Linking weather events to climate change

Linking weather events to climate change is problematic. By now, most of us have heard it said that individual cold snaps in the winter don't prove there's no warming. At the same time though, talk about global warming skyrockets during heat waves. So, how do we make sense of the relationship of weather to climate change?

Part of the problem is the media search for concrete, simple answers to an extremely complex scientific issue, complicated by the fact that climate change deniers are willing to give concrete, simple answers, and to speak in absolutes.
In addition, the global rise in temperature means that no aspect of weather is free from the influence of global warming, so every event becomes subject to scrutiny.

An analogy with the effect of steroid use on sports achievement has been widely used in recent discussions of the weather/climate link.

Baseball is a sport that keeps track of statistics. There are huge data sets and very sophisticated ways of analyzing the performance of individual players and teams, as compared with hundreds of other players' or teams' performances, decade after decade. If a baseball player starts taking steroids, you cannot say that any one home run was due to the steroids. What you can do, is look at his record at the end of the season, compare it to the years before steroid use, and say that he would not have hit that many home runs had he not been taking them.

In the same way, while we can't say for sure "this event would not have happened without global climate change," what we can say is that this many events of this severity would not have occurred had the climate not been warmer. As the heat rises, it changes the odds of extreme events of many kinds. This is not an assumption or a hypothesis, it is cause and effect as dictated by known laws of physics and chemistry: A majority of weather events are connected to water. When air and water are warmer, it is because there is more energy in them, and consequently, the molecules are moving around faster. The higher speed means that, in the case of water, it is less likely to stay in liquid form. Water evaporates faster, and stays in the air longer, and so higher temperatures mean worse droughts, as the heat evaporates the water, and they also mean bigger rainstorms and snowstorms when a drop in temperature allows the water to condense and fall back to the ground.

An example of this effect on a massive scale came in 2010 when a heat wave in Russia evaporated massive amounts of water, which the jet stream then carried to Pakistan. When it came down as rain in Pakistan, the resulting floods covered an area the size of the United States eastern seaboard. In fact a newly published analysis of precipitation in the U.S. between 1948 and 2011 shows that extreme precipitation events have increased in both size and severity, and record-shattering droughts are starting to seem like an annual occurrence.

When you combine that with the heat waves we've been seeing, and the unprecedented weather events like the massive derecho in June of this year, we can say with a high degree of confidence, that we are seeing climate change in action.