John Locke
FOUNDATION

spotlight

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High Tide for Hype on the OBX

Apocalyptic predictions miss the mark on North Carolina sea levels

KEY FACTS: **• The North Carolina Coastal Resources Commission's (CRC) forecast of sea level rise from climate change is far greater than the consensus estimate of the United Nations' Intergovernmental Panel on Climate Change. The CRC forecasts 38 inches over the next 87 years, while the UN's mean value is about 14 inches from 1990 through 2100.**

• Global warming forecasts that are associated with such a large sea level rise are demonstrably erroneous. While global warming is real, and human activities are one cause, it now appears that the most publicized forecasts systematically overestimate the rate of temperature rise.

• Contrary to public perception, Atlantic hurricane activity exhibits no systematic changes in the last hundred years, despite the fact that many storms went undetected prior to the satellite and hurricane-hunter eras.

• Damage from hurricanes exhibits no trend after allowing for the increasing number of coastal residents and changes in property values.

• Sea level rise caused by the melting of land ice is very small and is likely to remain so over the period. Recent research shows that the loss of ice from Greenland is approximately compensated by a gain in Antarctica.

• Residents of the northern Outer Banks experienced sea-level rise in the last 100 years—caused mainly by geologic processes—greater than the mean value forecast by the UN for next hundred years. It is therefore likely that people will similarly adapt in this century.

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It's blow-hard season again in Carolina, when every homeowner from Bird Island to Carova Beach fears the Big One that washes away the beach house.

Our greener friends are telling us that the Big One will get bigger, year by year, thanks to dreaded global warming caused by pernicious economic activity. The Coastal Resources Commission (CRC) says to plan for 38 inches of sea level rise in the next 87 years. Surely warmer seas will whip up increasingly strong and frequent hurricanes, magnifying the effect of sea level rise.

It's enough to make you sell that beach house. To me. Please. I'll take it off your hands before it washes into the Atlantic, which, according to the CRC, could happen pronto.

I'm willing to offer you bottom dollar for your house a) because everyone thinks it is doomed and b) because they're wrong.

It's a good idea to be bearish on apocalypse futures, especially those of the environmental variety. I've lived through The Population Bomb, The Limits to Growth, global cooling, acid rain, ozone depletion, too much ozone, and peak oil. I suspect I'll live through global warming and sea level rise. And when we survive, we will be hectored with the next one, acid oceans.

The hallmark of apocalypse projections is that they are usually rooted in some fact, blown wildly out of proportion. Carbon dioxide—which is really the respiration of our industrial civilization—indeed does absorb infrared radiation. That's real and not subject to much debate. Nor is the fact that—everything else being equal (which is never true in the real world)—this will result in a warming of the lower atmosphere. Nor is it debatable that the mean surface temperature of the planet is higher than it was 100 years ago, and that water expands with heat, so sea level must have risen and will continue to rise.

The real question is not whether climate will change (it always does), but how much, and how it changes.

It's Not the Heat…

Who in North Carolina hasn't learned, by the age of three or so, that "it's not the heat, it's the humidity." So, here's what they should be taught about global warming: "it's not the heat, it's the sensitivity."

By "sensitivity," scientists mean how much warming results from an increment of atmospheric carbon dioxide, usually expressed as the amount of temperature rise that will ultimately result from doubling the concentration of this gas over its preindustrial background level. Because of some other compounds we release into the air, like methane, we're effectively well over half-way to that doubling.

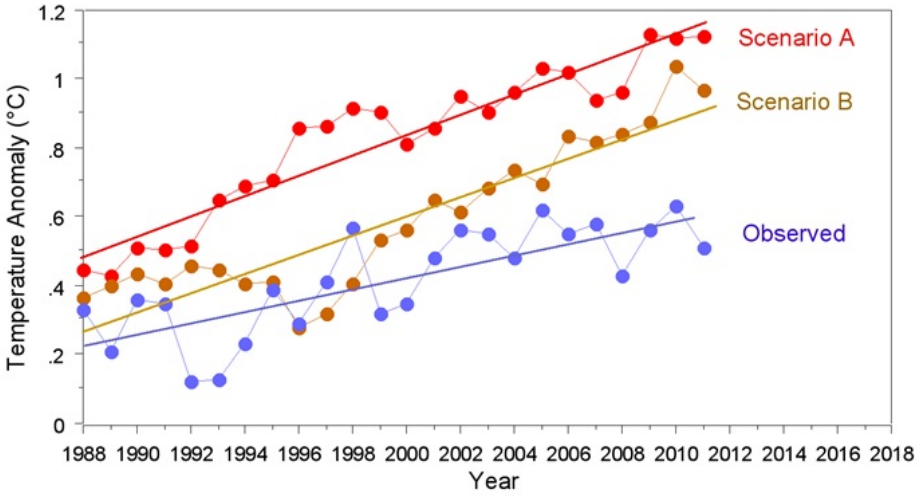
And therein lies the rub. In global warming, the real research question—and the one that the federal government is loathe to fund—is not "How much will it warm?" but "Why has it warmed so little?" and the corollary, "Where's the big rise in sea level?"

A view of the numbers shows why the Coastal Resources Commission is whistling by the graveyard of apocalypse past.

The birthdate of the global warming (and sea level-rise) end of the world predictions was June 23, 1988, when NASA's James E. Hansen testified to Congress on a hot day in a hot room that there was a strong "cause and effect relationship between the current climate and human alteration of the atmosphere." By "human alteration," Hansen meant increasing atmospheric carbon dioxide. (For Senator Tim Wirth (D-CO), "human alteration" meant turning off the air conditioner in the hearing room the night before, something he is still proud of having done.)

Hansen brought with him a dire forecast—and one that is consistent with the CRC's 38 more inches by 2100. How's that prediction doing?

Hansen's 1988 Forecast - Update



NASA's James Hansen gave these forecasts (red and gold) to Congress on June 23, 1988. The blue line shows his observed temperatures since then.

Hansen had two forecasts for increasing greenhouse gas emissions. The first, "Scenario A," was what he called "Business-as-Usual" (BAU), and the second, "Scenario B," assumed fairly significant global limitations. (He had a third one which held emissions constant in 2000, something obviously impossible.)

Despite the fact that the world has been pretty BAU, the atmospheric concentrations of carbon dioxide being observed are pretty much in between those upon which Scenarios A and B in the graph below are based.

That forecast was a great big flop, predicting about twice as much warming as has occurred. For a while—through the late 1990s—it looked like the earth's temperatures were close to those in Hansen's "Scenario B," but that's only because he had random "volcanoes" (which cool surface temperatures) go off in his computer model. There's a big drop in 1995-6 from one of these. In reality, there was no volcano, so his forecast temperatures should have continued to rise during that period.

What's wrong here is, in fact, the "sensitivity." It's set too high, something that appears to be characteristic of most climate models. This is self-evident from a look at the box on pages 4 and 5.

So what does all of this mean for the beach house?

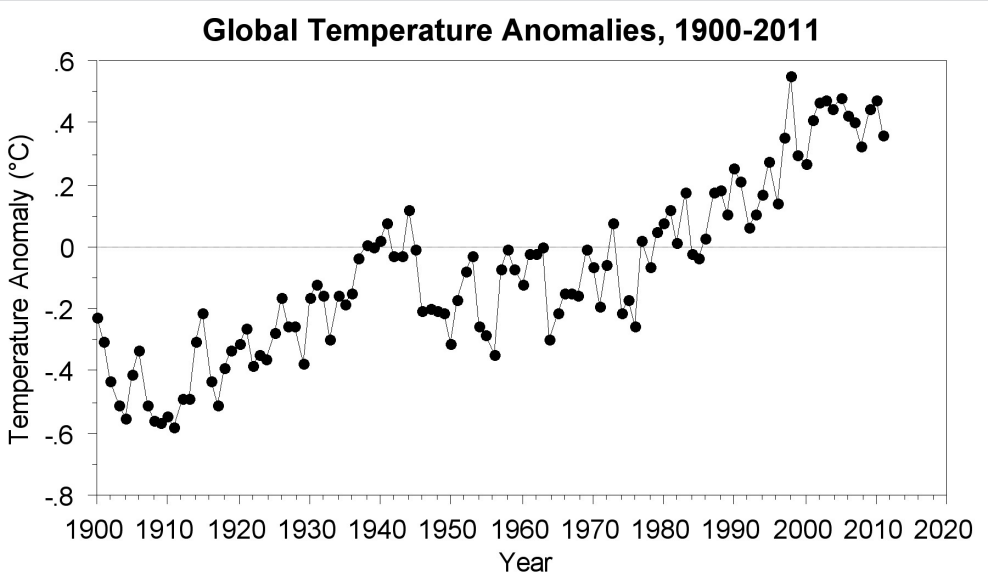
The last climate compendium of the United Nations gives a mean global sea-level rise of about 14 inches for their midrange emissions scenario. The 39-inch figure used by the CRC is about three times this consensus.

The Coastal Research Commission's 38 inches is based upon a warming almost three times what is in the linear trend, which itself is based upon an emissions scenario for carbon dioxide that the world is simply not on (and, thanks to ubiquitous and worldwide gas-bearing shale deposits, is not likely to get on). Besides the linear argument (which I published in 2001), there are now multiple lines of evidence in the scientific literature arguing that too much warming was predicted, too fast. James Hansen's preposterous notion that the sea could rise 23 feet in a hundred years gets about as much respect from nature as did his 1988 temperature forecast. His disaster scenario is based upon Greenland suddenly shedding almost all of its ice.

Since 1993, we have had a consistent platform of satellites that monitor sea level from space. The reason that this data is so important is that it is very hard to precisely measure sea level with ground-based gauges. There are just too many other factors that can interfere. For example, while global sea level is estimated to have risen about eight inches since 1900, the rate at Duck is over twice that. That's probably because Duck is being influenced by the same geological processes—called land subsidence (sinking)—that are evident around the Chesapeake Bay and the Mid-Atlantic. That excess "rise" in water has nothing to do with recent climate change and cannot be stopped by any policy or fiat of the CRC.

Global warming is real. So what?

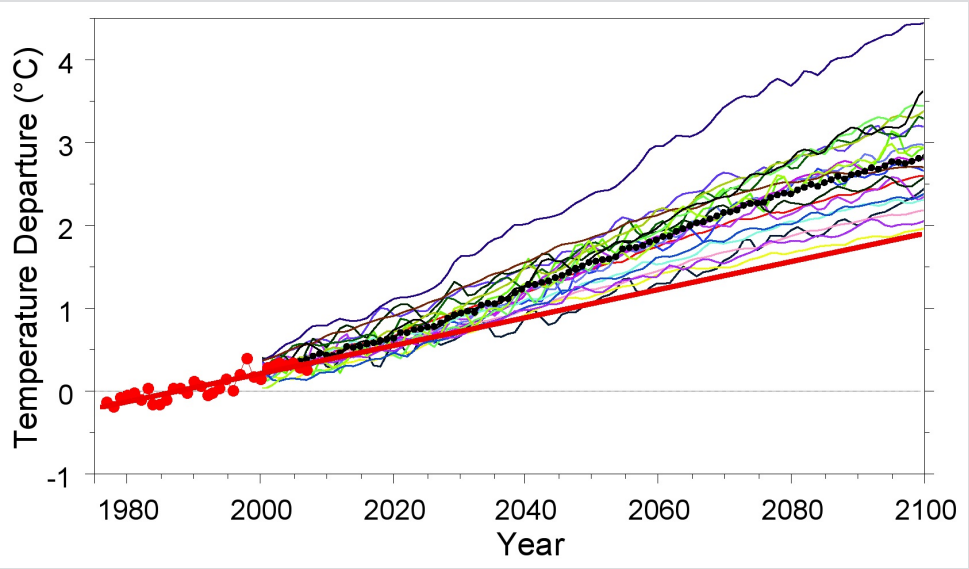
Here's the global surface temperature history as given by the Climatic Research Unit at the University of East Anglia. It is the one used most by research scientists. While my research has demonstrated some small problems with it, it's really not a bad general guide for what has been happening.



Temperature departures from the 1951-80 average from the University of East Anglia. Scientists tend to use this history more than others.

Note that there are two warmings, from approximately 1910-45, and from 1977-98. The first one has little to do with human greenhouse gas emissions, because we really hadn't altered the atmosphere very much back then. A lot of scientists (myself included) think that people have something to do with the second one.

The lack of warming since 1997 is a subject of considerable debate. Either the other factors that influence temperature (like solar activity, El Nino, and volcanoes) are acting in concert to cancel greenhouse warming, or something is quite wrong with our computer models. There is evidence that both are partially true.



The thin colored lines are the individual climate models for the "midrange" emissions scenario from the United Nations. Changes in atmospheric carbon dioxide concentration appear to be in line with those upon which this forecast is based. The thick black line is the average of all of the models, and the red line is the observed trend established since 1977.

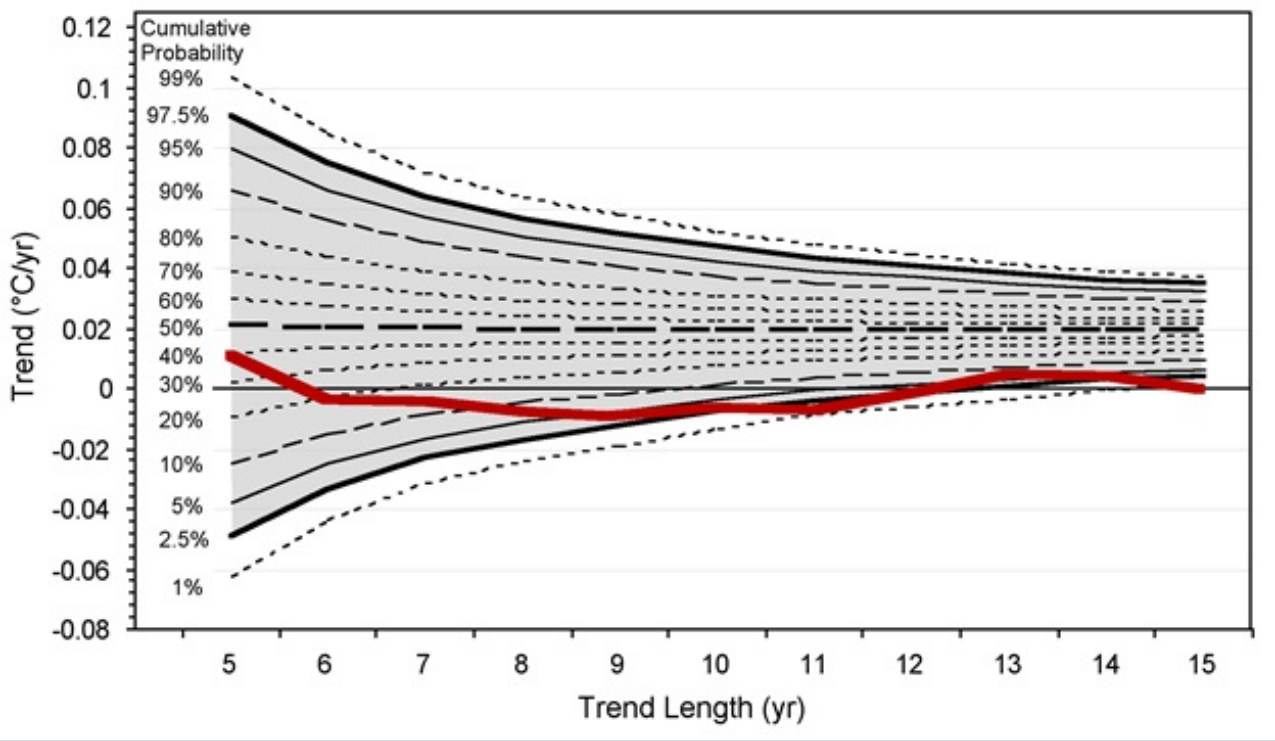
But let's assume that the models are OK. Now look at the suite of climate model projections for the emissions scenario that the world appears to be on. These come from the United Nations' Intergovernmental Panel on Climate Change.

What pops out is that, once warming starts, these simulations generally say that it takes place at a constant rate. I've also superimposed the observed temperature history since 1977, which, despite the hiatus since 1998, also looks like a constant-rate phenomenon.

So, unless the mathematical form of projected warming (i.e. a quasi-straight line) is wrong, nature is telling us that it will be around 1.6°C (2.9°F) this century. If we can't even get the form right, policymakers have no business using our science, and taxpayers have wasted an awful lot of money.

This figure is about half of the one the Coastal Research Commission uses. Besides this simple argument (which I published in 2001), there are now multiple lines of evidence in the scientific literature arguing that too much warming was predicted, too fast.

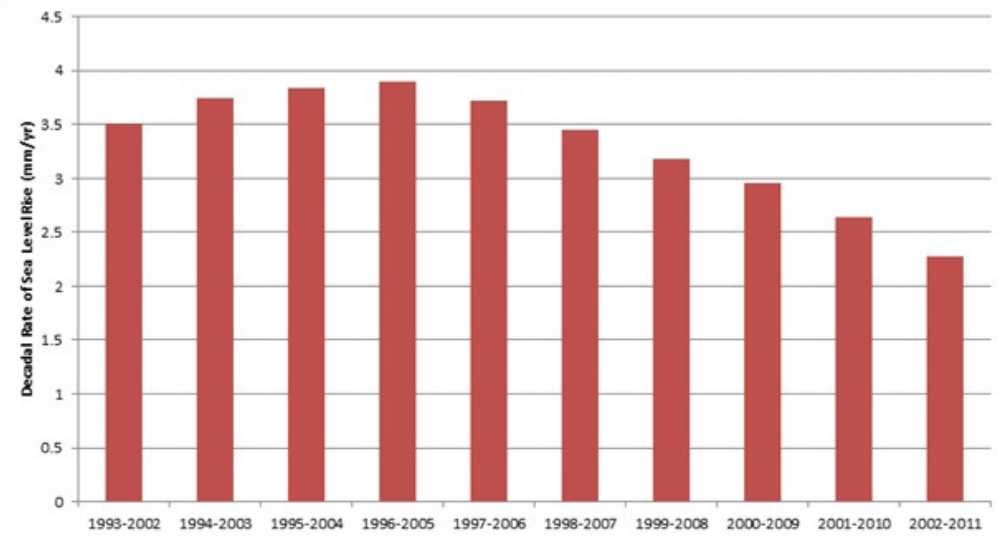
Another way to look at this is to look at the distributions of warming (or cooling) trends predicted by a very large number of climate models for periods of differing length, and then comparing that to observed trends. This work was done by Chip Knappenberger and presented at a Los Alamos National Laboratory Conference in September 2011.



Probability of predicted trends of 5-15 years in length (black) and observed trend (red) from the East Anglia record. For most periods of 9-15 years in length, the observed trend is at or below the 5% probability in the models. This is strong evidence for systematic overprediction of warming over the last 15 years, beneath the statistical limits of model expectations.

Down in Wilmington and Southport, the rise is pretty much in line with the global average, which is more typical of the North Carolina coast.

Here are the ten-year running averages of the rise in global sea level as measured by the satellites:



Global average sea level change, 10-year running means beginning with 1993-2002. The rate of sea level rise is declining. Figures are in mm / year. Note that one inch=25.4mm. The current rate is about ten inches per century. The value used by the CRC is this highest one in this chart.

Contrary to the CRC's predictions, satellites show a decline in the rate of sea level rise.

It's doubtful that this will last for long, but it is worth noting that the CRC assumed a base sea level rise that was higher than is now being observed. The value that is used in the work they cite is closer to the initial value sensed by the satellites. On this, the UN urged some caution in its last (2007) climate compendium:

> Global average sea level rose at an average rate of 1.8 [1.3 to 2.3] mm per year over 1961 to 2003. The rate was faster over 1993 to 2003: about 3.1 [2.4 to 3.8] mm per year. Whether the faster rate for 1993 to 2003 reflects decadal variability or an increase in the longer-term trend is unclear.

Well, now it is pretty "clear" that the first readings were in fact an artifact of the natural variability of sea level rise.

Much of the concern over the rise of the ocean stems from the confusion surrounding the world's two largest masses of land ice, Greenland (9% of the total) and Antarctica (89%). The net ice balance in Greenland is negative, but hardly alarming. According to Xiaoping Wu, of the Jet Propulsion Laboratory (JPL) at the California Institute of Technology, satellite data show that the current ice loss there would total up to an inch per century.

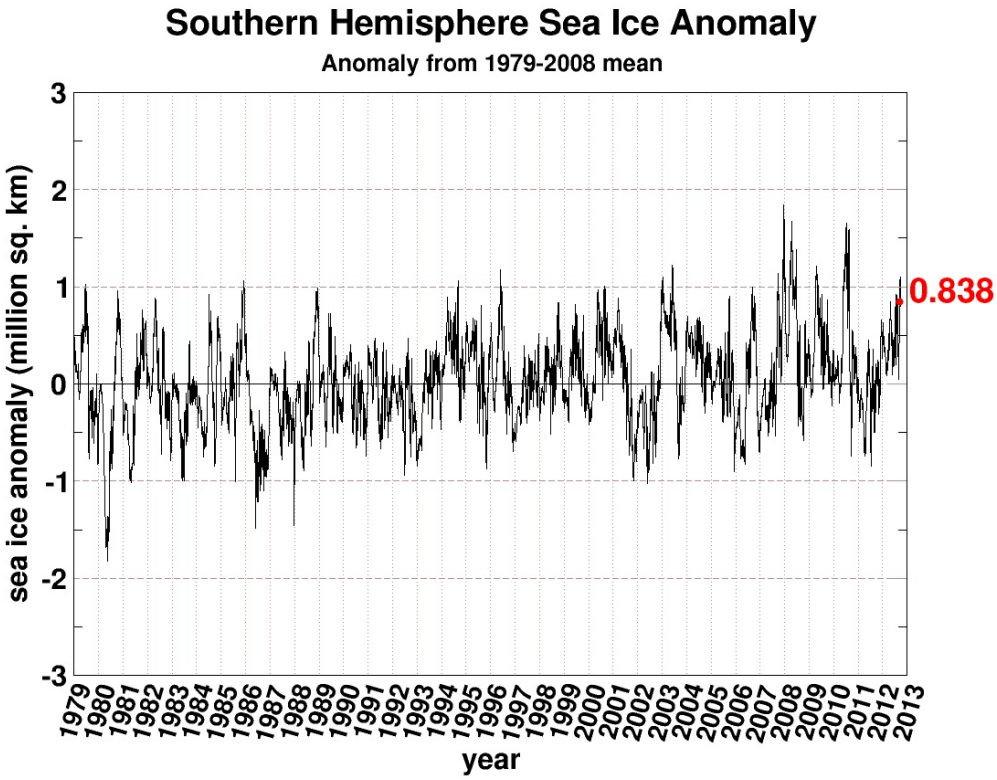
Hansen notwithstanding, Greenland is likely to remain bleak for the duration. For millennia after the end of the ice age, July temperatures in the Eurasian arctic were as much as 13°F higher they were prior to the major emissions of greenhouse gases (we know this because trees—that can be carbon-dated—are buried in what is now barren tundra). The integrated warming over Greenland had to be several times what we can generate in the policy-relevant future, and still the ice stayed in place.

Antarctica is an interesting case. The IPCC projects that it will gain ice in this century. That's a result of slightly warming the vast Southern Ocean, which results in an increase in atmospheric moisture. When moist air is converged

over the Antarctic continent, it slows down and precipitates, exactly what happens in Buffalo's snowbelts when cold air blows off Lake Erie before it freezes.

While NASA is exceedingly vocal in publicizing bad news about global warming, their press office seems to have ignored the findings of their ice scientist, Jay Zwally, who reported in July that, indeed, Antarctica is gaining ice because of increasing snowfall. It's gaining almost exactly as much as Greenland is losing.

Here's a look from another satellite showing the departure from normal in sea-ice surrounding Antarctica. The rise is statistically significant at a very high level. While sea-ice loss (or gain) has no bearing on sea-level rise, what's happening to it around Antarctica is a good indicator of what is going on climatically.



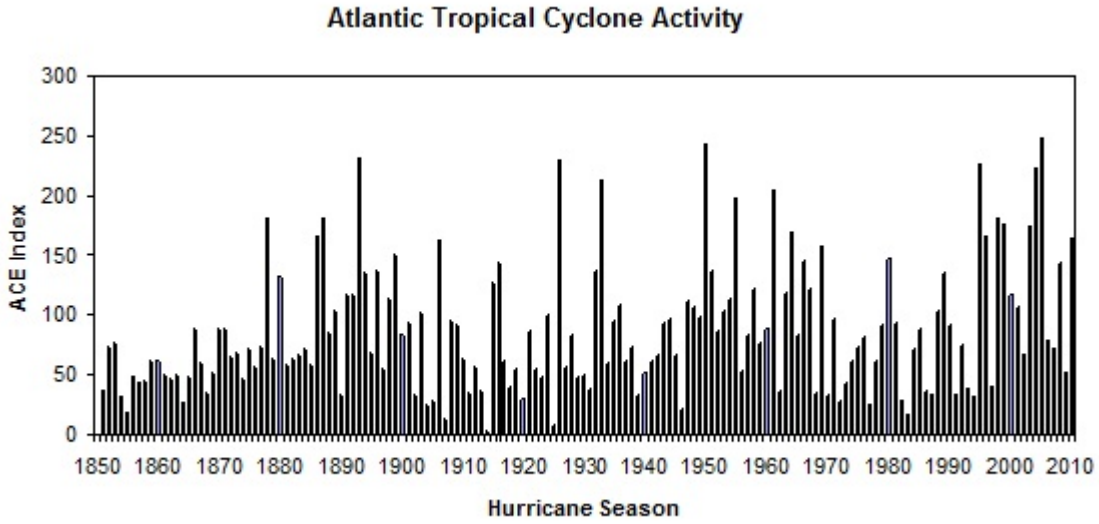
The fact that Antarctica and Greenland are pretty much at a standoff means that sea level rise between now and 2100 is likely to be driven mainly by the thermal expansion of water accompanying the warming. If we're going to get to the UN's median of 14 inches, sea level rise is going to have to be closer to a rate of 15 inches per century until 2100. But that's predicated on a warming rate that is higher than what is being observed. To get to the CRC's value, it's going to have to average nearly four feet per century between now and then, even as warming is proceeding at a rate slwoer than expected. It will have to get real toasty, real fast.

As can be seen from some very long tide-gauge records, sea levels do not change very suddenly. If, for some reason that is not apparant from oceanic behavior as the world has warmed in the past, we actually approached the rate required, it would be obvious for decades prior to its occurrence.

Are Hurricanes Getting Worse?

One of the rural myths about climate change is that hurricanes are surely becoming more frequent/and or more destructive as surface temperature rises, which will enhance the destruction caused by rising seas.

Perhaps the best measure of hurricane activity is something known as the "Accumulated Cyclone Energy" (ACE) index, which incorporates the power of storms in a given year. The National Oceanic and Atmospheric Administration recently compiled ACE values back to 1850, although they surely miss many storms in the 19th century. Other researchers, such as Christopher Landsea of the National Hurricane Center, have demonstrated that a large number of storms in the east-central Atlantic probably went undetected until the satellite era, beginning around 1970.



Accumulated Cyclone Energy (ACE) index for the Atlantic Basin. There is no clear relationship with global temperature, especially considering that storms are likely undercounted prior to the satellite era. Data from http://www.aoml.noaa.gov/hrd/tcfaq/E11.html

The dramatic escalation in the number of beachfront homes and (until recently) in property values in North Carolina is typical of that of the entire Atlantic Coast. In fact, the total value of beachfront property from the Texas Gulf Coast to Eastport, Maine, is approximately the same as our nation's Gross Domestic Product.

Increasing monetary losses lead to the perception that hurricanes are becoming more destructive. In reality, after adjusting for value and population, there as been no significant trend in costs, as shown repeatedly by Roger Pielke, Jr., at University of Colorado. It is just that more people are living in harm's way, and more are willing to pay a premium price for a house built on largely artificial sand dunes on one of the most hurricane-prone shorelines in the world.

The service life of a beach house is about thirty years before it is out of fashion and needs major repairs. So if you sell me yours now, it's pretty likely to be around when I dump it.

While Carolina beachfront owners continue to wait for the Big One, the earth continues on a warming trend that is lower than it was forecast to be, and sea level is slowly rising. But, unless there is a sharp change that is simply not being revealed in recent climate and carbon dioxide data, the expectation of 38 inches of rise in the next 87 years is not very likely at all. If, indeed, it becomes so, a change will be obvious over several decades, or the life expectancy of a beach house.

So, here's my offer…

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