77	2.90	2.64	2.12	5.79
	YEAR OF OCCURRENCE		1975	1965	1977	1954	1979	1958	1987	1978	1972	1973	1968	1950	AUG 1978
	NORMAL NO. DAYS WITH:														
PRECIPITATION ≥ 0.01	30	12.1	9.4	10.9	10.4	11.8	12.3	11.2	11.8	12.1	9.8	10.5	11.7	134.0	
PRECIPITATION ≥ 1.00	30	0.1	0.0	0.2	0.2	0.4	0.8	1.1	1.2	0.9	0.6	0.3	0.1	5.9	
SNOWFALL	NORMAL (IN)	30	17.2	10.3	14.1	6.3	0.6	0.0	0.0	0.0	0.*	1.3	11.4	16.1	77.3
	MAXIMUM MONTHLY (IN)	55	46.8	31.5	45.5	31.5	8.1	0.2	T	T	2.4	9.7	50.1	44.3	50.1
	YEAR OF OCCURRENCE		1969	1955	1965	1950	1954	1945	1992	1995	1991	1995	1991	1950	NOV 1991
	MAXIMUM IN 24 HOURS (IN)	55	16.3	17.0	19.4	11.6	4.3	0.2	T	T	2.4	7.9	24.1	25.4	25.4
	YEAR OF OCCURRENCE		1994	1948	1965	1983	1954	1945	1992	1995	1991	1966	1991	1950	DEC 1950
	MAXIMUM SNOW DEPTH (IN)	50	42	38	48	41	9	0	0	0	0	6	30	32	48
	YEAR OF OCCURRENCE		1969	1969	1965	1965	1950					1966	1991	1983	MAR 1965
NORMAL NO. DAYS WITH:															
SNOWFALL ≥ 1.0	30	4.2	3.3	4.0	1.8	0.2	0.0	0.0	0.0	0.0	0.4	2.9	4.5	21.3	

PRECIPITATION (inches) 1998 DULUTH, MN (DLH)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1969	4.70	0.26	0.39	1.46	2.82	2.18	3.03	2.18	4.13	2.42	1.25	2.67	27.49
1970	0.51	0.43	1.15	3.16	2.81	1.68	3.58	0.71	2.01	6.07	3.39	1.97	27.47
1971	1.56	2.37	2.02	1.29	3.45	3.25	3.91	4.50	2.67	6.09	2.07	1.22	34.40
1972	2.28	1.47	1.45	2.17	2.00	3.70	6.71	10.31	5.30	0.83	1.37	2.02	39.61
1973	0.67	0.29	1.54	1.35	3.81	2.43	2.36	8.46	4.28	4.56	1.61	0.69	32.05
1974	0.97	0.82	0.78	2.07	3.09	4.07	4.85	3.79	0.98	1.57	1.36	1.15	25.50
1975	3.69	0.76	2.59	2.21	1.44	5.59	2.26	2.52	2.32	1.20	4.19	0.64	29.41
1976	1.57	1.05	3.67	0.73	0.15	6.16	2.60	1.84	1.84	0.48	0.19	0.39	20.67
1977	0.36	0.47	4.43	1.27	3.50	3.97	3.91	3.26	5.97	3.20	2.37	1.31	34.02
1978	0.52	0.35	0.47	1.96	3.49	2.96	7.67	7.49	1.52	0.77	1.27	1.19	29.66
1979	0.76	1.89	3.58	1.15	6.01	4.33	5.45	2.10	2.01	3.01	0.47	0.16	30.92
1980	1.55	0.56	1.02	0.41	0.82	2.35	3.94	5.34	6.61	1.64	0.70	0.63	25.57
1981	0.32	1.50	1.05	4.48	1.15	5.83	3.26	2.84	2.42	3.59	0.96	0.97	28.37
1982	2.02	0.48	2.06	2.06	4.30	1.97	6.21	1.60	4.19	5.07	3.08	1.19	34.23
1983	1.34	0.49	2.05	2.28	2.12	2.00	3.51	3.37	5.57	2.32	5.01	1.97	32.03
1984	0.78	0.61	0.54	2.34	1.83	5.70	1.33	1.96	3.82	5.19	0.82	1.91	26.83
1985	0.39	0.66	1.85	2.35	4.44	3.18	4.16	3.91	6.02	1.76	2.33	0.78	31.83
1986	0.66	0.74	0.88	4.11	2.59	8.04	4.58	5.29	6.26	0.66	2.01	0.45	36.27
1987	0.69	0.31	0.60	0.24	4.02	0.83	5.46	1.87	2.93	0.96	1.26	0.67	19.84
1988	0.78	0.13	2.55	0.44	3.96	4.56	1.14	6.82	6.18	1.05	3.44	1.12	32.17
1989	1.87	0.34	1.49	2.11	3.50	3.81	1.09	5.02	4.40	1.02	1.01	0.63	26.29
1990	0.51	0.51	3.35	3.76	1.48	4.83	2.42	5.39	6.49	3.51	0.65	0.49	33.39
1991	0.52	0.55	1.17	3.90	6.11	5.64	5.33	2.49	9.38	2.85	4.89	0.61	43.44
1992	0.60	0.58	0.84	2.87	2.87	5.04	3.64	4.13	3.90	1.13	1.84	1.23	28.67
1993	1.79	0.38	0.44	2.42	4.74	6.95	5.75	3.63	1.81	0.56	2.60	1.28	32.35
1994	1.85	0.62	1.11	4.11	1.91	4.54	2.20	3.45	5.61	2.27	2.53	0.33	30.53
1995	1.38	1.04	1.97	2.19	4.13	0.55	5.73	6.67	3.02	4.24	1.84	1.54	34.30
1996	1.35	1.10	0.50	1.47	1.61	5.10	8.37	2.92	5.34	3.08	3.95	0.86	35.65
1997	0.94	0.23	1.48	1.07	1.90	5.17	4.33	1.26	1.75	2.29	0.43	0.13	20.98
1998	0.36	2.72	1.84	1.42	2.21	6.13	1.72	2.59	3.33	4.21	3.42	1.57	31.52
POR= 95 YRS	1.11	0.91	1.63	2.19	3.09	4.04	3.74	3.46	3.40	2.23	1.73	1.10	28.63

WBAN : 14913

AVERAGE TEMPERATURE (°F) 1998 DULUTH, MN (DLH)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1969	7.5	14.4	21.4	40.6	50.6	53.8	64.0	68.5	56.7	40.7	28.9	17.5	38.7
1970	2.4	8.4	21.1	38.7	46.6	60.8	68.8	66.0	55.5	44.4	27.8	12.7	37.8
1971	0.6	12.6	21.8	38.3	48.1	61.7	62.0	62.4	57.3	47.7	28.1	14.7	37.9
1972	0.2	6.4	17.9	33.3	53.5	58.4	61.2	61.9	50.0	38.9	25.9	7.2	34.6
1973	11.6	13.7	31.8	38.3	47.8	59.1	64.8	65.5	53.6	48.2	27.9	11.7	39.5
1974	5.6	11.0	20.6	37.9	46.6	58.6	67.1	60.1	47.9	42.8	29.2	19.5	37.2
1975	9.6	12.0	18.2	31.0	53.3	57.9	68.7	62.0	50.9	46.7	31.3	11.8	37.8
1976	4.7	20.7	22.0	42.6	50.6	63.2	66.1	64.9	55.3	37.1	22.1	4.5	37.8
1977	-2	17.2	31.4	44.4	57.4	60.0	65.9	58.6	53.2	44.3	28.0	11.3	39.3
1978	5.1	10.5	25.6	38.3	54.8	60.2	64.7	63.6	57.3	44.9	26.2	10.1	38.4
1979	0.6	5.0	23.0	34.5	47.2	59.8	66.1	62.0	56.9	43.0	29.4	22.2	37.5
1980	8.7	10.7	19.7	41.4	54.9	59.5	67.6	63.6	52.9	38.9	30.1	11.6	38.3
1981	11.9	16.3	28.3	39.2	50.2	58.7	65.5	64.3	52.9	40.5	34.7	14.8	39.8
1982	-3.2	10.6	20.8	35.7	52.8	54.8	64.5	60.8	54.3	45.1	24.4	19.6	36.7
1983	13.2	21.1	25.6	35.1	46.7	59.9	69.6	69.7	56.6	44.9	31.6	1.8	39.7
1984	7.1	23.0	18.7	42.4	50.5	61.4	66.6	67.7	51.9	45.7	28.4	13.2	39.7
1985	6.5	11.6	30.3	42.1	54.9	56.5	64.6	59.7	52.1	42.7	19.9	3.0	37.0
1986	11.7	11.5	28.5	42.1	51.8	58.9	64.7	60.8	52.7	43.4	24.0	18.8	39.1
1987	15.3	23.7	31.6	46.1	53.1	63.1	67.6	63.5	57.2	39.4	32.2	20.4	42.8
1988	4.8	6.2	24.4	40.1	56.0	62.8	70.0	64.5	55.4	38.6	28.9	13.5	38.8
1989	14.3	3.4	18.9	36.8	51.7	58.4	68.6	64.8	55.9	44.4	23.2	4.1	37.0
1990	18.7	14.9	27.1	40.2	48.3	61.5	64.6	64.1	56.2	42.1	31.4	12.6	40.1
1991	5.9	19.4	26.1	42.7	54.7	61.7	63.8	66.3	53.0	40.4	22.0	15.9	39.3
1992	16.7	21.2	25.9	36.2	53.8	56.3	59.4	60.5	53.8	41.7	27.3	15.9	39.1
1993	11.9	14.5	27.1	37.2	50.3	57.1	63.6	65.0	49.5	40.0	24.4	17.0	38.1
1994	-2.1	6.5	28.6	39.6	53.8	62.5	64.5	62.5	58.5	47.2	33.6	21.3	39.7
1995	13.7	11.7	28.2	34.7	52.4	65.1	66.8	67.4	55.1	43.7	20.6	12.1	39.3
1996	2.2	11.9	19.4	33.7	48.2	60.4	62.1	65.4	56.2	43.6	21.6	11.2	36.3
1997	7.0	14.5	23.5	35.7	45.8	62.2	63.8	61.0	57.5	43.9	24.9	22.7	38.5
1998	16.4	29.0	25.4	44.1	55.9	58.8	65.7	67.1	59.3	45.9	32.1	18.7	43.2
POR= 95 YRS	8.5	12.7	24.2	38.4	49.6	58.7	65.2	63.7	55.1	44.1	28.4	14.6	38.6

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HEATING DEGREE DAYS (base 65°F) 1998 DULUTH, MN (DLH)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
1969-70	99	20	258	746	1075	1466	1939	1581	1355	781	573	162	10055
1970-71	38	67	311	630	1107	1616	1996	1464	1332	794	518	124	9997
1971-72	111	133	273	531	1099	1553	2012	1698	1458	946	357	211	10382
1972-73	134	146	440	802	1167	1792	1654	1429	1022	793	526	171	10076
1973-74	72	66	354	513	1106	1651	1843	1508	1373	806	565	206	10063
1974-75	45	160	507	684	1069	1404	1713	1479	1447	1013	358	226	10105
1975-76	46	129	418	561	1003	1642	1867	1279	1325	667	440	101	9478
1976-77	35	112	310	860	1280	1871	2017	1334	1033	612	242	170	9876
1977-78	46	196	347	636	1101	1662	1852	1520	1212	794	324	176	9866
1978-79	71	99	262	615	1159	1699	1999	1679	1293	910	549	172	10507
1979-80	52	115	252	674	1059	1317	1745	1573	1398	702	326	201	9414
1980-81	39	76	357	800	1043	1650	1644	1358	1133	769	455	185	9509
1981-82	74	62	363	752	903	1549	2117	1523	1363	875	370	303	10254
1982-83	66	161	332	609	1212	1398	1598	1226	1214	887	562	185	9450
1983-84	30	9	285	615	996	1959	1792	1210	1429	671	446	116	9558
1984-85	40	40	391	588	1093	1601	1809	1494	1067	679	314	252	9368
1985-86	57	178	394	686	1349	1925	1646	1492	1127	680	416	196	10146
1986-87	76	151	361	663	1224	1426	1537	1153	1027	561	376	112	8667
1987-88	34	100	234	782	977	1377	1862	1704	1253	741	300	146	9510
1988-89	22	97	287	812	1081	1590	1567	1721	1424	839	405	206	10051
1989-90	27	78	272	633	1249	1887	1428	1398	1166	745	506	130	9519
1990-91	76	94	273	700	1003	1623	1833	1273	1201	661	332	129	9198
1991-92	97	67	363	754	1284	1515	1492	1266	1207	859	355	271	9530
1992-93	174	167	332	717	1121	1518	1638	1408	1171	825	451	239	9761
1993-94	73	71	459	769	1214	1485	2082	1635	1123	756	351	105	10123
1994-95	58	114	197	544	932	1347	1584	1487	1136	902	389	98	8788
1995-96	43	16	305	655	1327	1634	1946	1537	1410	932	514	172	10491
1996-97	105	38	277	655	1296	1660	1789	1407	1280	873	588	106	10074
1997-98	96	155	228	649	1193	1309	1498	1001	1218	620	282	193	8442
1998-	50	21	196	581	981	1431							

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COOLING DEGREE DAYS (base 65°F) 1998 DULUTH, MN (DLH)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1969	0	0	0	0	11	4	76	135	16	0	0	0	242
1970	0	0	0	0	8	42	162	102	30	0	0	0	344
1971	0	0	0	0	0	32	24	60	47	1	0	0	164
1972	0	0	0	0	8	22	24	59	0	0	0	0	113
1973	0	0	0	0	0	1	72	84	18	0	0	0	175
1974	0	0	0	0	0	19	115	15	0	0	0	0	149
1975	0	0	0	0	2	18	168	41	0	0	0	0	229
1976	0	0	0	0	0	53	75	117	26	0	0	0	271
1977	0	0	0	0	12	24	80	6	0	0	0	0	122
1978	0	0	0	0	17	34	70	64	39	0	0	0	224
1979	0	0	0	0	4	25	95	30	15	0	0	0	169
1980	0	0	0	0	25	46	126	40	3	0	0	0	240
1981	0	0	0	0	2	2	97	48	6	0	0	0	155
1982	0	0	0	0	0	0	58	36	18	0	0	0	112
1983	0	0	0	0	0	42	179	165	42	0	0	0	428
1984	0	0	0	0	4	13	96	133	4	0	0	0	250
1985	0	0	0	0	9	4	54	20	15	0	0	0	102
1986	0	0	0	0	13	18	74	26	0	0	0	0	131
1987	0	0	0	0	13	62	121	60	7	0	0	0	263
1988	0	0	0	0	27	83	183	89	4	0	0	0	386
1989	0	0	0	0	0	17	147	80	7	0	0	0	251
1990	0	0	0	7	0	32	70	73	16	0	0	0	198
1991	0	0	0	0	20	35	69	117	8	0	0	0	249
1992	0	0	0	0	13	18	9	37	3	3	0	0	83
1993	0	0	0	0	0	8	36	76	0	0	0	0	120
1994	0	0	0	0	11	36	52	43	8	0	0	0	150
1995	0	0	0	0	7	107	105	99	14	4	0	0	336
1996	0	0	0	0	0	44	25	58	21	0	0	0	148
1997	0	0	0	0	0	27	67	37	8	0	0	0	139
1998	0	0	0	0	8	12	81	93	32	0	0	0	226

SNOWFALL (inches) 1998 DULUTH, MN (DLH)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
1969-70	0.0	0.0	0.0	4.3	9.1	38.8	7.5	8.9	9.9	14.8	1.6	0.0	94.9
1970-71	0.0	0.0	0.0	0.2	16.8	20.9	31.8	27.4	12.7	6.5	0.6	0.0	116.9
1971-72	0.0	0.0	0.0	0.2	6.4	17.5	30.9	20.7	11.0	20.4	T	0.0	107.1
1972-73	0.0	0.0	T	0.5	6.7	20.0	9.2	3.0	2.1	2.8	1.5	0.0	45.8
1973-74	0.0	0.0	0.0	T	7.6	15.7	13.4	15.3	15.1	5.2	1.0	0.0	73.3
1974-75	0.0	0.0	0.3	0.8	4.5	19.1	32.7	12.3	30.3	0.4	T	0.0	100.4
1975-76	0.0	0.0	0.0	0.1	25.7	7.8	20.6	8.8	26.4	0.0	T	0.0	89.4
1976-77	0.0	0.0	0.0	0.8	2.7	7.8	8.8	5.1	15.3	0.1	0.0	0.0	40.6
1977-78	0.0	0.0	0.0	1.7	16.0	12.0	13.5	11.4	8.3	6.8	0.0	0.0	69.7
1978-79	0.0	0.0	0.0	T	10.1	20.8	11.9	23.3	17.0	4.2	1.4	0.0	88.7
1979-80	0.0	0.0	0.0	0.8	6.0	2.0	21.9	10.3	12.6	1.5	T	0.0	55.1
1980-81	0.0	0.0	0.0	1.3	1.6	7.1	4.7	13.3	4.2	4.3	T	0.0	36.5
1981-82	0.0	0.0	T	1.4	12.5	15.5	34.2	8.0	17.8	6.3	0.0	0.0	95.7
1982-83	0.0	0.0	0.0	0.8	16.0	21.4	15.7	9.0	9.9	23.7	T	0.0	96.5
1983-84	0.0	0.0	T	T	37.7	32.1	20.0	4.0	9.9	3.3	0.3	0.0	107.3
1984-85	0.0	0.0	T	3.5	2.4	8.2	15.3	12.0	26.7	0.1	0.0	0.0	68.2
1985-86	0.0	0.0	0.7	2.3	34.1	18.8	11.5	10.3	11.4	0.2	T	0.0	89.3
1986-87	0.0	0.0	0.0	1.8	8.2	7.3	11.2	5.1	6.7	0.3	T	0.0	40.6
1987-88	0.0	0.0	0.0	3.9	5.8	11.3	16.7	2.3	13.7	0.1	0.0	0.0	53.8
1988-89	0.0	0.0	0.0	0.3	24.3	20.7	31.2	5.3	17.6	19.0	0.7	0.0	119.1
1989-90	0.0	T	0.0	0.6	8.4	14.2	5.5	15.0	11.6	2.4	0.6	T	58.3
1990-91	0.0	0.0	0.0	3.2	5.1	13.5	11.4	9.7	9.5	8.5	2.9	0.0	63.8
1991-92	0.0	0.0	2.4	4.3	50.1	12.9	9.3	10.6	0.7	9.7	0.0	0.0	100.0
1992-93	T	0.0	T	5.1	29.4	15.5	24.9	10.0	5.8	3.5	T	0.0	94.2
1993-94	0.0	0.0	T	0.6	28.5	15.1	35.3	7.9	13.0	10.0	0.0	T	110.4
1994-95	0.0	0.0	0.0	0.2	15.5	6.2	12.8	17.6	20.9	16.2	T	0.0	89.4
1995-96	0.0	T	0.1	9.7	20.4	25.9	34.0	21.3	11.4	12.6	T		
1996-97					15.9	41.7	35.5	8.9	23.6	1.7	0.1	0.0	
1997-98	0.0	0.0	0.0	1.2	16.9	6.0	29.9	9.6	14.2	2.3	0.0	T	80.1
1998-	0.0	T	0.0	T	15.7	12.8							
POR= 54 YRS	T	T	0.1	1.5	12.9	15.2	17.6	11.3	13.4	6.5	1.0	T	79.5

WBAN : 14913

REFERENCE NOTES:

<p>PAGE 1: THE TEMPERATURE GRAPH SHOWS NORMAL MAXIMUM AND NORMAL MINIMUM DAILY TEMPERATURES (SOLID CURVES) AND THE ACTUAL DAILY HIGH AND LOW TEMPERATURES (VERTICAL BARS).</p> <p>PAGE 2 AND 3: H/C INDICATES HEATING AND COOLING DEGREE DAYS. RH INDICATES RELATIVE HUMIDITY W/O INDICATES WEATHER AND OBSTRUCTIONS S INDICATES SUNSHINE. PR INDICATES PRESSURE. CLOUDINESS ON PAGE 3 IS THE SUM OF THE CEILOMETER AND SATELLITE DATA NOT TO EXCEED EIGHT EIGHTHS(OKTAS).</p> <p>GENERAL: T INDICATES TRACE PRECIPITATION, AN AMOUNT GREATER THAN ZERO BUT LESS THAN THE LOWEST REPORTABLE VALUE. + INDICATES THE VALUE ALSO OCCURS ON EARLIER DATES. BLANK ENTRIES DENOTE MISSING OR UNREPORTED DATA. NORMALS ARE 30-YEAR AVERAGES (1961 - 1990). ASOS INDICATES AUTOMATED SURFACE OBSERVING SYSTEM. PM INDICATES THE LAST DAY OF THE PREVIOUS MONTH. POR (PERIOD OF RECORD) BEGINS WITH THE JANUARY DATA MONTH AND IS THE NUMBER OF YEARS USED TO COMPUTE THE MEAN. INDIVIDUAL MONTHS WITHIN THE POR MAY BE MISSING. WHEN THE POR FOR A NORMAL IS LESS THAN 30 YEARS, THE NORMAL IS PROVISIONAL AND IS BASED ON THE NUMBER OF YEARS INDICATED. 0.* OR * INDICATES THE VALUE OR MEAN-DAYS-WITH IS BETWEEN 0.00 AND 0.05. CLOUDINESS FOR ASOS STATIONS DIFFERS FROM THE NON-ASOS OBSERVATION TAKEN BY A HUMAN OBSERVER. ASOS STATION CLOUDINESS IS BASED ON TIME-AVERAGED CEILOMETER DATA FOR CLOUDS AT OR BELOW 12,000 FEET AND ON SATELLITE DATA FOR CLOUDS ABOVE 12,000 FEET. THE NUMBER OF DAYS WITH CLEAR, PARTLY CLOUDY, AND CLOUDY CONDITIONS FOR ASOS STATIONS IS THE SUM OF THE CEILOMETER AND SATELLITE DATA FOR THE SUNRISE TO SUNSET PERIOD.</p>	<p>GENERAL CONTINUED: CLEAR INDICATES 0 - 2 OKTAS, PARTLY CLOUDY INDICATES 3 - 6 OKTAS, AND CLOUDY INDICATES 7 OR 8 OKTAS. WHEN AT LEAST ONE OF THE ELEMENTS (CEILOMETER OR SATELLITE) IS MISSING, THE DAILY CLOUDINESS IS NOT COMPUTED. WIND DIRECTION IS RECORDED IN TENS OF DEGREES (2 DIGITS) CLOCKWISE FROM TRUE NORTH. "00" INDICATES CALM. "36" INDICATES TRUE NORTH. RESULTANT WIND IS THE VECTOR AVERAGE OF THE SPEED AND DIRECTION. AVERAGE TEMPERATURE IS THE SUM OF THE MEAN DAILY MAXIMUM AND MINIMUM TEMPERATURE DIVIDED BY 2. SNOWFALL DATA COMPRISE ALL FORMS OF FROZEN PRECIPITATION, INCLUDING HAIL. A HEATING (COOLING) DEGREE DAY IS THE DIFFERENCE BETWEEN THE AVERAGE DAILY TEMPERATURE AND 65° F. DRY BULB IS THE TEMPERATURE OF THE AMBIENT AIR. DEW POINT IS THE TEMPERATURE TO WHICH THE AIR MUST BE COOLED TO ACHIEVE 100 PERCENT RELATIVE HUMIDITY. WET BULB IS THE TEMPERATURE THE AIR WOULD HAVE IF THE MOISTURE CONTENT WAS INCREASED TO 100 PERCENT RELATIVE HUMIDITY.</p> <p>ON JULY 1, 1996, THE NATIONAL WEATHER SERVICE BEGAN USING THE "METAR" OBSERVATION CODE THAT WAS ALREADY EMPLOYED BY MOST OTHER NATIONS OF THE WORLD. THE MOST NOTICEABLE DIFFERENCE IN THIS ANNUAL PUBLICATION WILL BE THE CHANGE IN UNITS FROM TENTHS TO EIGHTHS(OKTAS) FOR REPORTING THE AMOUNT OF SKY COVER.</p>
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1998  
DULUTH,  
MINNESOTA (DLH)

Duluth, Minnesota is located at the western tip of Lake Superior. The city, about 20 miles long, lies at the base of a range of hills that rise abruptly to 600 - 800 feet above the level of Lake Superior. The range runs in a northeast and southwest direction. Two or 3 miles from the lake the land becomes a slightly rolling plateau.

Duluth in the summer is known as the Air Conditioned City. Being situated below high terrain and along the lake, any easterly component winds automatically cool the city. However, with westerly flow in the summer, the wind generally abates at night, thus, allowing cool lake air to move back into the city area near the lake.

An important influence on the climate is the passage of a succession of high and low pressure systems west and east. The proximity of Lake Superior, which is the largest and coldest of the Great Lakes, modifies the local weather. Summer temperatures are cooler and winter temperatures are warmer. The lake effect at Duluth is most prevalent when low pressure systems pass to the south creating easterly winds. In the summer, warm, moist air flowing over the cold lake surface has a stabilizing effect that results in cool, cloudy weather over Duluth. However, during the winter cold air flowing over the warm open lake surface absorbs moisture that is later precipitated over Duluth as snow. The lake effect is further reflected from the low frequency of severe storms such as wind, hail, tornadoes, freezing rain (glaze), and blizzards when compared to other areas that are a further distance from the lake.

Easterly component winds at Duluth occur 40 to 50 percent of the time from March through August and 20 to 25 percent of the time from November through February. During the winter 60 to 70 percent of the winds are from a westerly component.

The climate of Duluth is predominantly continental with significant local Lake Superior effects. Duluth averages 143 days between the last occurrence of 32 degrees in mid-May and the first in early October. At the Duluth Airport about six miles away from the lake, the average first and last occurrences of 32 degrees are late May and late September, giving a freeze-free period of 123 days.

Fall colors throughout this area are outstanding. Reds, yellows, browns, and combinations of these are an experience to see. Recreation is superb from December through March for cross-country and down-hill skiing and snowmobiling. The snow is dry.

Ice in the harbor forms about mid-November and generally is gone by mid-April. The shipping season can vary from year to year depending on temperatures and the winds that move the ice around. In most years there is little or no shipping during February and March on Lake Superior.

STATION LOCATION

DULUTH, MINNESOTA

LOCATION	OCCUPIED FROM	OCCUPIED TO	AIRLINE DISTANCES AND DIRECTIONS FROM PREVIOUS LOCATION	NORTH	WEST	ELEVATION ABOVE											* Type M = AMOS T = AUTOB S = ASOS W = AWOS	REMARKS
						SEA LEVEL	GROUND											
							WIND	EX T	P	S	R	W	8	H	A	E		
<u>CITY</u>																		
Miller Block, SE Corner Lake & Superior Streets	10/18/70	6/30/82	NA	46°47'	92°06'	625	48	19	19									Window shelter.
St. Louis Hotel Bldg. SE Corner 4th Ave. West & Superior Street	7/1/82	11/30/84	0.4 mi. SW	46°47'	92°06'	633	77	57	57									Extreme thermometers 56 feet until 1/2/84. Window shelter.
Metropolitan Block 115-117 W. Superior St.	12/1/84	1/29/95	0.25 mi. NE	46°47'	92°06'	634	71 b75 c72	61 a71	61 a71									a - Effective 4/1/88. b - Effective 11/22/88. c - Effective 4/1/91.
Post Office Building NE corner 5th Ave. West and First Street	1/30/95	12/31/03	0.3 mi. SW	46°47'	92°06'	685	106 d 116	95	95									d - Effective 6/13/1900.
631 West 7th Street	1/1/04	2/28/50	0.5 mi. WNW	46°46'	92°06'	1128	47	11 e5	11 e5		NA f3	NA g5						e - Effective 10/20/23. f - Installed 4/25/05, moved to Airport 7/10/50. g - Installed 11/22/40, moved to Airport 7/8/50.
705 West 9th Street	3/1/50	10/31/59	500 ft. NW	46°47'	92°06'	1162			5									WBO consolidated at WBAS 3/1/50. Special Meteorological Station established for temperature and precipitation observations only.
<u>AIRPORT</u>																		
Williamson-Johnson Municipal Airport (6 miles NW of P.O.)	8/8/40	3/1/50	NA	46°50'	92°11'	1409	47 i52 ii55	NA 14	5 h4	NA	NA	NA	NA 14	NA	NA	NA	NA	CAA station to 12/11/41. h - Effective 6/6/41. i - Installed 6/6/41. ii - Effective 2/4/48. iii - Effective 4/11/50.
Williamson-Johnson Municipal Airport + Duluth International Airport (Effective 1963)	3/1/50	10/15/75	NA	46°50'	92°11'	1408 ri1428	55 iii53 r21	7 n7	7 n7	NA j25	NA k4 n4	NA j5 m3 n3 s7	4 n4	NA p6 q6	NA	NA	NA	j - Installed 7/8/50. k - Installed 7/10/50. m - Effective 8/6/60. n - Minor move 8/8/60. p - Commissioned near thermometer site 9/1/60. q - Moved 2600' NNW 6/22/61. r - Effective 6/22/61. s - Effective 8/11/65.
Duluth International Airport	10/15/75	Present	500 ft. NNW	46°51'	92°11'	1422	t21	6 u6	6 u6	24 w36	24	24 v6	24 v4	t6 x6	NA	NA	NA	t - Not moved 10/15/75. u - Moved 700' NW 8/27/76. v - Moved 250' W 8/27/76. w - Raised 7/15/80. x - Type change 7/30/85. y - Relocated 3/14/93. S ASOS Commissioned 04/01/96

SUBSCRIPTION: Price and ordering information available through: National Climatic Data Center, Federal Building, Asheville, North Carolina 28801.  
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