Habanero Heat is Coming Sooner than We Thought

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One of the authors of this study from Stanford University says: "Frankly, I was expecting that we'd see large temperature increases later this century with higher greenhouse gas levels and global warming . . . I did not expect to see anything this large within the next three decades. This was definitely a surprise."

The IPCC "likely" scenario, the A1B Scenario, shows that the earth will warm by 1.8 degrees C by 2039 (3.6 degrees F). But until now, the detail in the climate models has been too coarse to tell us much detail about regional or local impacts. This is all changing now with much larger supercomputers and more intricate climate models. For example, the new Ranger supercomputer at the University of Texas has nearly 16,000 quad-core chips totaling 63,000 processors in all - in one computer!

This study looked at grid cells across the US that were just 15.5 miles across, and stacked 18 high. The “grid” is like a layer cake. The model calculates the actions and reactions for the different cells continuously. This creates is 250,000 computational cells. It is this immense amount of computing power that is required to finally be able to "see", what to climate scientists, has previously been unattainable resolution.

But before I get to the details of this unprecedented work, there is a very important concept that needs to be discussed. This is the concept of conservative science. The polls that show that American’s confidence in climate science is waning (down 14% from 2008 to 2009). This shows that the concept of conservative science, at least with climate science, is not very well understood.

On top of this poor understanding of the industry of science, polls also show that far too many Americans (up fifteen percent in the past 10 years) think climate scientists exaggerate their findings.

The reasons that these folks understand things to be this way are extensive and omni-present in our society. They range from vested interests to religion and include just about everything in-between. Even our beloved weatherman and weathergirl have significant roles in the misunderstanding of the validity of climate scientist. Climate is about long-term weather: decades of it.

But all of this is another story. Right now the important thing is that there is greater than 99% consensus among climate scientists that changes are real, almost entirely caused by man and happening faster than expected.

So this important concept of conservative science then is exactly the opposite of what nearly half of Americans think about climate science. The thing with science, regardless of the discipline, is that it is conservative. Scientists do not exaggerate. It is against the most basic and fundamental principles of science to exaggerate.

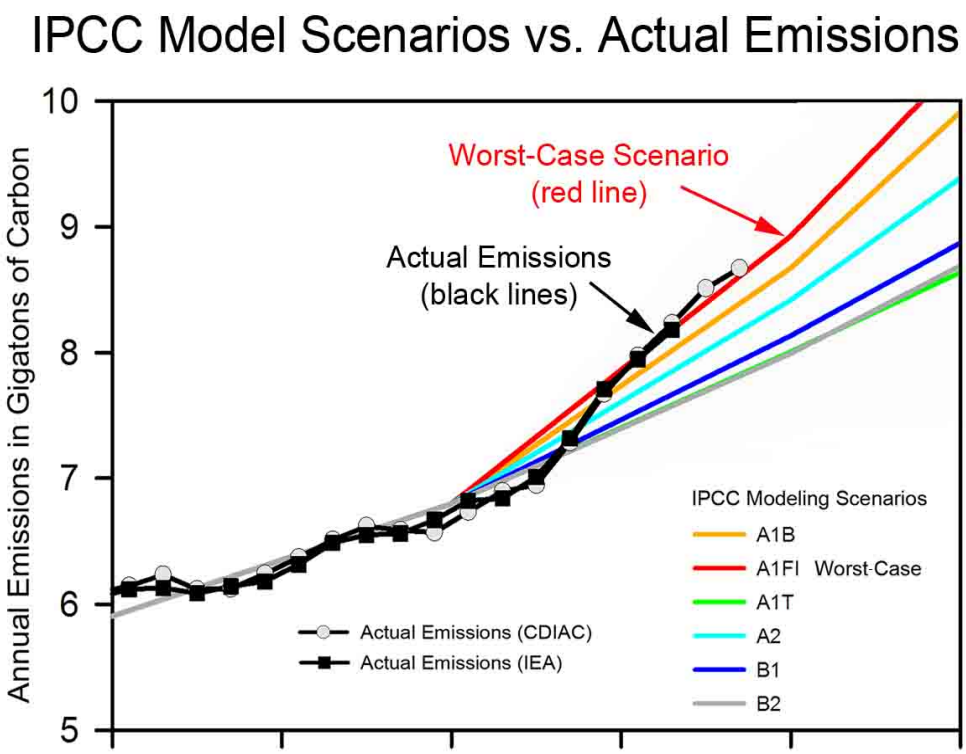
Let me explain how I can say this. There is even a maxim in the industry of science that can help us to understand how the accuracy of facts is critical to the fundamentals of science. This maxim is "Publish or perish". It has grown out of an understanding that a scientist must continually publish the results of their work and they must continue to make new discoveries, or they will not longer be scientists.

The academic journals where scientists publish their findings have reputations to uphold. If they publish work that is inaccurate their reputation is tarnished. So when a scientists work proves inaccurate, that scientist finds it ever more difficult to find a journal that will publish his or her work.
The perish part comes in to play when the scholarly institutions (the universities and institutes of higher learning) learn that a scientists work is not being picked up by the journals. They will not put up with a scientist that cannot publish and that scientist then, relative to his or her chosen profession, perishes.

To keep from perishing, the scientist writes conservatively. If a scientist says something "might" be so, rather than something "is" so, he or she is not as wrong as if there was something definitive that was proven the opposite.

All of this conservative work then has gone into the preparation of the computer models and the consensus reports that form the backbone of our climate science knowledge.

To prove it, all we have to do is plot current emissions against the climate model scenarios. The graph "IPCC Models vs. Actual Emissions" shows actual CO2 emissions are higher than the IPCC A1F1 scenario. The A1F1 (the red line) is the highest emission scenario that the IPCC considers. In effect, this is the worst-case scenario. So then, actual CO2 concentrations, from data from both major sources in the climate community (the black lines) is higher than the A1F1 worst-case scenario.



Observed global fossil-fuel and industrial CO2 emissions compared with averages of 6 scenario groups from the IPCC Special Report on Emissions Scenarios (colored lines). The Carbon Dioxide Information and Analysis Center (CDIAC) and the International Energy Agency provided the current observations of CO2 emissions. The latest update was obtained from www.globalcarbonproject.org.

Source: Synthesis Report, Climate Change, Global Risks, Challenges and Decisions, Climate Change Congress, International Alliance of Research Universities, University of Copenhagen, March 2009.

What does this mean? In the short term, and especially with the way that greenhouse gas regulation efforts are going on earth today, this trend will continue. And by the short term, I mean climatologically. This short term would be for at least the next decade or two. Remember, the time frame for climate discussions, the amount of time that it takes something to happen with climate - including emissions mitigations effects - starts in decadal time.

Now the big trouble with not acting quickly on regulating greenhouse gases of course is feedback mechanisms. The longer we wait to react, the greater the impacts those feedback mechanisms will have. This means that our efforts to control global warming will need to be greater than we have anticipated if we continue to delay action because the feedbacks will have added so much extra heat to the system that would not have otherwise had to deal with.

Compounding these concepts, the track record of the world for addressing climate change through greenhouse gas mitigation efforts is appallingly bad. We have almost universally not met Kyoto goals, or flatly refused to acknowledge the Kyoto protocol in the case of the largest greenhouse gas polluter - far larger than China - the United States.

(This is of course because of the “load” of greenhouse gases already in our atmosphere. Annual emissions are just a tiny amount of the total amount of greenhouse gases that remain in our skies because of the long life of carbon dioxide.

Just since 1970, we the world has emitted 812 gigatons of greenhouse gasses (one gigatons is a billion tons, 812 gigatons is more than the weight of 2,000 Empire State buildings), and we now know that half of CO2 stays in our skies for 300 years, not 200 years like we previously understood. And that’s just the half-life. For all intents and purposes, the rest stays there forever.

So if our annual global emissions are ten gigatons, this means that we emit about 1 percent of the total load every year. You can see how the United States, who has emitted 185 gigatons since 1970, has contributed far more to the problem than China, who has emitted 90 gigatons since 1970.)

What all of this conservative science mitigation delay means is that our emissions will continue to outpace the worst-case IPCC scenario and that disparity between reality and the models, unless we make extraordinary emissions cuts much sooner than it appears likely, will continue to grow.

Now, here's the frightening thing about Diffenbaugh and Ashfaq's work: Their modeling is based on the A1B Scenario. Look at the IPCC scenarios above. The A1B Scenario is half way between the middle of the road and the worst-case scenario. Real world emissions are growing much faster than the A1B Scenario that these guys looked at. This of course means that impacts will be more profound, even than they are already.

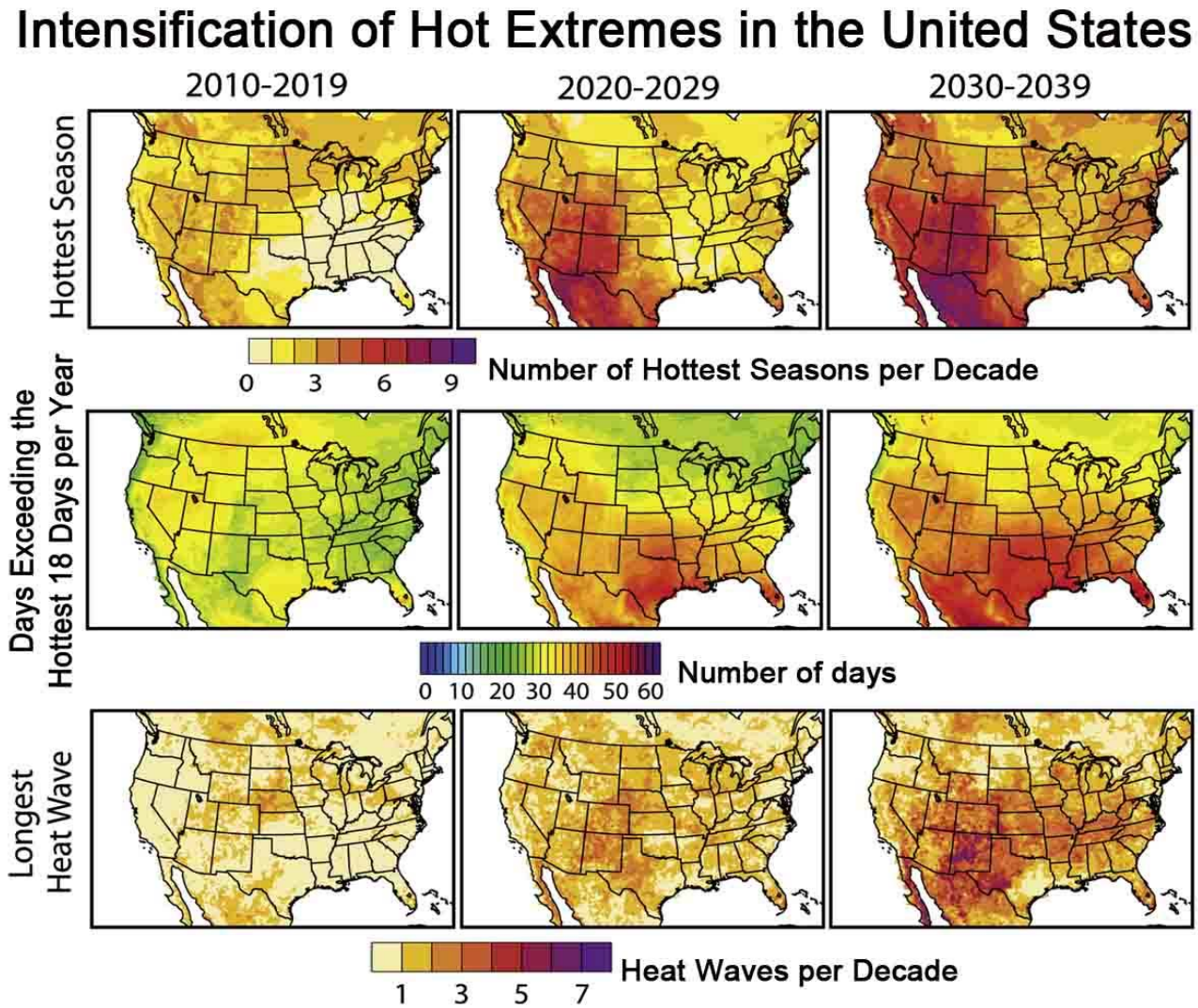
What these workers did was identify the longest heat wave, the hottest summer season and the average number of extremely hot days per year over the last half of the 20th century. This period includes the drought of the 1950s (which in meteorological extent and severity was actually worse than the Dust Bowl) *and* it includes the Super El Nino years of 1997 and 1998.

Then these guys loaded up their two dozen climate models with their extremely fine resolution programming and ran them off into the future. What they found is sobering.

The Stanford researchers found a dramatic spike in extreme seasonal temperatures during the current decade, that is between 2010 and 2020. They say that temperatures equaling the hottest season on record for the last half of the 20th century could occur four times on average across the nation *in the ten years between 2020 and 2029*.

This is such a dramatic pronouncement that I must repeat it: The most extreme summer of the last half of the 20th century - the half that already includes significant global warming, will be repeated (likely) four times in the ten years between 2020 and 2029.

They say that the longest heat wave that occurred



Source: Diffenbaugh and Ashfaq, Intensification of hot extremes in the United States, Geophysical Research Letters, 2010.

between 1951 and 1999 will reoccur from two to five times over much more than half of the nation just in the next decade alone. This number climbs to five times between 2020 and 2029 over much of the western and central United States and this will increase to up to five times per decade over much of the entire U.S. during the following decade, starting just twenty years from now.

For the ten year period between 2030 to 2039, beginning just 20 years from now, large areas of the West will experience 7 seasons that will be as extreme as or more extreme than the most extreme summer of the fifty years prior to 2000.

The 95% temperature exceedance that is the number of days that will be as hot or hotter than the hottest 18 days per year, wherever you are, during the decade 2010 to 2019 will nearly double over more than half of the nation (green is no change) and starting in 20 years double to nearly triple.

What this likely means is that perpetual drought, due to extreme heat, will settle in much sooner than has been anticipated. But this diagnosis has to be taken with skepticism. Remember, This team used the AIB scenario in their models, a scenario that is not worse than the middle of the road, but not as bad as the worst-case scenario. Real Emissions are increasing faster than the worst-case scenario.

Based on their work, Diffenbaugh and Ashfaq tell us that dangerous global warming could occur before the commonly accepted 2 degrees C threshold is met. Their paper ends "...the response to a given GHG stabilization target is likely to be greater than to the equivalent concentrations within the [modeling] tested here. Although accurate decadal-scale climate prediction represents a significant challenge, the intensification of hot extremes reported here suggests that constraining global warming to 2 °C above pre-industrial conditions may not be sufficient to avoid dangerous climate change."

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