

EXTREME WEATHER IN DELAWARE: A SCIENTIFIC AND NOT-SO-EXTREME VIEWPOINT

by
David R. Legates, Ph.D., C.C.M.¹
Professor of Climatology
University of Delaware

On Wednesday, August 25, I was invited by *Environment America* to speak at its September 8 press conference on “Extreme Weather in Delaware”, to promote the release of their new report on the subject at Legislative Hall. Ms. Hannah Leone was pleased to have me speak because my “knowledge on climate change and weather would be a great asset to the event.”

On Friday, August 27, I was uninvited from the event by Ms. Leone, who noted that “I believe it is in the best interest of the success of our report that you do not participation [sic] in this event” but “as lead climatologist in the state, your opinion would be beneficial to us.” She had earlier indicated to me in a telephone call that she wanted to make sure everyone was on the same page at the event.

I believe that it is in the best interest of the citizens of Delaware that my “knowledge on climate change and weather” is made public, in light of the biases that are potentially inherent in the *Environment America* report. I say ‘potentially inherent’ because, although I was promised a copy of the report, even after I was uninvited, I have yet to receive it. However, Ms. Leone was kind enough to indicate the premise of the report in her first e-mail to me:

On September 8th we will be holding a press conference around our new Environment America Extreme Weather Report that examines the science linking global warming with hurricanes and tropical storms; coastal storms and sea level rise; flooding and extreme rainfall; snowstorms; and drought, wildfire and heat waves. The report includes snapshot case studies of these extreme weather events that have occurred in the U.S. since 2005, and the damage that they caused, including a case study in Delaware. We do not suggest that these extreme weather events were caused by global warming. Rather, the point of examining the recent extreme weather events—and the economic losses and other negative impacts they caused—is to document why we need to take action to protect against them, including by reducing emissions of pollutants that are changing our climate.

The contradictions and biases evidenced by my communications with *Environment America* are fascinating. Although they willingly admit that “we do not suggest that these extreme weather events were caused by global warming,” they are willing to assert that: (1) average planetary temperatures continue to increase; (2) the frequency and/or intensity of these events are increasing; and (3) reducing ‘climate changing’ CO₂ emissions will protect against these events. I will argue that none of these assertions is true.

¹In this presentation, I am speaking as a professional climatologist and a certified consulting meteorologist – my views do not represent those of the University of Delaware or any other organization.

Globally-Averaged Air Temperatures

The Climate Research Unit (CRU) of the University of East Anglia² (of *ClimateGate* fame) compiles data on global air temperature. If you download the data and plot it for yourself, or simply take a look at the graph they post on their main page, you can see that air temperature for at least the last decade, and possibly longer, has not been increasing – despite increases in atmospheric carbon dioxide. Moreover, e-mails released from the CRU and the subsequent discussion with CRU personnel reveal that both Kevin Trenberth of the US National Center for Atmospheric Research and Phillip Jones of CRU commented on the lack of warming – and both are ardent supporters of the anthropogenic global warming theory:

“The fact is that we can't account for the lack of warming at the moment and it is a travesty that we can't.” Kevin Trenberth, NCAR

From the February 14, 2010 UK Daily Mail: “Professor Jones also conceded the possibility that the world was warmer in medieval times than now – suggesting global warming may not be a man-made phenomenon. And he said that for the past 15 years there has been no ‘statistically significant’ warming...He further admitted that in the last 15 years there had been no ‘statistically significant’ warming, although he argued this was a blip rather than the long-term trend. And he said that the debate over whether the world could have been even warmer than now during the medieval period, when there is evidence of high temperatures in northern countries, was far from settled.”

If globally-averaged air temperature has remained virtually unchanged while atmospheric carbon dioxide concentrations have increased over the past fifteen years, then the link between carbon dioxide and global temperatures is tenuous, at best.

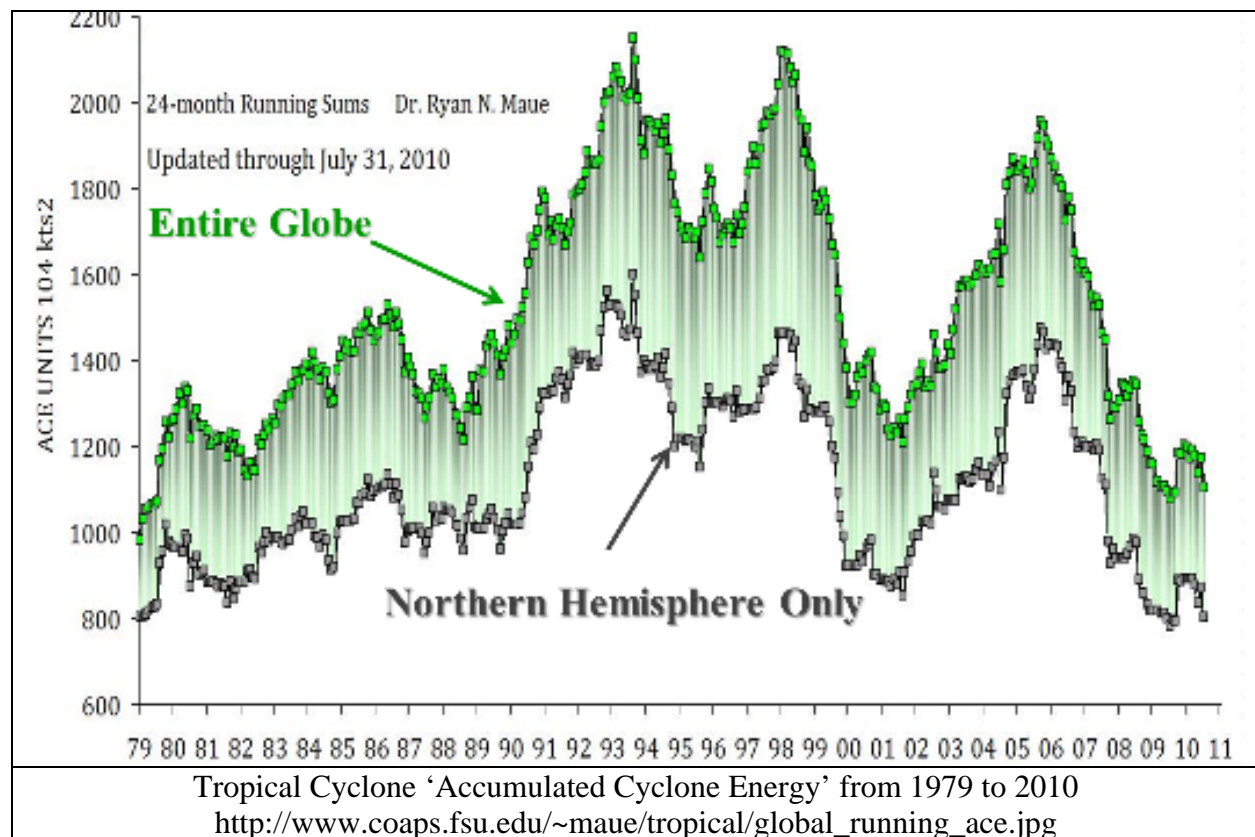
Hurricanes and Tropical Storms

Contrary to Al Gore's representations in *An Inconvenient Truth*, the frequency and intensity of hurricanes and tropical storms has not increased over the past thirty-two years – much less the last five years. *Accumulated Cyclone Energy* (ACE), a measure of both the frequency and intensity of storms, tallies the energy present in all tropical cyclones (also called hurricanes or typhoons in other parts of the world). As a plot by Ryan Maue of the Florida State University shows, we currently are nearly at a thirty-two year *low* in ACE for both the globe and the Northern Hemisphere. Because there clearly is no trend to this plot, it cannot be concluded that either the frequency or intensity of tropical storms are increasing.

In November 2006, ten of the world's leading hurricane scientists issued a statement which says, in part: “The possibility that greenhouse gas induced global warming may have already caused a substantial increase in some tropical cyclone indices has been raised, but no consensus has been reached on this issue.” On the existence of trends in storm intensity, the scientist's statement

² <http://www.cru.uea.ac.uk/>

indicates: “This is still a hotly debated area for which we can provide no definitive conclusion.”³ Bill Read, director of the National Hurricane Center and graduate of Brandywine High School in Wilmington DE, acknowledged on June 24, 2008 that the global warming-hurricane line carries “so much emotional baggage” it can be “really hard to sift out the science.” Read agreed with others at the National Oceanic and Atmospheric Administration that the link between global warming and hurricanes “is still to be determined.” Indeed, there is disagreement about the effect of warming on tropical storms and whether the number and intensity of storms will be affected. “All of that comes out as different numbers. I think there are a lot of unresolved issues in the science,” Read said.

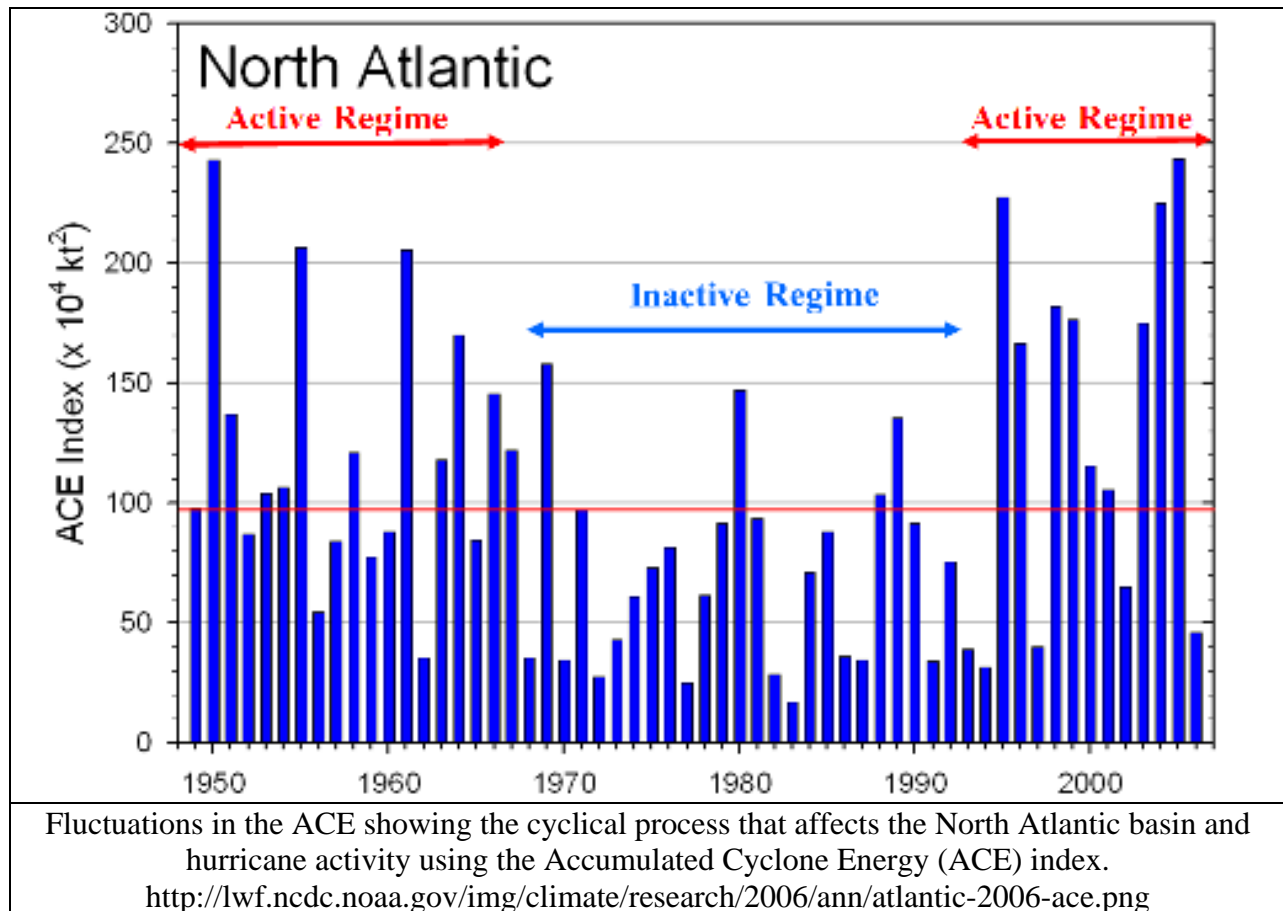


As for the Atlantic Basin, we have seen an increase in hurricane frequency and intensity since 1995. But that is a cyclic pattern that is related to changes in ocean heat (the *Atlantic Multidecadal Oscillation*), as has been widely explained by hurricane experts Dr. William Gray of Colorado State University⁴ and Dr. Christopher Landsea of the National Hurricane Center⁵.

³ http://wind.mit.edu/~emanuel/Hurricane_threat.htm

⁴ Gray, W.M. (2006). Global warming and hurricanes. *27th Conference on Hurricanes and Tropical Meteorology*. Monterey, California, American Meteorological Society.

⁵ Landsea, C.W., B.A. Harper, *et al.* (2006). "Can we detect trends in extreme tropical cyclones?" *Science* **313**:452-454.



Sea Level Rise

Historically, sea level has risen nearly 400 feet since the demise of the last ice age (about 20,000 years ago) and the pace of sea level rise has been much greater in the past. More recently, sea level has risen between 6 and 8 inches over the last century and the trend in sea level rise has not been affected by the increase in atmospheric carbon dioxide concentrations during the latter half of the Twentieth Century. The UN's *Intergovernmental Panel on Climate Change* concluded in its latest scientific report (issued in 2007) that sea level rise by 2100 would be between 6 and 17 inches globally.

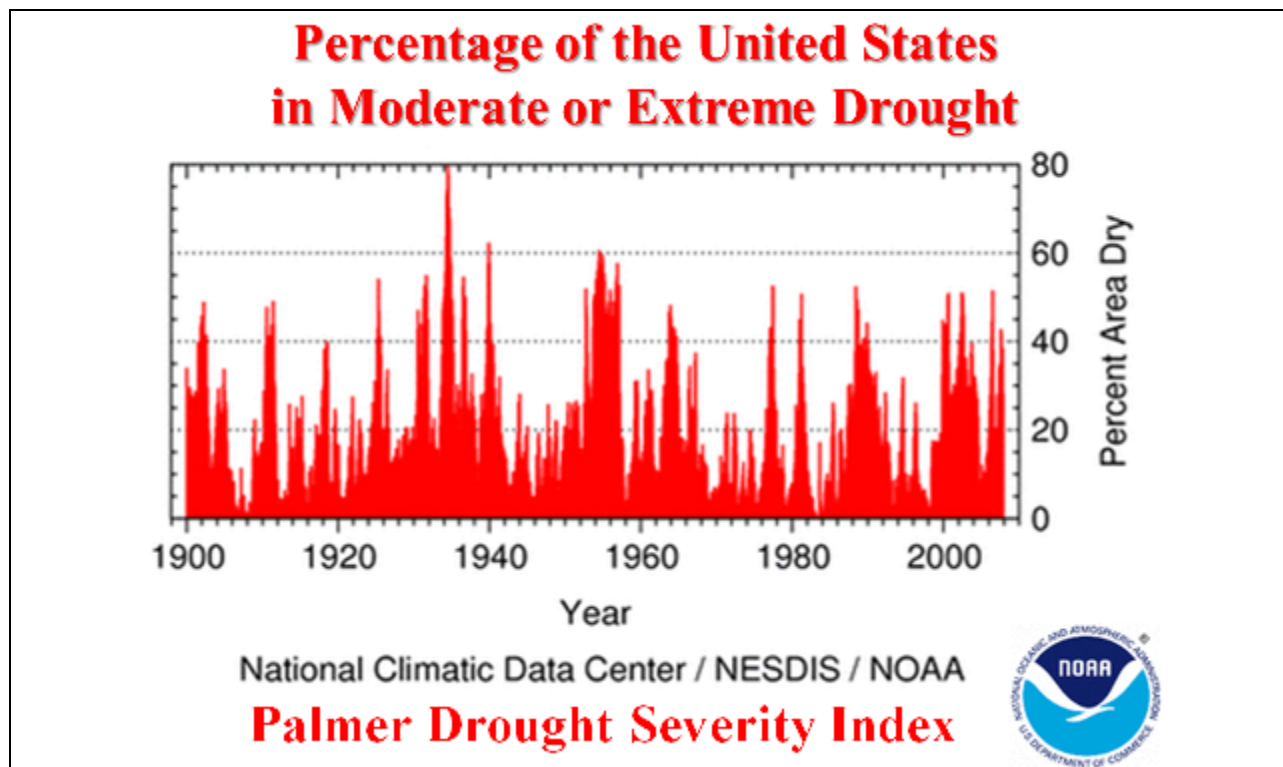
This is in stark contrast to presentations by Al Gore, NASA, local news outlets, and groups like Greenpeace, all of whom have ridiculously hyped the concept of sea level rise far beyond what even the IPCC indicates is the worst case scenario. A map provided by Senator Carper's office to a Delaware citizen who inquired about climate change shows Delaware becoming nothing more than a small chain of islands – the result of a 15 foot rise in sea level. The implication is that this will happen in our lifetimes or our children's lifetimes. That is patently false.

Wunsch and colleagues⁶ note that despite trends in sea level, “it remains possible that the database is insufficient to compute mean sea level trends with the accuracy necessary to discuss the impact of global warming—as disappointing as this conclusion may be.” Note too that Dr. Wunsch is a believer in human-induced climate change.

Floods and Droughts

For the State of Delaware, we are not seeing a significant change in precipitation patterns. The National Climatic Data Center keeps track of a climatological index that is independent of land use change and changes in stream management practice. That index shows no long-term increase or decrease in wetness or dryness for the United States. Mark New and colleagues⁷ at the CRU has provided long term trends in precipitation for the globe and they show no long-term trend in global or hemispheric precipitation.

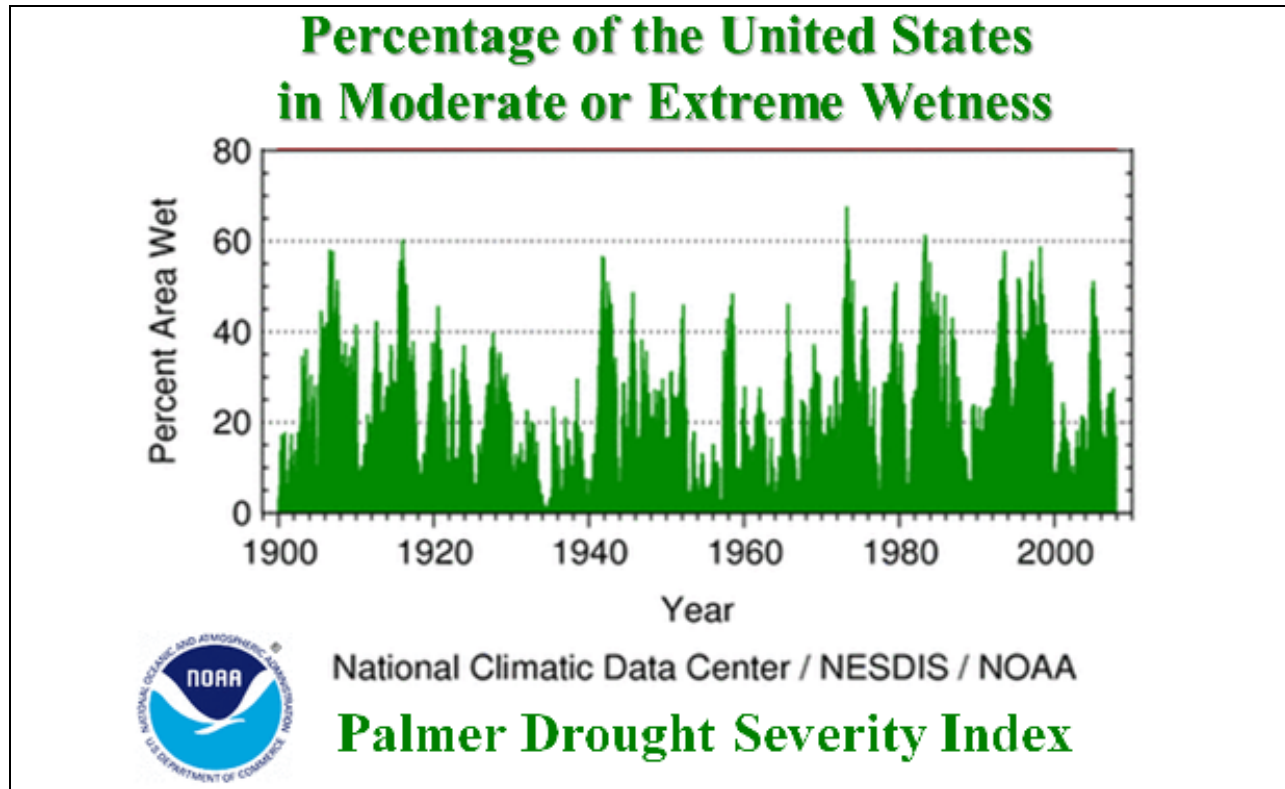
Moreover, in an extensive assessment of streamflow trends in the United States, Lins and Slack⁸ concluded that “hydrologically, these results indicate that the conterminous U.S. is getting wetter, but less extreme.”



⁶ Wunsch, C., *et al.* 2007: “Decadal trends in sea level patterns: 1993-2004”. *Journal of Climate* 20(24): 5889-5911

⁷ New, M., *et al.* 2001: “Precipitation measurements and trends in the Twentieth Century,” *International Journal of Climatology* 21:1899-1922

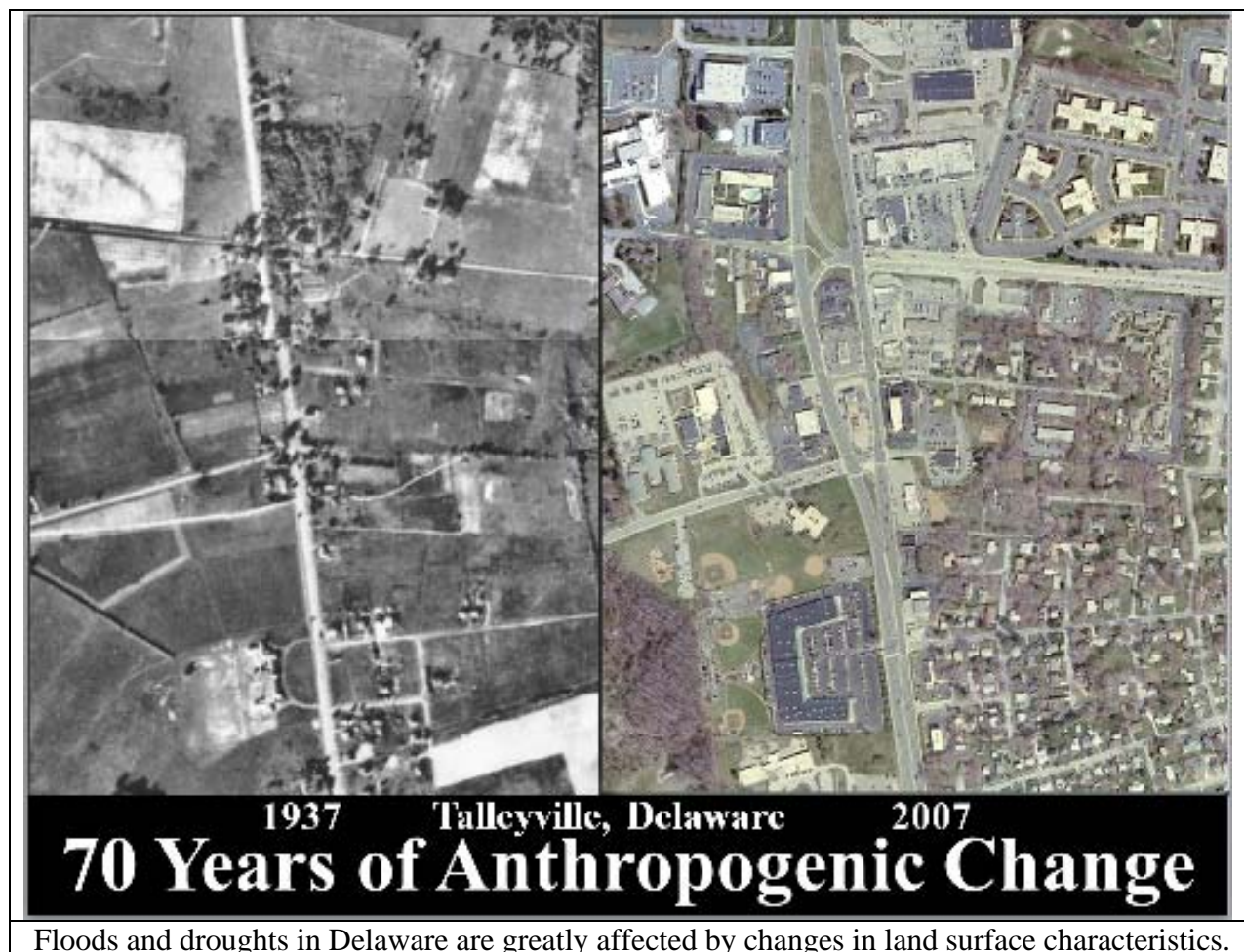
⁸ Lins, H.F. and J.R. Slack 1999: “Streamflow trends in the United States.” *Geophysical Research Letters* 26(2):227-230.



In my recent paper with Gregory J. McCabe in *The Journal of Geophysical Research*,⁹ we show that there is no change in drought frequencies or intensities in the Southwest US when the data source is the First Order National Weather Service Network – the most complete and accurate database available. (Co-operative station data have significant problems in this respect). This same pattern holds for the remainder of the country. For the State of Delaware, we have not seen a significant change in precipitation patterns.

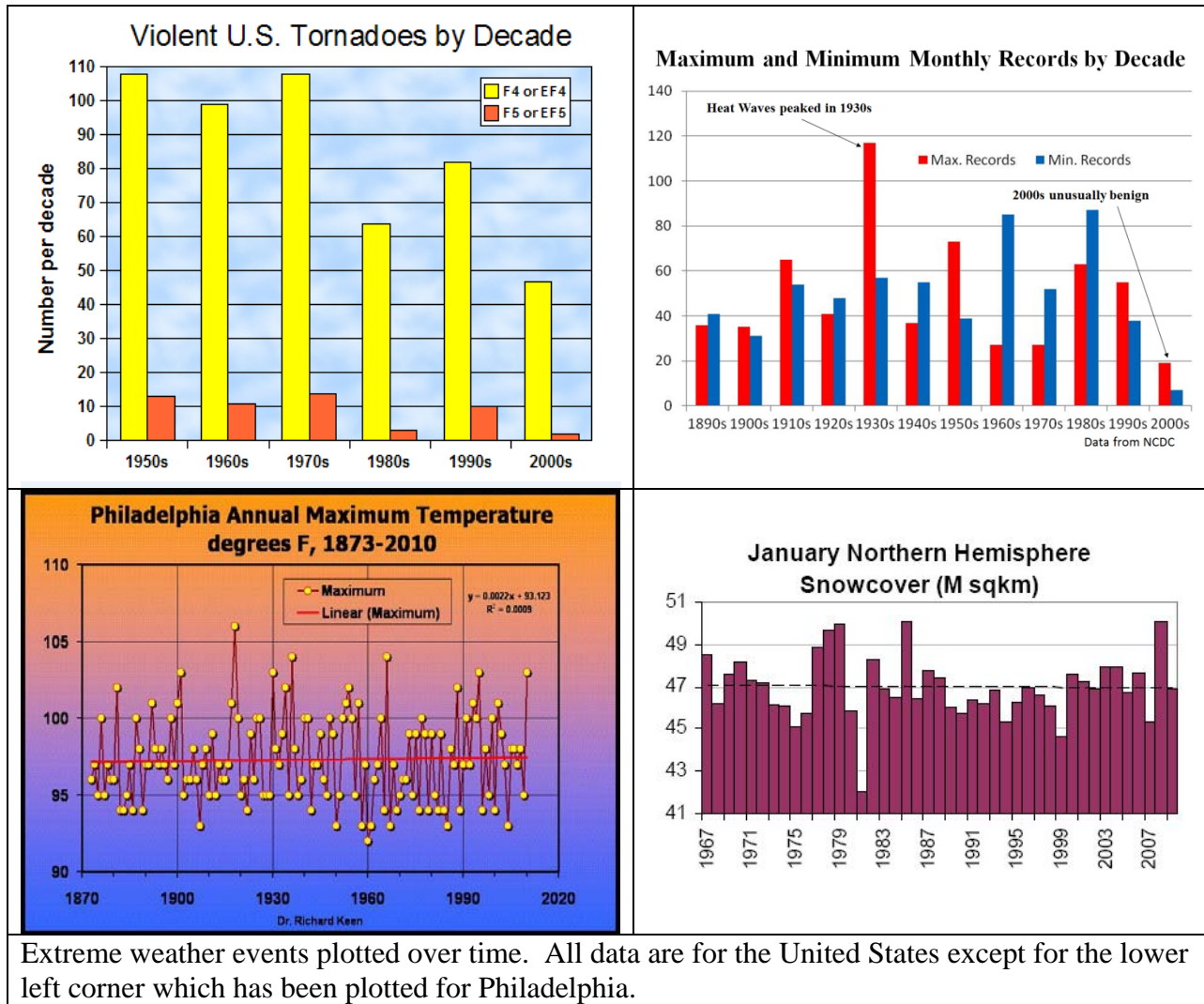
However, as the aerial photos suggest, there have been significant changes between 1937 and 2007 in land use, the number of people living in northern New Castle County, and the number of water-intensive businesses. Thus, drought occurrences are expected to increase solely because of the increased demand. Moreover, when heavy rain falls, significant street flooding occurs, which enhances runoff to the Brandywine River, thereby increasing flood frequencies. THAT is why we have seen more floods and droughts in New Castle County in recent years. It has nothing to do with climate change; increased water use and changing land use puts a greater strain on water supplies and demands which suggests to some a change in precipitation. That is simply not the case.

⁹ McCabe, G.J., D.R. Legates, and H.F. Lins (2010). "Variability and trends in dry day frequency and dry event length in the southwestern United States." *Journal of Geophysical Research* **115**(D07108).



Other Climate Variables

The claim is often made that tornadoes, maximum and minimum temperatures, heat waves, and snowcover are increasing, presumably due to global warming. However, this small handful of graphics demonstrates that none of these events are increasing in frequency. The data and graphs further underscore the likelihood that it is the press coverage of these events, not the frequency of their occurrence, that is changing.



Previous Releases by Environment America – Extreme Rainfall

In December 2007, *Environment America* released another report – *When it Rains, It Pours: Global Warming and the Rising Frequency of Extreme Precipitation in the United States*. In the report, and the accompanying press conference, articles in local newspapers, and rallies in Wilmington, *Environment America* note that its findings were released on the eve of a major congressional debate on legislation restricting greenhouse gas emissions and were “intended to influence the debate in Washington over the Lieberman-Warner Climate Security Act of 2007” and affect similar legislation here in Delaware. *Environment America* claimed that severe storms (those with 2 inches or more of rain in a given day) “are now 37 percent more frequent in Delaware” since 1948. While the data from the single station used in Delaware to estimate this – the National Weather Service (NWS) Cooperative Station at Porter Reservoir in Wilmington – does suggest such an increase, there are several factors that make this claim highly dubious.

First, data from neither the NWS Cooperative Station at the University of Delaware Agricultural Farm in Newark nor from the NWS First-Order weather station at the New Castle County

Airport show such a trend. However, both of these (inconvenient) datasets were ignored in the *Environment America* analysis. Our research has found that such trends in NWS Cooperative Stations are often spurious.⁹ Moreover, a discussion with the actual observer who takes the measurements at Porter Reservoir indicates that heavy rainfall records are often estimated only after the fact, since Porter Reservoir is a storm- and wastewater treatment plant, which has greatly increased responsibilities after heavy rainfall events – reading the rainfall total in the gage is a low priority.

However, the telling factor in the 2007 *Environment America* report is its Appendix B: Change in Extreme Precipitation Frequency by State, 1948-2006. Even the report itself indicates that *Environment America*'s estimate of changes in extreme precipitation for Delaware was *not statistically significant*. Unfortunately, no one in the news media or state legislature bothered to examine the report. More importantly, no one from *Environment America* bothered to mention this critical fact in the organization's headline-grabbing executive summary, news release, or press conference. But as *Environment America* noted, its intent was to "influence debate" in Washington and Delaware – not, one may conclude, to present a fair, honest, or scientific analysis.

B. Change in Extreme Precipitation Frequency by State, 1948–2006

State	Percent Increase in Frequency of Extreme Precipitation	95% Confidence Interval		Statistically Significant?
		Lower Bound	Upper Bound	
>>>	>>>	>>>	>>>	>>>
Delaware	37%	-3%	77%	No
>>>	>>>	>>>	>>>	>>>

Appendix B of *When it Rains, It Pours: Global Warming and the Rising Frequency of Extreme Precipitation in the United States*, released by *Environment America* in December 2007.

Conclusions

As a Delaware Native who has lived in this State for almost forty years, I care very much about the Diamond State and its ecology. I too am concerned that we act as good stewards of our environment. As a scientist, I have spent my entire professional career studying weather and climate and trying to understand climate change processes. I am therefore outraged when I see outright misstatements of fact being used for political gain. My concern is that there has been no significant increase in extreme weather – just an increase in its coverage with a more global media and an increase in its hype due to the political ramifications that climate change can have.

Environment America's claim that the alleged increase in extreme weather events can be alleviated by taking action to reduce emissions of carbon dioxide is unfounded. These events have not been increasing in either frequency or intensity and they are clearly not linked to increasing concentrations of carbon dioxide. Limiting carbon dioxide emissions will have no effect at all on the frequency or intensity of these events. Unfortunately the negative ramifications of attempting to limit such emissions will be far too real. Our best solution is to make the public more aware of these dangers, provide more timely detection and dissemination of potential extreme weather hazards (in which the National Weather Service and several State agencies have been actively engaged), and encourage people to stop building in hazardous locations, thereby putting the existing population more at risk.