Is Weather More Extreme In A Warmer World? The Answer Is In The Ice

By Meteorologist Art Horn

When I was a television meteorologist sometimes a hurricane would destroy an area, tornadoes would strike with little or no warming, winter storms would bury cities in snow, floods would inundate communities and temperature records would be broken. People accepted these events as the normal variability that has always confronted and confounded humanity.

Not so anymore. Now when a minimal category one hurricane strikes it's called "a super storm." When Washington D.C. is digging out from under two feet of snow it's given a name like "snowmageddon." When drought hits the farm belt it's said to be consistent with predictions that say in a warmer world dry conditions will become more severe. In today's world virtually any weather event that causes any interruption in the flow of daily life is proof that weather is becoming more extreme due to global warming. Is there really more extreme weather in a warmer world?

When I start a semester teaching meteorology, one of the first things my students learn (hopefully) is that it's temperature contrast across the earth that drives weather. They learn that the greater the temperature contrast between the poles and the equator, the harder the atmosphere works to equalize that contrast. The way this work is done is with stronger storms. Stronger storms do a better job of transporting heat from the tropics to the polar regions, therefore reducing the contrast in temperature across the earth. In a sense the storms are the earth's safety valves helping to reduce the pressure so the pipes don't blow!

In a warmer world with less temperature contrast between the poles and the equator the weather would be less extreme, not more

so. In the Northern Hemisphere winter the storms are much more powerful than in the summer. In winter jetstream winds miles above our heads roar at 150 to 200 miles per hour where as in summer they drift along at 20 to 40 miles per hour. Weaker temperature contrast decreases the available energy to make bigger storms and that's what you would have in a warmer world.

What proof do I have of this claim that weather is less extreme in a warmer world? The answer is in the ice. The ice in glaciers holds a record of earth's past temperature. Greenland is a great repository of very old ice. Scientists have drilled deep into the ice and have retrieved long cores that can be dated year by year and then analysed to reveal past temperature.

The method of recreating past temperature from ice cores is quite ingenious. Water in the oceans is made up of two hydrogen atoms and one oxygen atom. But not all water is the same. About 99.8% of all water in the oceans has oxygen with an atomic weight of 16. About 0.2% of the water in the worlds oceans has oxygen with an atomic weight of 18. Oxygen 18 is about 11% heavier than oxygen 16 so it is a little harder to evaporate and once in the clouds it falls out in precipitation a little more readily, depending on temperature. It is this difference between lighter oxygen and heavier oxygen that tells us so much about the temperature of the past.

When the world is warmer, more of the heavier oxygen 18 makes it farther north as snow. When this snow falls onto the Greenland ice cap it is eventually crushed by more overlying snowfall and becomes ice. This ice has a higher concentration of oxygen 18 to oxygen 16. Years, decades and centuries of ice with this higher ratio of oxygen 18 to 16 tell us the earth was warmer. When the earth is colder the heavier oxygen 18 falls out sooner before reaching the colder polar regions like Greenland. The result is that the snow that falls on the Greenland ice cap has a lower concentration of oxygen 18 to 16. In the ice cores this lower ratio

tells us the earth was colder when that snow fell thousands of years ago.

So what does this remarkable record of temperature frozen in the ice tell us about past climate and weather? The ice says that when the earth has been colder the climate, and therefore the weather, which is what ultimately makes up climate over the long run, was much more extreme than today, wildly so. The ice age temperature variability is enormous. The Greenland ice core reveals that the temperature range during the ice age was around 40 degrees Fahrenheit! There were periods of time when the temperature would plunge 20 to 30 degrees for thousands of years then suddenly stop falling. After that the temperature would rocket upward in just a few hundred years or just a few decades to where the temperature had been before or even warmer! These were amazingly wild temperature swings. Only the most robust and adaptable of creatures could have survived these massive gyrations of extreme climate change. These gigantic roller coaster temperature swings, in very short periods of time, reduce the changes of the last 100 years to irrelevant insignificance.

In the winter, during the ice age, the temperature over the ice sheet, being a mile above sea level, would drop to perhaps 100 degrees below zero or lower. The temperature in the tropic was still warm so the temperature contrast between the air over the ice and the tropics would have been much larger than today resulting in wild weather extremes. When the ice age ended the contrast in temperature across the earth eased. The result of this decrease in temperature contrast has been far less temperature instability over the last 10,000 years. Temperature has varied by only 5.5 degrees Fahrenheit since the ice age ended as opposed to 40 degrees during the ice age! The ice core data is telling us that when the earth is warmer there is much less volatility of temperature and therefore the weather that results from that decrease in volatility is much less extreme.

Other than the long term trends in temperature we can derive from the ice cores, our "official" weather records only extend back to 1895 in the United States. There are no weather records of the extremes of weather for 99% of the last 10,000 years. The evidence from the Greenland ice strongly indicates that when the earth is cold the weather is crazy beyond anything we see today with inconceivably large temperature swings back and forth in very short periods of time. This indicates enormous extremes of weather.

So is the weather more extreme today than the past? The answer from the ice is no, not by a long shot.