Where Has All the Snow Gone?

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Introduction

It seems like winter weather changes every year. We used to get a lot of snow and I can remember when I was younger, seeing enough snow that you could build a snowman, but you could also build a fort and climb inside and stack up snowballs for a fight.

My parents talked about the snowfall they used to get and it seems they got much more than I have ever seen.

So where has all the snow gone? Why has the weather changed so much in just a few years? We learned in school that weather and climate are the same, but different. Weather is what's happening now, but climate is weather over time- like 30 years. That's a lot of weather!

Is this one those deals where parents and older generations always tell their kids it was worse when they were little or has there really been a chance in the snowfall? If so, what has caused this weather phenomena?

For this research project, weather over this past 30 years will be studied to determine if the snowfall has decreased or increased over time. The hypothesis will be that snowfall has

decreased over time, making it impossible to maintain the same amounts of snow as in earlier times.

Experimental Design

The purpose of this project is to research historical data for snowfall, air temperature, and cloud cover for the past thirty years in my urban area for the winter months: December through February.

Current data will be collected using the NASA GLOBE Observer app and atmospheric protocols which are uploaded into the NASA database. Snowfall, air temperature will be collected daily using the app and an IRT (noncontact infrared thermometer) through February and recorded in the logbook to be analyzed later.

Historical data will be researched through a number of credible sites and added to the logbook for analysis. Both historical and current data will focus only on the calendar winter months. Some of those sites include: GLOBE.gov and www.weatherundergound.com which provide historical data to its members.

The GLOBE Observer app is a NASA based, citizen science driven, weather app that uses real time data and compared it to satellite data for use with NASA work. This data base stores real

time data gathered by citizen scientists from all over the world,

for use by students and scientists as needed, for research.
You can see it in use here. The phone shows you directions as it takes pictures automatically in four cardinal directions plus up and down. These help the user determine what the landcover is like where the observation is taken. It reports air temperatures, cloud cover, wind speed, and several other atmospheric conditions. During the solar eclipse, it will also cover atmospheric activities related to that.

It is expected that the research will show that the hypothesis will be supported by the data. The historical data and the current data gathered will show a decrease over time, making it impossible to generate more snowfall.

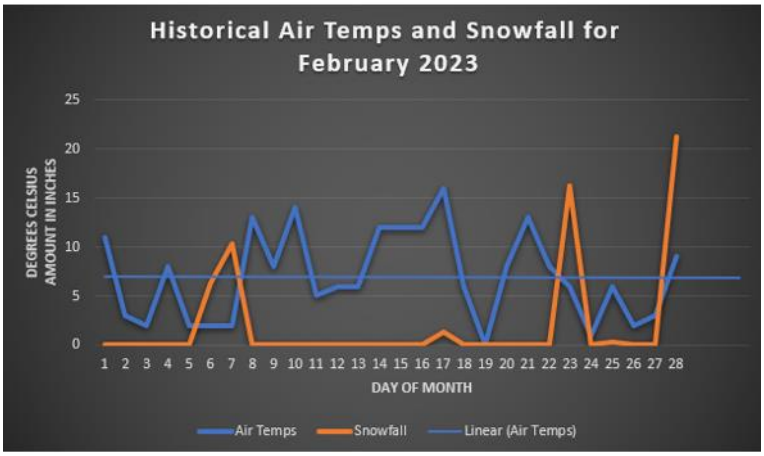
Results and Discussion

So what did the results show?
First, the amount of data gathered was overwhelming. There was no way this amount of data could be gathered and sorted in the time provided so I was forced to select a much small sample in an

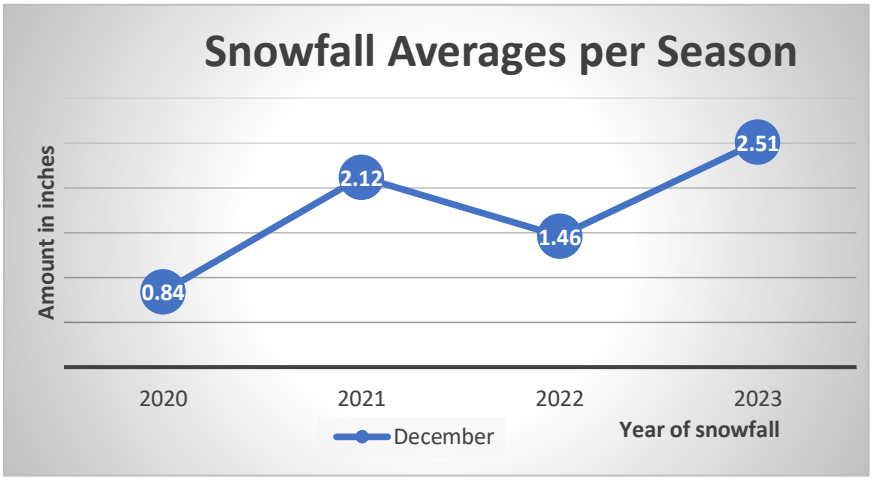
attempt to prove or disprove my hypothesis. For this research project, only the data for the years 2020 through 2024 are utilized. To use all that was provided, it would take the rest of the school year to complete all the math equations! The raw data will be visible in the log book section. This chart is a random sample of how the data was grouped for analysis. From this, we could analyze the temperatures and snowfall amounts for season and for month of the year. We also counted sunny days and cloudy days. There is a great deal of data here. Each month was completed in this manner. For most months, the temperatures stayed pretty consistent: going all over the place! The next three charts will show the comparison between the snowfall in each month

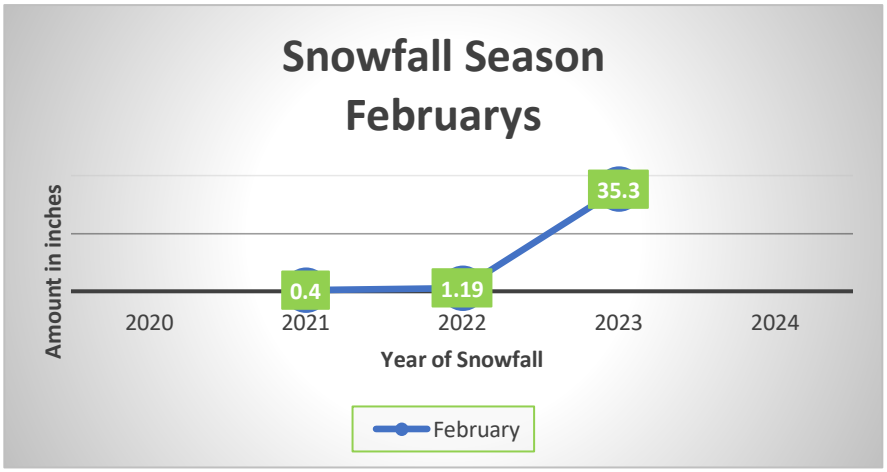
Date Feb 2023	Air Temperature Celsius	snow/amount in inches	Cloudy days 71.5% 28.5% clear Average snowfall 35.3"
1	11	0	
2	3	0	
3	2	0	
4	8	0	
5	2	0	
6	2	6.35	Y
7	2	10.37	Y
8	13	0	Y
9	8	0	Y
10	14	0	Y
11	5	0	Y
12	6	0	Y
13	6	0	Y
14	12	0	
15	12	0	
16	12	0	Y
17	16	1.32	Y
18	6	0	Y
19	0	0	Y
20	8	0	Y
21	13	0	Y
22	8	0	Y
23	6	16.26	
24	1	0	Y
25	6	0.25	Y
26	2	0	Y
27	3	0	Y
28	9	21.29	Y

8 sunny days



during the seasons as they progressed. This was the most surprising to me. It was completely the opposite of what I expected to find. Analyzing the data in this manner was interesting but did not provide me with anything that would assist me in answering the hypothesis question: Where has all the snowfall gone?





From the data on these graphs, it appears that the snowfall is not decreasing but increasing! Between years 2022 and 2023, all three months showed a dramatic increase in snow fall which remains consistent through all the

seasons. This also infers that snow fall might be cyclical, since snow is now increasing instead of decreasing. (A complete set of charts can be found at the end of this report.)

Next Steps and Limitations /RWE

The next steps would be to compile all the data for the 30-year time period that constitutes a regional climate for my area. Then to complete all the math computation require to organize the data into usable forms for this research. This might be best in a non-school period which allows time for this to be completed.

Looking over this data where it can be visualized, would give the researcher the answers needed for the hypothesis.

Even so, both samples are too small to fully answer this question for the entire planet. It does infer that this snowfall question might best be answered in a cyclical movement. There are times of higher snowfall and times of lower snowfall and that is depends on weather patterns. Further research is necessary. This is the biggest limitation for this research: the small sample size and the short time frame.

This data is important to many careers and sets of people. Everyone from the local consumer, city planners, builders, infrastructures, water providers, would all be interested in this research. It would help in building structures that can withstand weather patterns, snowfalls or lack thereof, and water quality

provision for communities who would need to know how weather affects the cycling of water through the local environment.

Conclusion

In conclusion, the data offered another response to the question being researched. It did not prove or disprove my hypothesis. The hypothesis was incomplete as the data showed an INCREASE in snowfall but the increased came from years back when there was much less snowfall within the same climate period. It infers that there are times of high snowfall and low snowfall and that perhaps another source is responsible for the snowfall, other than the temperatures and cloud cover. Further research should uncover this mystery.

Reference List

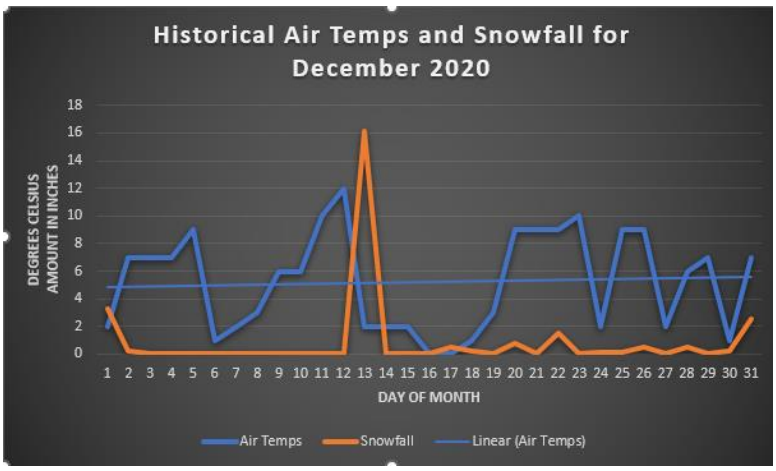
www.globe.gov

www.wunderground.com

www.weather.gov

www.timeanddate.com/weather/usa/detroit/historic

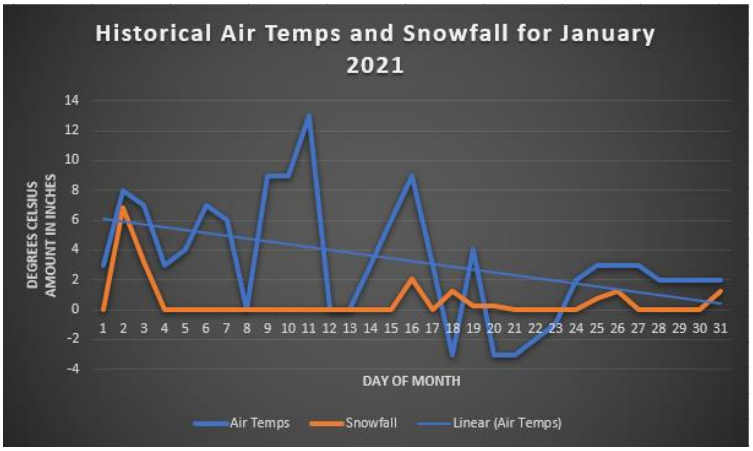
Date Dec 2020	Air Temperature Celsius	snow/amount in inches	Cloud Cover 84% 16% clear days Average snowfall 0.84”
1	2	3.3	Y
2	7	0.25	
3	7	0	
4	7	0	Y
5	9	0	Y
6	1	0	Y
7	2	0	Y
8	3	0	Y
9	6	0	Y
10	6	0	Y
11	10	0	Y
12	12	0	Y
13	2	16.16	Y
14	2	0	Y
15	2	0	Y
16	0	0	
17	0	0.5	Y
18	1	0.25	Y
19	3	0	Y
20	9	0.81	Y
21	9	0	
22	9	1.52	Y
23	10	0	Y
24	2	0.16	Y
25	9	0.16	
26	9	0.51	Y
27	2	0	Y
28	6	0.51	Y
29	7	0	Y
30	1	0.25	Y
31	7	2.54	Y



Five days with no clouds

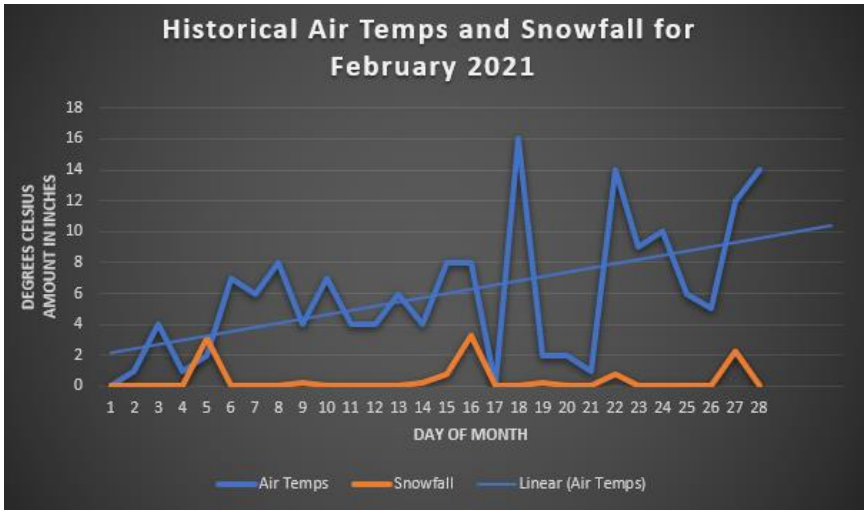
Date Jan 2021	Air Temperature Celsius	snow/amount in inches	Cloudy days 77.5% 22.5% clear days Average snowfall 0.55”
1	3	0	
2	8	6.86	
3	7	3.21	
4	3	0	Y
5	4	0	Y
6	7	0	Y
7	6	0	Y
8	0	0	Y
9	9	0	Y
10	9	0	
11	13	0	Y
12	0	0	Y
13	0	0	Y
14	3	0	Y
15	6	0	Y
16	9	2.03	Y
17	3	0	
18	-3	1.25	Y
19	4	0.25	Y
20	-3	0.25	Y
21	-3	0	
22	-2	0	Y
23	-1	0	Y
24	2	0	Y
25	3	0.76	
26	3	1.25	Y
27	3	0	Y
28	2	0	Y
29	2	0	Y
30	2	0	Y
31	2	1.27	Y

7 Sunny days



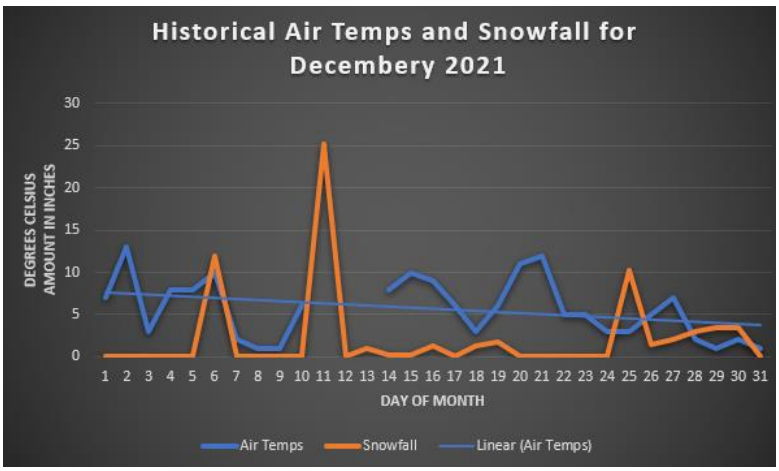
Date Feb 2021	Air Temperature Celsius	snow/amount in inches	Cloudy days 64.3% 35.7% clear Average snowfall 0.4”
1	0	0	
2	1	0	Y
3	4	0	Y
4	1	0	Y
5	2	3.05	Y
6	7	0	
7	6	0	
8	8	0	
9	4	0.25	
10	7	0	
11	4	0	
12	4	0	
13	6	0	Y
14	4	0.25	
15	8	0.76	
16	8	3.3	Y
17	0	0	Y
18	16	0	Y
19	2	0.25	Y
20	2	0	Y
21	1	0	Y
22	14	0.75	Y
23	9	0	Y
24	10	0	Y
25	6	0	Y
26	5	0	Y
27	12	2.25	Y
28	14	0	Y

10 sunny days



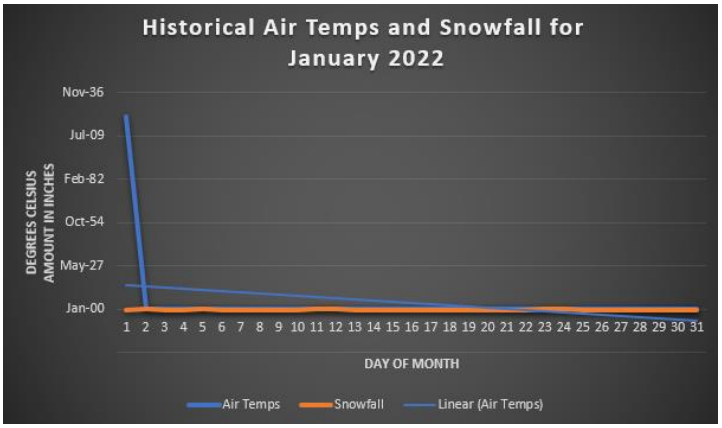
Date Dec 2021	Air Temperature Celsius	snow/amount in inches	Cloudy Days 74.2% 25.8% clear Average snowfall 2.12”
1	7	0	Y
2	13	0	Y
3	3	0	Y
4	8	0	Y
5	8	0 (rain)	Y
6	10	11.95	
7	2	0	
8	1	0	Y
9	1	0	Y
10	6	0	Y
11		25.15	Y
12		0	Y
13		1	Y
14	8	0.25	Y
15	10	0.25	Y
16	9	1.27	
17	6	0	
18	3	1.27	
19	6	1.83	Y
20	11	0	Y
21	12	0	
22	5	0	Y
23	5	0	Y
24	3	0	
25	3	10.16	Y
26	5	1.52	Y
27	7	2.05	Y
28	2	3.05	Y
29	1	3.5	
30	2	3.5	Y
31	1	0	Y

8 sunny days



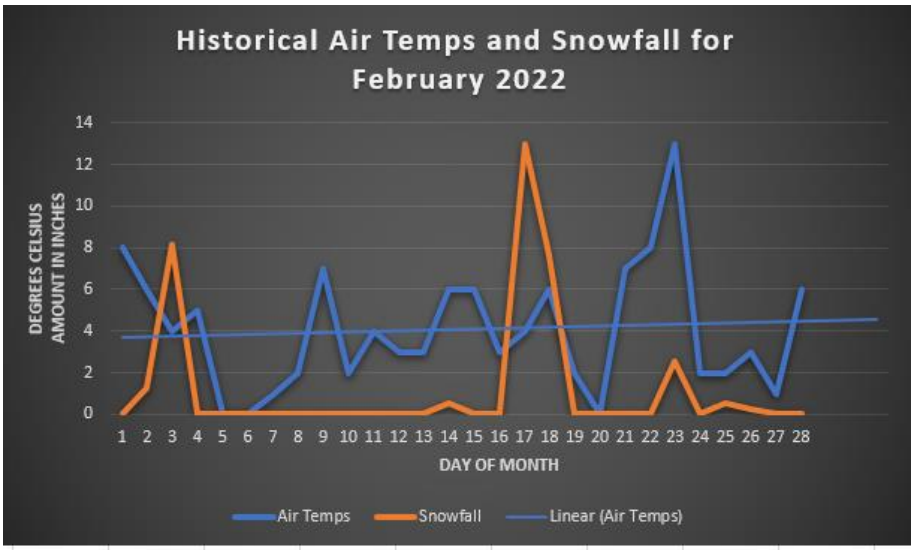
Date Jan 2022	**Air Temperature Celsius**	**snow/amount in inches**	**Cloudy days 71% 29% clear Average snowfall 0.1”**
1	3	0	
2	8	1.52	
3	7	0	
4	6	0	
5	-2	8	Y
6	2	0	Y
7	3	0	
8	3	0	Y
9	-6	0	Y
10	3	0	Y
11	1	0.5	Y
12	-3	0.5	Y
13	-3	0	Y
14	-3	0	Y
15	1	0	Y
16	5	0	
17	2	0	
18	-2	0	Y
19	-8	0	Y
20	0	0	Y
21	0	0	Y
22	2	0	
23	6	0.51	Y
24	6	0.51	
25	-4	0	Y
26	2	0	Y
27	-3	0	Y
28	-4	0	Y
29	-6	0	Y
30	-7	0	Y
31	-3	0	Y

9 sunny days



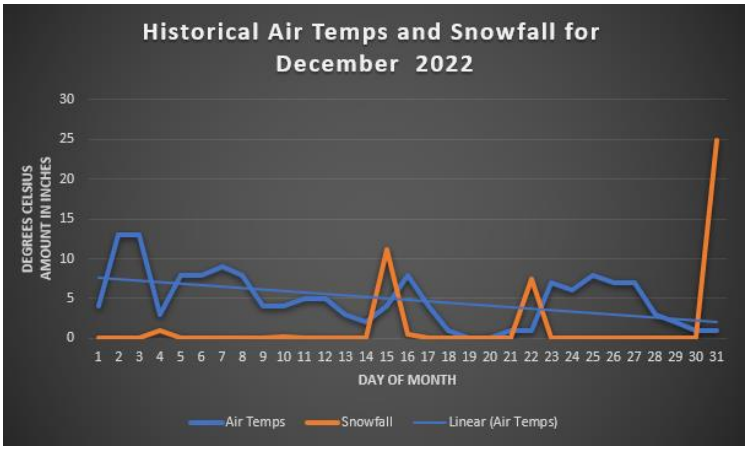
Date Feb 2022	Air Temperature Celsius	snow/amount in inches	Cloudy days 67.9% 32.1% clear Average snowfall 1.19”
1	8	0	
2	6	1.27	
3	4	8.13	
4	5	0	Y
5	0	0	Y
6	0	0	Y
7	1	0	Y
8	2	0	Y
9	7	0	Y
10	2	0	Y
11	4	0	Y
12	3	0	Y
13	3	0	Y
14	6	0.51	Y
15	6	0	
16	3	0	Y
17	4	12.95	
18	6	7.62	Y
19	2	0	Y
20	0	0	
21	7	0	
22	8	0	
23	13	2.54	
24	2	0	Y
25	2	0.5	Y
26	3	0.25	Y
27	1	0	Y
28	6	0	Y

9 sunny days



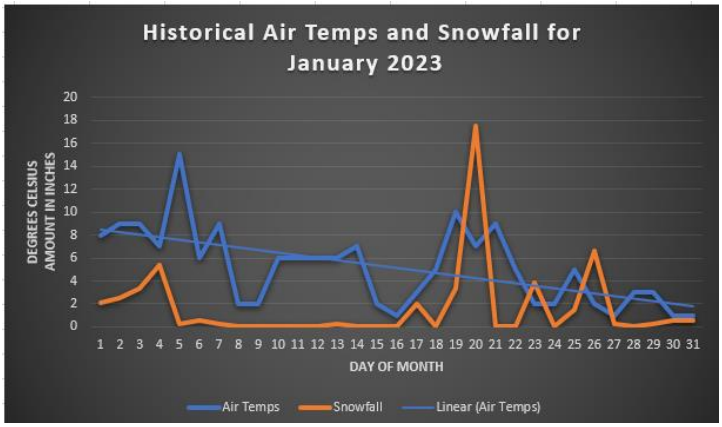
Date Dec 2022	Air Temperature Celsius	snow/amount in inches	Cloudy days 77.5% 22.5% Average snowfall 1.46”
1	4	0	
2	13	0	
3	13	0	Y
4	3	1.02	
5	8	0	Y
6	8	0	Y
7	9	0	Y
8	8	0	Y
9	4	0	Y
10	4	0.25	Y
11	5	0	Y
12	5	0	Y
13	3	0	Y
14	2	0	
15	4	11.15	
16	8	0.51	Y
17	4	0	Y
18	1	0	Y
19	0	0	Y
20	0	0	Y
21	1	0	Y
22	1	7.4	Y
23	7	0	
24	6	0	
25	8	0	Y
26	7	0	Y
27	7	0	Y
28	3	0	Y
29	2	0	Y
30	1	0	Y
31	1	24.89	Y

7 sunny days



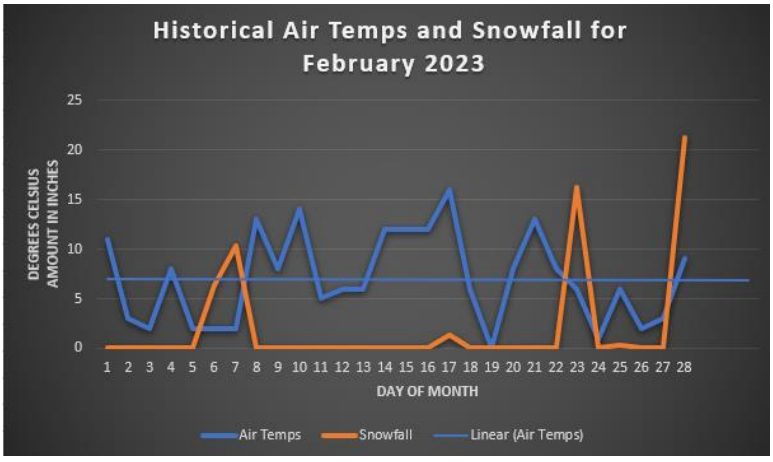
Date Jan 2023	Air Temperature Celsius	snow/amount in inches	Cloudy days 80.7% 19.3% Average snowfall 1.64%
1	8	2.05	Y
2	9	2.54	Y
3	9	3.3	Y
4	7	5.35	Y
5	15	0.25	Y
6	6	0.51	Y
7	9	0.25	Y
8	2	0	Y
9	2	0	Y
10	6	0	Y
11	6	0	Y
12	6	0	Y
13	6	0.25	Y
14	7	0	Y
15	2	0	Y
16	1	0	Y
17	3	2.0	Y
18	5	0	Y
19	10	3.35	Y
20	7	17.53	
21	9	0	
22	5	0	Y
23	2	3.81	
24	2	0	Y
25	5	1.52	
26	2	6.6	
27	1	0.25	
28	3	0	Y
29	3	0.25	Y
30	1	0.51	Y
31	1	0.51	Y

6 sunny days



Date Feb 2023	Air Temperature Celsius	snow/amount in inches	Cloudy days 71.5% 28.5% clear Average snowfall 35.3”
1	11	0	
2	3	0	
3	2	0	
4	8	0	
5	2	0	
6	2	6.35	Y
7	2	10.37	Y
8	13	0	Y
9	8	0	Y
10	14	0	Y
11	5	0	Y
12	6	0	Y
13	6	0	Y
14	12	0	
15	12	0	
16	12	0	Y
17	16	1.32	Y
18	6	0	Y
19	0	0	Y
20	8	0	Y
21	13	0	Y
22	8	0	Y
23	6	16.26	
24	1	0	Y
25	6	0.25	Y
26	2	0	Y
27	3	0	Y
28	9	21.29	Y

8 sunny days



Date Dec 2023	**Air Temperature Celsius**	**snow/amount in inches**	**Cloudy days 78.2% 21.8% clear Average snowfall 2.51”**
1	10	2.54	Y
2	7	12.7	Y
3	7	0	
4	6	5.84	
5	4	0	
6	6	16	Y
7	6	0	Y
8	10	0	Y
9	13	0.51	Y
10	17	0.25	Y
11	7	0	
12	7	0	
13	3	0	
14	7	0	Y
15	9	0	Y
16	9	0	Y
17	4	1.27	Y
18	4	5.24	Y
19	7	6.87	Y
20	2	1.57	
21	6	0	Y
22	9	0	Y
23	13	5.33	Y
24	11	0	Y
25	9	1.27	Y
26	7	3.56	Y
27	7	1.52	Y
28	4	11.99	Y
29	1	1.78	Y
30	0	0	Y
31	0	0	Y

7 sunny days