Global Warming and Hurricanes: Still No Connection

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TCS

A scientific team led by Peter Webster of the Georgia Institute of Technology today published findings in *Science* magazine. The team claimed to have found evidence in the historical record of both more tropical cyclones, such as Hurricane Katrina, but also a higher percentage of more intense ones.
This follows on the heels of Massachusetts Institute of Technology's Kerry Emanual proclaiming in the Aug. 4 on-line edition of *Nature* magazine that he had found evidence that global warming in the last 30 years was producing more intense cyclones.

The conclusion many draw from papers such as these is that anthropogenic global warming from the burning of fossil fuels by humans is causing more lethal storms. A closer look, though, reveals not human actions but rather natural cycles are the primary cause.

Much has already been written concerning the findings of Emanuel, and their potential shortcomings, both by myself and others. So, in this article, let's focus on the results this week in *Science*.

Webster and colleagues analyzed the occurrence of tropical systems of all strengths across the principal regions of the world's oceans where they form -- the North Atlantic, the Eastern Pacific, the Western Pacific, the Southwestern Pacific, and the North and South Indian Ocean basins. They limited their analysis to the period since 1970 -- the time since satellites were first used to monitor tropical cyclone development. During this same period, the sea surface temperature (SST) in these basins increased by about 0.5ºC (or just under 1ºF). The researchers sought to determine whether there were any changes in the patterns of hurricanes that could be related to the warmer SSTs.

How Frequent?

They found that the total number of tropical storms (tropical cyclones with maximum winds less than 75 mph) and hurricanes (tropical cyclones with winds equal to or exceeding 75mph) varies a bit from year to year, but over the last 30 years, there has been no trend towards either more or fewer storms. This is interesting because in the North Atlantic Ocean (the primary basin where hurricanes form that effect the United States), storms have become much more frequent since 1995. In other parts of the world, however, such as in the Western and Eastern Pacific, and in the Southern Hemisphere oceans, tropical cyclone frequency has declined since the early 1990s. Such variable behavior in the trends of storm frequency from around the world led the researchers to conclude that:

> *In summary, careful analysis of global hurricane data shows that, against a background of increasing SST, no global trend has yet emerged in the number of tropical storms and hurricanes. Only one region, the North Atlantic, shows a statistically significant increase, which commenced in 1995. However, a simple attribution of the increase in numbers of storms to a warming SST environment is not supported, because of the lack of a comparable correlation in other ocean basins where SST is also increasing.*

How Intense?

But Webster and colleagues did not limit themselves only to the investigation of tropical cyclone frequency. They also examined how tropical cyclone intensity may have changed. Here they found a different result. They report that, globally, since 1970, the annual number of weak (category 1) hurricanes has declined a bit, the number of moderate (categories 2 and 3) hurricanes has fluctuated but the average has remained about the same, and the number of severe (categories 4 and 5) has increased. This same pattern of change is also evident in the annual percentage of the storm types -- in the early 1970s, category 1 storms made up about 45% of all hurricanes, category 2 and 3 storms contributed another 40% and the strong category 4 and 5 storms made up the remaining 15%. By the end of the study period (the early 2000s) the annual contributions were about equal. However, despite this apparent trend towards more intense hurricanes, they found that the highest wind speed observed in the most intense storms has remained remarkably constant. In other words, they found that the strongest storms are not getting stronger, but that there has been a tendency for more of them.

Figure 1 shows Webster et al.'s results.

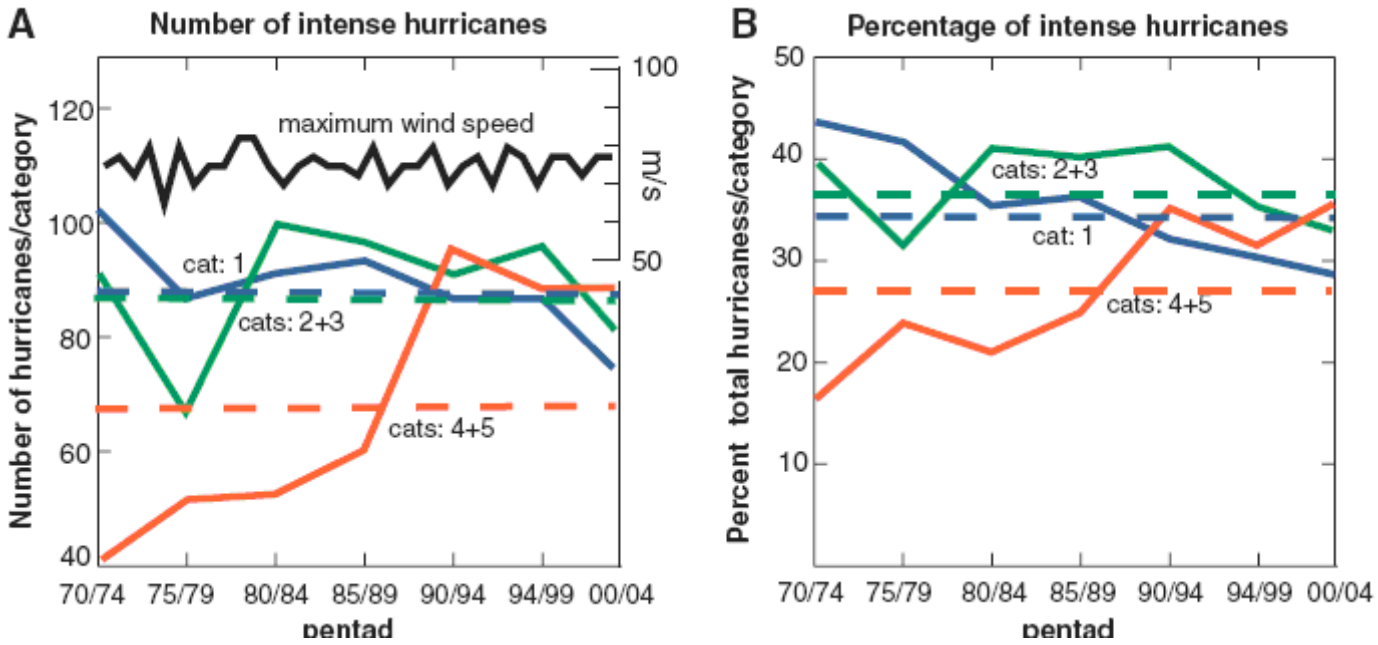

Figure 1. (A) the total number of category 1 storms (blue curve), the sum of categories 2 and 3 (green), and the sum of categories 4 and 5 (red) in 5-year periods. The black curve is the maximum wind speed observed globally. (B) Same as (A), except that the numbers are presented as a percentage of the total annual storm count.

These results led the researchers to conclude:

> *We conclude that global data indicate a 30-year trend toward more frequent intense tropical cyclones. This trend is not inconsistent with recent climate model simulations that a doubling of CO_2 may increase the frequency of the most intense cyclones, although attribution of the 30-year trends to global warming would require a longer global data record and, especially a deeper understanding of the role of hurricanes in the general circulation of the atmosphere and ocean, even in the present climate state.*

The caveat at the end has implications that likely supercede any attempted attribution of the recent behavior of tropical cyclones to anthropogenic global warming. For example, while Webster et al.

chose to begin their analysis in 1970, citing the best available global coverage of hurricanes as their justification, it turns out that in the North Atlantic basin, a full coverage of hurricanes began in the mid to late 1940s when hurricane hunter aircrafts were first used -- this is a full 25 years before satellite monitoring became available. Thus, in the Atlantic, we can peek back a little further to see how the trend since the 1970s fits into a longer-term perspective.

Using data on Atlantic basin tropical cyclones from the National Hurricane Center, the Webster analysis in Figure 1 can be recreated using data that began in 1945. The results for the North Atlantic basin are depicted in Figure 2.

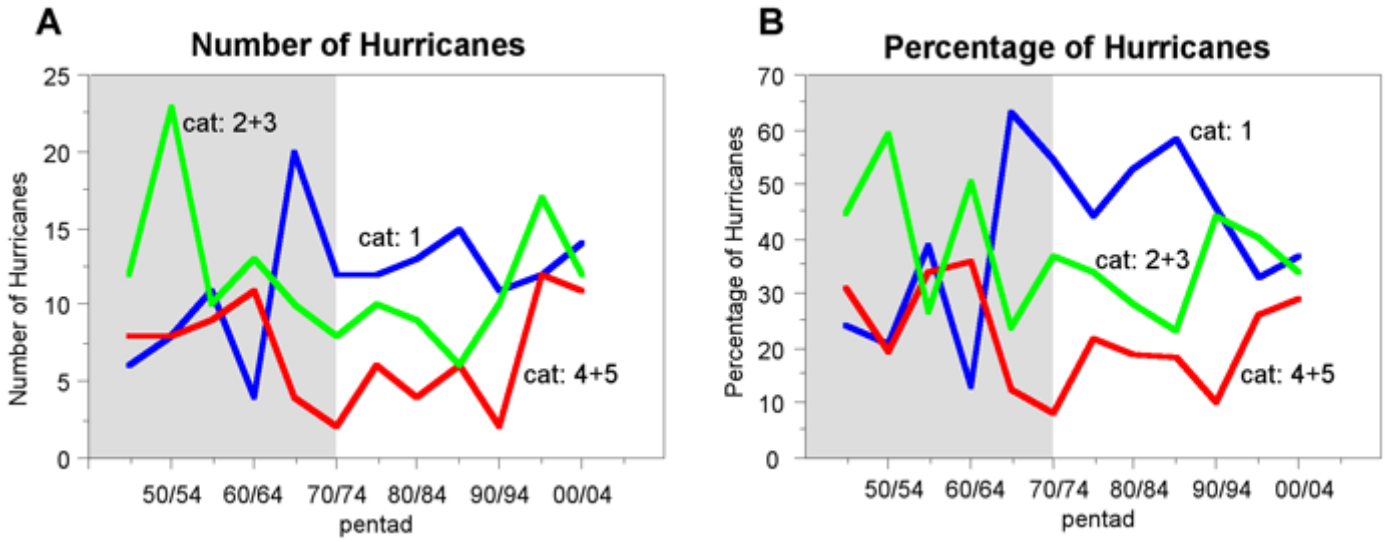

Figure 2. Same as Figure 1, except for the analysis is for only the North Atlantic basin and begins in 1945.

The region shaded in gray is the data from the period prior to that analyzed by Webster's group. Note that the behavior since 1970 (unshaded portion) is pretty much just as Webster et al. had found (compare with Figure 1) -- declines in the weaker category 1 storms and increases in the numbers and percentages of the strong category 4 and 5 storms. However, in the 25 years prior to 1970, *just the opposite occurred* -- the number and percentage of strong hurricanes declined while weak storms became more common. When taken as a whole, the pattern appears to be better characterized as being dominated by active and inactive periods that oscillate through time, rather than being one that indicates a temporal trend. This characterization is one that does not fit so well with the concept that hurricanes are becoming more intense because of increases in atmospheric CO2.

While the impacts of the currently active hurricane period are being felt especially hard in the United States, there remains no scientific proof that human contributions to an enhanced greenhouse effect are the root cause.

Reference

Emanuel, K., 2005. Increasing destructiveness of tropical cyclones over the past 30 years. Nature, posted on-line August 4, 2005, doi:10.1038:nature3906

*Webster P., et al., 2005. Changes in tropical cyclone number, duration, and intensity in a warming environment. Science, **309**, 1844-18*