

# Weather and Climate

## WHAT IS THE DIFFERENCE?



Ask a Michigander to describe November weather in the Great Lakes State, and you'll likely hear words like "cold, gray, windy, rainy and maybe snowy." No one would say "65 degrees and sunny."

But on November 12, 2010, we experienced just those conditions in lower Michigan. It's not surprising for people to attribute such an unexpectedly warm day to climate change, given the attention the topic receives in the media. Yet, that one warm day in November is not evidence of climate change. We cannot draw conclusions about a location's climate based on one day's weather, or even one month, season or year. A key to making sense of this statement is understanding the difference between weather and climate.

### Michigan's Variable Weather

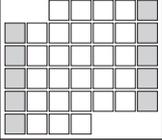
Everyone knows what weather is. We encounter it every time we go outside, experiencing it as stinging cold, sweltering heat, gentle rain, thunderstorms, fog, wind, humidity and more. In scientific terms weather is the state of the atmosphere at a particular place and time. Weather has direct influence in our lives, affecting what we wear and how we plan our activities. Should I take an umbrella with me? Will it be snowing for tomorrow's morning commute? Here in Michigan, one day in spring can be 70 degrees and sunny, the next day freezing rain. Weather is highly variable over hours, days and weeks and is difficult to predict beyond one week. It's also highly variable across distance, even small distances; your town doesn't always share the exact weather with the next town over.

### Climate is What You Expect, Weather is What You Get

Weather is not the same as climate, though they are directly related. Weather is day-to-day conditions at a specific place, while climate is the weather that prevails in a region over a long period of time. In other words, climate is average or typical weather. Like pieces of a jigsaw puzzle, daily weather observations eventually become climate records. Climate is determined by averaging a set of weather observations collected over a long time period. Think of it like a class: for each report card, your daily and weekly assignments and exam scores are averaged to determine your final grade. Weather is like your assignments and exam scores — and climate is like your final grade.

An easy way to remember the difference between weather and climate is this: climate is what you expect, weather is what you get. In other words, your understanding of climate gives you an idea of typical weather at a given place and time, but you won't know the actual weather until you are in the middle of it. If you earn an A on each of your first two report cards, your teacher will probably expect a similar performance for your third report card. Of course it's possible that you don't earn another A, but your previous grades give the teacher a sense of what to expect.

CONTINUED ON BACK

WEATHER			CLIMATE	
DAY to DAY			AVERAGE	
MON	TUES	WED	June	Monthly Average High 76°
 72°   67°	 70°   66°	 68°   63°		
<b>QUIZ</b> A (a) true b. false	<b>TEST</b> B a. true (b) false <i>Nunciamus malis revelationibus vix editis quid</i>	<b>HOMEWORK</b> C <i>exceptis sit desertum ad qui dolus aut quibus operis hinc est sua non est nisi eos vult</i>	<b>REPORT CARD</b> Math <b>A</b> Science <b>B+</b> English <b>B</b>	

### Weather vs. Climate Quiz

Does each statement below describe weather or climate?

1. "Today feels so much hotter than yesterday."
2. "We usually have a lot more snow than this in January."
3. "Today's high temperature was 10 degrees cooler than normal."
4. "Heavy thunderstorms are expected to move through the area this evening."
5. "I've lived on Lake Huron for 60 years and I've never experienced wind like this"

Answer Key: 1. Weather, 2. Climate, 3. Climate, 4. Weather, 5. Climate

## Why study weather and climate?

We study weather and climate because we want to make sense of our world and plan for the future. We use climate information to guide many important personal and societal decisions like when to schedule outdoor events such as weddings and family reunions, which crops to plant and when, how to size and design stormwater management infrastructure, how much money a city should budget for snow removal, and how to determine insurance rates for homes in flood-prone areas. Weather forecasts help us plan for the short-term future — the next minutes, hours and days — but climate information helps us plan months and years in advance.

We are all walking weather stations, constantly taking readings of the weather we experience and building a mental database that makes up our concept of climate where we live. When someone asks “what is summer like in Michigan?” we access this mental database of weather observations to answer the question. We all have our own idea of climate because each individual’s dataset is different depending on their experience. For example, your grandparents’ perception of Michigan’s climate will be different than yours. When they tell stories about how difficult the winters were when they were children, does this indicate that the climate has changed? How do we know if our perceptions of climate match what is really going on?

This is where formal science comes in. Scientists use information collected at weather stations to study weather and climate. Weather stations are facilities with instruments that collect and record data on local weather conditions. By studying data collected over many years,



WEATHER STATION,  
MACKINAW CITY

scientists can draw conclusions about a region’s climate. They do this by calculating short-term (month, season, year) and long-term (decades) averages of weather characteristics at a network of weather stations in the region of interest. They also look at the range of weather conditions (highs and lows, extreme events) experienced during the time period of interest. Scientists study how these averages and ranges behave over time to understand how climate varies and changes over time.

### Key Terms

- **Weather** - the state of the atmosphere at any given time and place (temperature, humidity, precipitation, cloudiness, wind, etc.).
- **Climate** - the set of meteorological conditions that prevail in a particular place or region over a long period of time.

### Resources

Explore weather and climate data at the following websites:

- Midwestern Regional Climate Center: <http://mrcc.isws.illinois.edu>
- Michigan State Climatologist’s Office: <http://climate.geo.msu.edu>
- National Climatic Data Center: [www.ncdc.noaa.gov](http://www.ncdc.noaa.gov)

### References

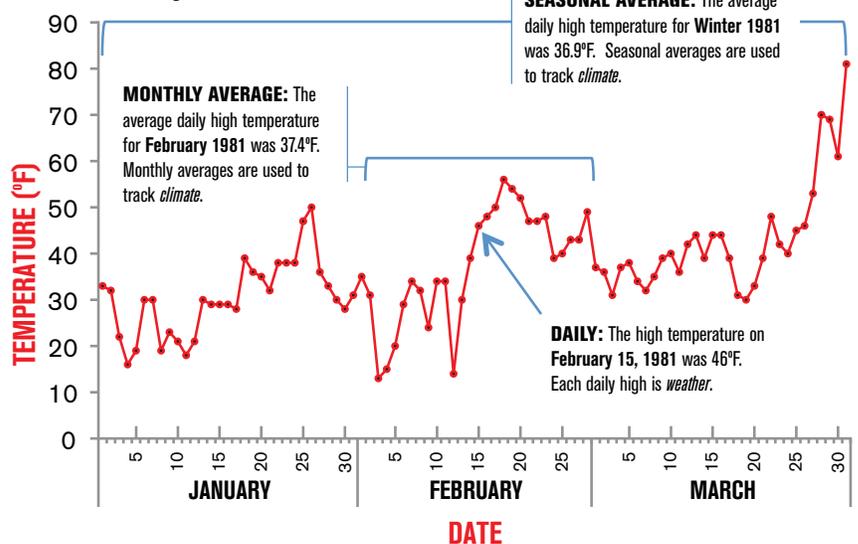
Climate Literacy: The Essential Principles of Climate Sciences. U.S. Global Change Research Program. March 2009. Available at: [http://cpo.noaa.gov/sites/cpo/Documents/pdf/ClimateLiteracyPoster-8\\_5x11\\_Final4-11LR.pdf](http://cpo.noaa.gov/sites/cpo/Documents/pdf/ClimateLiteracyPoster-8_5x11_Final4-11LR.pdf)

“What’s the Difference Between Weather and Climate?” NASA. February 2005. Available at: [www.nasa.gov/mission\\_pages/noaa-n/climate/climate\\_weather.html](http://www.nasa.gov/mission_pages/noaa-n/climate/climate_weather.html)

## Real World Data

This graph illustrates the relationship between weather and climate using real temperature data from a weather station in South Haven, Michigan. Each point on the graph is a daily high temperature, which is weather. The average of all of the points on the graph (36.9°F) is the seasonal average daily high temperature for winter 1981. The average of each point in February (37.4°F) is a monthly average. By themselves, these seasonal and monthly averages are just numbers, but they become meaningful tools to track climate when compared to seasonal and monthly averages from other years. These kinds of year-to-year comparisons are used to identify climate variations and changes over time.

## DAILY HIGH TEMPERATURE, SOUTH HAVEN, MI January–March 1981



Michigan Sea Grant enhances the sustainability of Michigan’s coastal communities, residents, and businesses through research, outreach and education.

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