

Viewing Weather as the Expression of Climate

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ABSTRACT: It is common when speaking colloquially to describe climate as the average weather, which implies weather is the driver and climatic averages are a passive by-product of it, but it is useful to reframe this toward weather being the “expression” of climate. That is, a region’s climate defines the range of weather it might experience (including the extent and frequency of extremes). In this framing, weather is driven by a region’s climate. A changing climate then, necessarily, is experienced as a change in local weather events—often most visibly through changes in the extent or frequency of extreme weather.

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Established definitions for weather and climate

The *AMS Glossary of Meteorology* defines “weather” in the following way (American Meteorological Society 2023a):

weather

1. The state of the atmosphere, mainly with respect to its effects upon life and human activities.

As distinguished from climate, weather consists of the short-term (minutes to days) variations in the atmosphere. Popularly, weather is thought of in terms of temperature, humidity, precipitation, cloudiness, visibility, and wind.

[definitions 2 and 3 not included here]

By contrast, “climate” is defined as (American Meteorological Society 2023b):

climate

The slowly varying aspects of the atmosphere–hydrosphere–land surface system.

It is typically characterized in terms of suitable averages of the climate system over periods of a month or more, taking into consideration the variability in time of these averaged quantities. Climatic classifications include the spatial variation of these time-averaged variables. Beginning with the view of local climate as little more than the annual course of long-term averages of surface temperature and precipitation, the concept of climate has broadened and evolved in recent decades in response to the increased understanding of the underlying processes that determine climate and its variability.

This formal definition of climate includes quite a bit of nuanced language that is not easily accessible to most of the general public. By contrast, in material prepared for broader audiences, it is extremely common to see climate defined as being simply the “average of weather” (Met Office 2023; NASA 2023; National Geographic 2023; NOAA 2023; USGS 2023; WMO 2023). While useful in many contexts, such as providing a sense of what weather might be expected at a given location at a given time of year, this simplistic framing places a region’s climate as the passive result of that region’s weather.

Understanding the relationship between weather and climate is particularly important in the context of public understanding of climate change. It is, unfortunately, all too common for members of the public to dismiss the importance of climate change after having experienced a *weather* event that seems contrary to the expectation of a warming planet (such as a particularly cool month or an early or late snowstorm). In helping the public understand and appreciate the difference between weather and climate, Dr. J. Marshall Shepherd has promoted a couple of very useful metaphors in public presentations. In one, he describes climate as

your personality and weather as your mood (Shepherd 2013).¹ This metaphor provides two useful elements. First, someone's perceived personality is, in some sense, the average of their moods, and second, a person may still have grumpy days despite having a happy personality, just as we can experience occasional record-cold days of weather in a warming climate.

¹ This metaphor was introduced to Shepherd by Dr. John Knox (J. M. Shepherd 2023, personal communication).

In another metaphor, Shepherd describes weather as the clothes you are wearing on a particular day while climate is represented by the clothes in your closet (Shepherd 2018). This metaphor is particularly useful since it relates more directly to meteorological conditions, and also because it provides a sense of climate being more than just an average for a season or day of the year. The closet of someone living in Miami is likely to house mostly clothing appropriate for warm weather, while the closet of a Boston resident will have warm-weather clothing for the summer months (that may be very similar to the resident of Miami) but also clothing needed for the cold-weather winter months.

Weather as an expression of climate

We can push this clothing metaphor in a different direction to think about weather and climate somewhat differently. What you wear on any given day is an “expression” of your wardrobe, chosen from your closet of clothes. What you have available to wear on any given day is limited by what is in your closet. If you change the clothes in your closet, by adding some new ones or taking away some old ones (or both), you change the wardrobe expressions available to you on any given day. Many days will be the same as prior weeks or years, but with new wardrobe selections to choose from, other days will be quite different.

In a similar way, we can think of weather as being an expression of the climate in a region. This reverses the notion of a region's climate being the result of that region's weather (in the sense of an average), and instead places the region's climate as being the driver and the daily variable weather as being a result of the climate for that region. Thinking of a region's climate as the collection of weather events that might be experienced in that region (including the range and frequency of extremes) provides a framing that sees climate change as inevitably resulting in changes in the daily weather events. Many (and perhaps most) days will be similar to prior years, but the region will now experience weather patterns and extremes not seen before as the changing climate drives new expressions for the weather in that region.

This reframing offers a way to discuss with family, friends, or the general public, unusual or extreme weather events in the context of climate change. Whether a specific event would have occurred in the absence of climate change (or had different characteristics, such as being less severe) is an important question but requires a complex scientific analysis. The public conversation can instead be turned to the idea that since our weather is an expression of our climate, those unusual or extreme weather events are to be expected as a reflection of our current changing climate (and would have been different if our climate had not been changing even if it may be difficult to know exactly in what ways and by how much). Thus, an individual's notion of the weather being different now from decades past offers an opportunity to help everyone recognize that we are already experiencing our changing climate that is being expressed through changing weather.

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