

It's Not Called 'Eastern U.S. Warming'

by Paul Donahue

For those who lived through last winter's record breaking cold and snow across the eastern United States, it might seem like global warming has taken a vacation. The well-compensated and/or incurably stupid global warming deniers certainly didn't miss the opportunity to shout from the snow-covered rooftops that we all now had undeniable proof that global warming is a hoax. As just one example, in February *Forbes* ran a column by James Taylor, the right-wing Heartland Institute's professional global warming denier, titled "Record Cold And Snow Destroy Global Warming Claims." It is hard for me to understand why anyone would rely on business advice from *Forbes* when they publish a regular column by an idiot like Taylor, but that's a subject for another day.

When people present to me last winter's weather over the eastern U.S. as evidence that global warming is not occurring, there are three things I tell them.

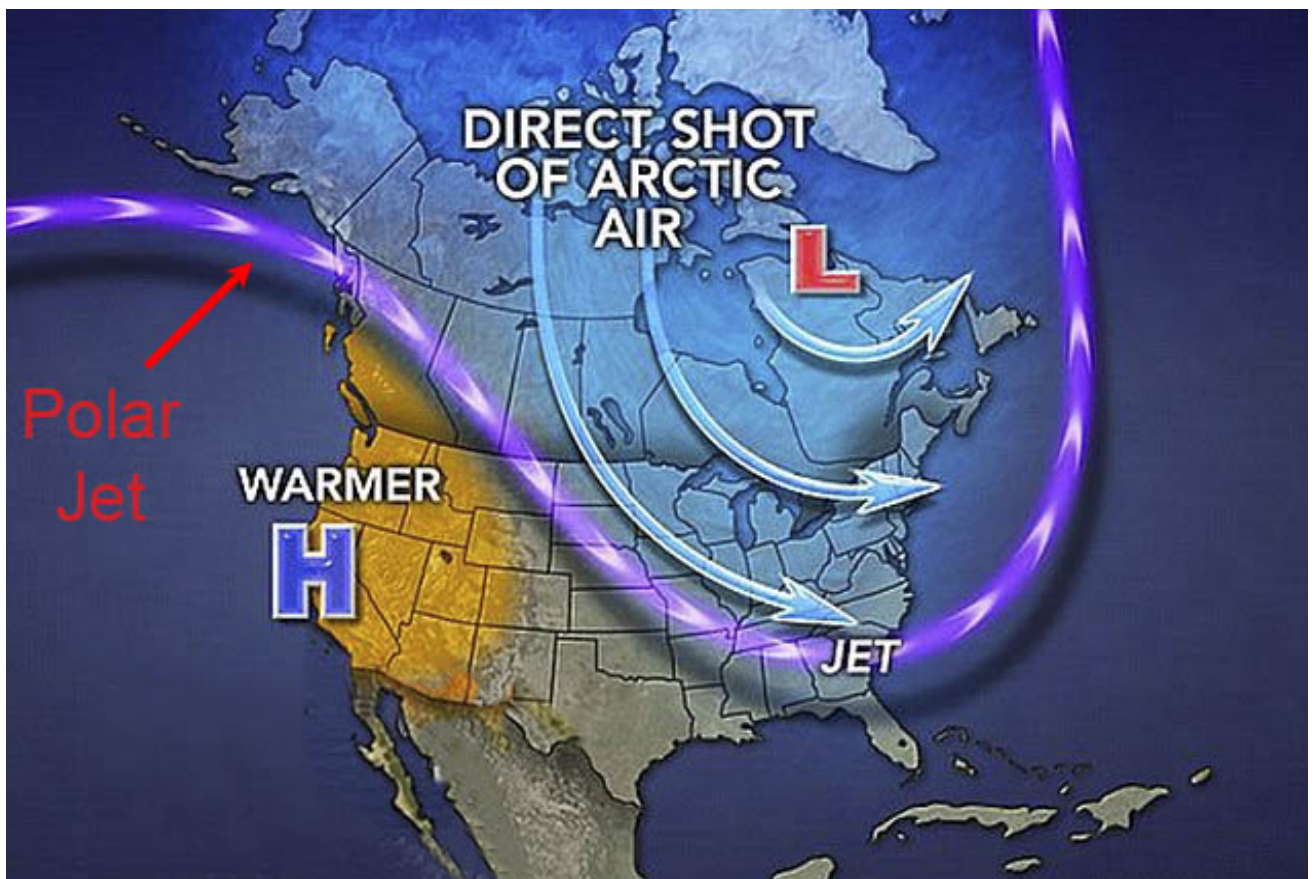
The first thing I tell them is that it is not called 'Eastern U.S. Warming', it's called 'Global Warming'. The eastern United States is a relatively small part of that globe. While the eastern U.S. was experiencing record cold last winter, the western U.S. was having a very warm winter, with five states - Arizona, California, Nevada, Utah, and Washington - having their warmest winters on record. California broke its previous record by 1.5° F. While record amounts of snow fell across the eastern U.S., a record drought continued across the West, particularly in California.

The second thing I tell them is that it is probably better to use the term 'climate change' or 'climate disruption' rather than 'global warming'. As climatologists have predicted, we are seeing more and more extreme weather, in all its forms. That doesn't just mean heat waves, it means violent thunderstorms, hurricanes, tornados, droughts, record rainfall and floods, and yes, record snowfall and record cold - extreme weather.

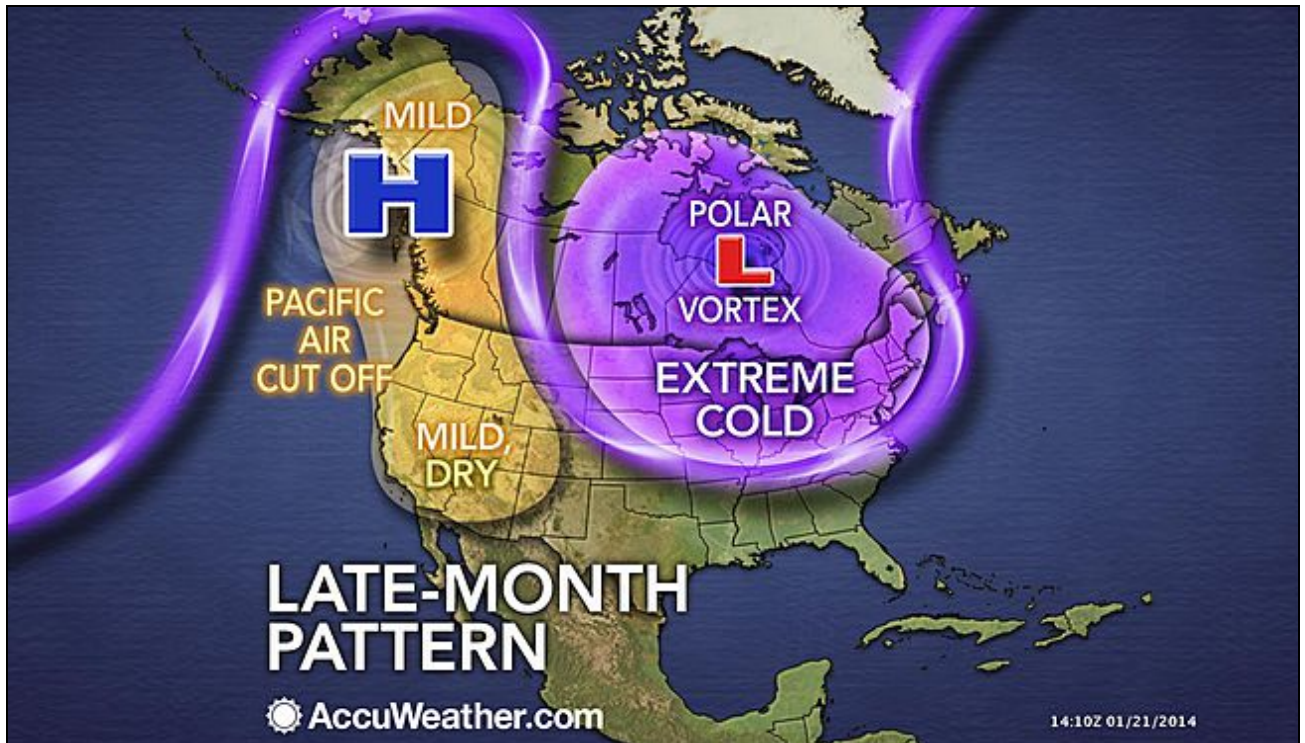
The third thing I tell them about last winter's weather is that, as counter-intuitive as it seems, the record cold and snow experienced across the eastern U.S. were actually a symptom of global warming, not a refutation of it. The explanation gets a little technical, but I'll try to put it in simple terms.

Weather systems in the Northern Hemisphere are driven by the jet streams, fast moving currents of air traveling in a generally east to west direction, encircling the globe in the upper levels of the atmosphere. There are two that pass over North America, the Subtropical Jet and the Polar Jet. The Polar Jet is the one that affects weather over most of the U.S.

The speed of the Polar Jet is a function of the difference in temperature between the polar air mass over the Arctic regions and the temperate air mass to the south. The greater the difference in temperature, the faster the jet stream (Polar Jet) flows. With global warming, the entire planet is warming, but it is not warming evenly, with the Arctic region warming significantly faster - about two to three times faster than the rest of the hemisphere. This phenomenon, known as Arctic Amplification, is largely being driven by the loss of the sea ice cover. This acts as a positive feedback mechanism. White ice that used to reflect the sun's energy back up into the upper atmosphere is replaced by dark ocean water that absorbs that energy. As the ocean water warms, more ice melts, which means even less energy is reflected back into the atmosphere. Then as the polar air mass above the Arctic Ocean warms, the temperature gradient that drives the jet stream winds is reduced, causing the winds to weaken.



Not only is Arctic Amplification causing the jet stream to weaken, but it is also causing it to change course. The path of the Polar Jet is typically wavy, but as it slows down, its path gets even more wavy. You've seen these waves or kinks on weather maps. It was one of these kinks that sat over the eastern U.S. last winter.



These waves or kinks in the Polar Jet mean two things for the weather. First, the weather systems associated with these waves move more slowly, so the weather conditions associated with those systems will last longer. It means that cold spells can last longer, and that storms hang around longer and dump more precipitation. Second, if the Polar Jet dips way down into the southern U.S., as it did last winter, it allows cold Arctic air to penetrate down into those southerly latitudes, much farther south than it normally would.

Very warm water in the Pacific also probably contributed to the very wavy pattern of the jet stream. While there was a huge southward dip of the jet stream over the eastern United States, over western North America there was a huge northward wave in the jet stream, and this was probably caused, at least in part, by the unusually warm surface waters of the Pacific.

The record high water temperatures of the nearshore Atlantic waters this past winter also contributed to the season's storms. The increased temperature difference between the land and the water was a source of energy for the storms. Additionally, when the ocean waters are warm, there is more evaporation, which provides more moisture and precipitation for storms.

In general, as the planet continues to warm, we should see fewer record cold events and more record warm events. However, as climatologists are constantly learning, the planet's weather system is incredibly complex and interconnected. A decade ago, who would have guessed that melting of the Arctic Sea ice would cause record cold winter temperatures in Georgia? Unfortunately, it's too late for

us to put the greenhouse gas genie back in the bottle. Atmospheric scientist Dr. Jennifer Francis of Rutgers has been studying the fluctuations in the jet stream waves. When asked what people across the eastern U.S. should expect from future winters, her response was, "Get ready for weirdness."

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