

VI. Hurricanes

AIT: “As the oceans get warmer, storms get stronger.” (*AIT*, p. 81)

Comment: *Some* storms *may* get stronger, but others may get weaker. There are two main types of storms, hurricanes (tropical cyclones) and wintertime (frontal) storms. Global warming is likely to affect each type differently.

Hurricanes draw their energy from the sea, and require warm sea surface temperatures (SSTs) to form. Some hurricanes may get stronger as the oceans warm, and the area of hurricane formation may expand. However, once SSTs reach about 83°F, as routinely happens in the Gulf of Mexico every summer, any hurricane has the potential to become a major (Category 3, 4, or 5) storm, if other conditions are present.¹ Such conditions include high humidity (dry air dissipates the hurricane’s thunderstorm core) and low wind shear (strong winds in the upper troposphere rip hurricanes apart).² Whether, or to what extent, global warming is actually increasing the strength and/or frequency of hurricanes is an empirical question, discussed below.

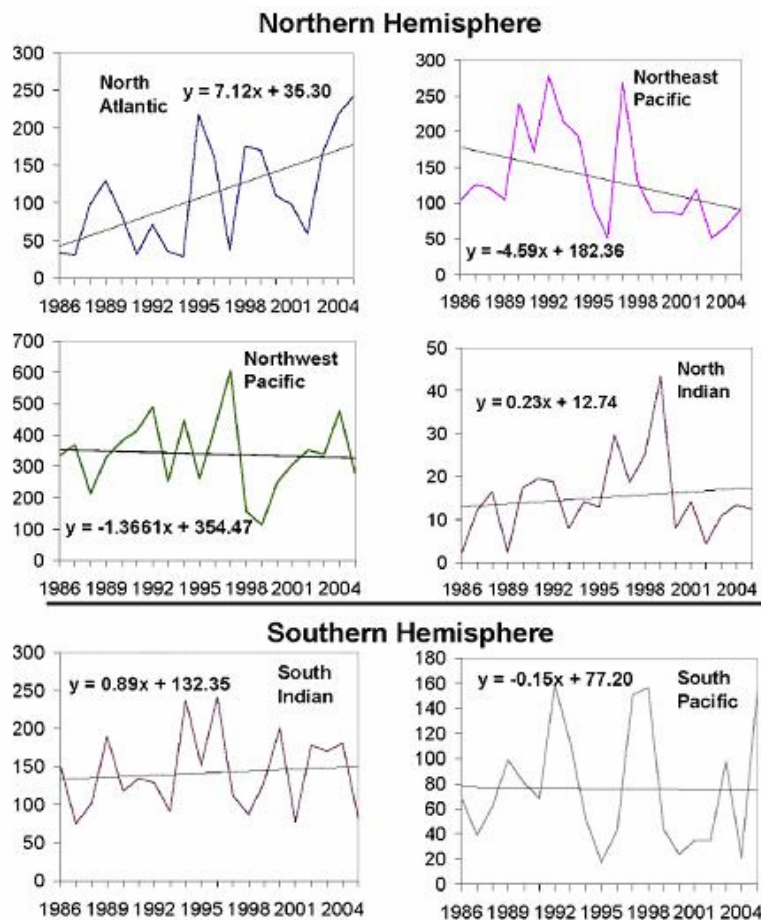
Wintertime storms draw their energy from the collision between cold and warm air fronts. If, as climate models predict, the higher northern latitudes warm more than the lower tropical latitudes, the temperature differential between colliding air masses should decrease, potentially reducing the intensity of some winter storms.³

AIT: “But there is now a strong, new emerging consensus that global warming is indeed linked to a significant increase in both the duration and intensity of hurricanes.” (*AIT*, p. 81)

Comment: The scientific jury is still out on these matters. Kerry Emanuel of MIT found that hurricane strength, a combination of wind speed and storm duration, which he calls the “power dissipation index” (PDI), increased by 50 percent since the mid-1970s, and that the increase is highly correlated with rising SSTs.⁴ However, other experts question these results.

Roger Pielke, Jr. of the University of Colorado finds that once hurricane damage is normalized for changes in population, wealth, and the consumer price index, there is no long-term change in hurricane damage—evidence against the hypothesis that hurricanes are becoming more destructive.⁵ Christopher Landsea of NOAA, noting no trend in the PDI for land-falling U.S. hurricanes, suggests that Emanuel’s finding may be an “artifact of the data”—a consequence of advances in satellite technology, which have improved detection, monitoring, and analysis of non-land-falling hurricanes.⁶

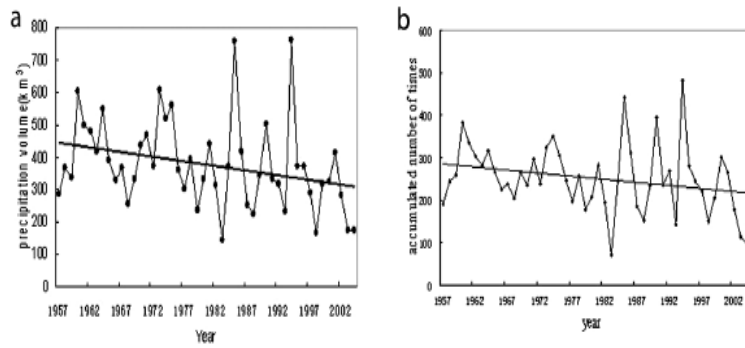
Philip Klotzbach of Colorado State University found “a large increasing trend in tropical cyclone intensity and longevity for the North Atlantic basin and a considerable decreasing trend for the North Pacific,” but essentially no trend in other tropical cyclone-producing ocean basins.⁷ See the Figure below.



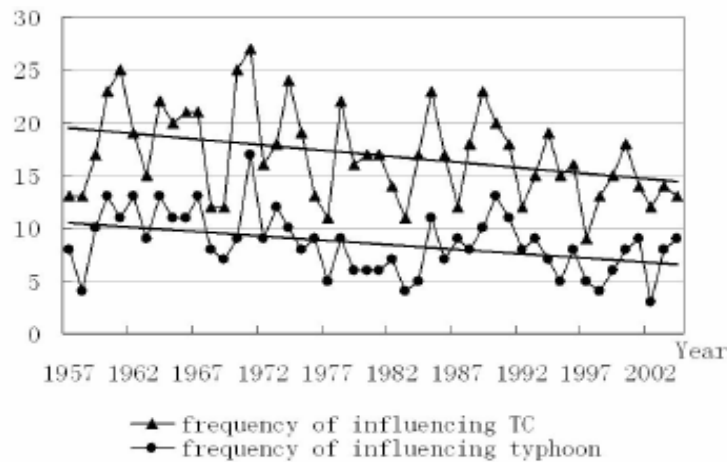
Accumulated Cyclone Energy (ACE) index values for six ocean basins. The ACE index is a measure of the energy contained in the tropical cyclone over its lifetime. There has been an increase in the North Atlantic, a decrease in the Northeast Pacific, and not much long-term change anywhere else. Source: Klotzbach (2006)

AIT: “Brand-new evidence is causing some scientists to assert that global warming is even leading to an increased frequency of hurricanes, overwhelming the variability in frequency long understood to be part of natural deep-current cycles.” (AIT, p. 81)

Comment: Gore doesn’t reference this “evidence,” so we are not in a position to evaluate whether it shows an increased frequency of hurricanes. Emanuel (2005), a study Gore cited on page 81, reports that ongoing research finds “no trend” in hurricane frequency. Webster et al. (2005), a study to which Gore alludes on page 89 (see below), also found no increase in the overall number of tropical cyclones. Ren et al. (2006) found a decrease during 1957-2004 in tropical cyclone precipitation and storm activity in China.⁸ See the Figures below.



Total annual volume of tropical cyclone precipitation (a) and total number of tropical cyclone torrential rain events (b) declined in China during 1957-2004
Source: Ren et al. (2006)



Frequency of rain-influencing tropical cyclones and typhoons in China declined during the same period.
Source: Ren et al. (2006)

AIT: “The emerging consensus linking global warming to the increasingly destructive power of hurricanes has been based in part on research showing a significant increase in the number of category 4 and 5 hurricanes.” (*AIT*, p. 89)

Comment: Peter Webster and colleagues found a significant increase in the number of major hurricanes during the period 1970-2004.⁹ In contrast, Klotzbach found only a “small increase in global Category 4-5 hurricanes from the period 1986-1995 to the period 1996-2005,” and considers it likely that “improved observational technology” accounts for the small increase he observed.

Patrick Michaels found that, in the Atlantic basin, the hurricane formation area with the best data over the longest period, the “trend” observed by the Webster team disappears

once data going back to 1940 are included.¹⁰ As the Figure below shows, the number and percentage of intense storms from 1940 to 1970 were about equal to the number and percentage of intense storms from 1970 to 2004. The gray shaded area illustrates the data in the 30-year period prior to the period analyzed by Webster et al. The pre-1970 data comes from the National Hurricane Center.¹¹

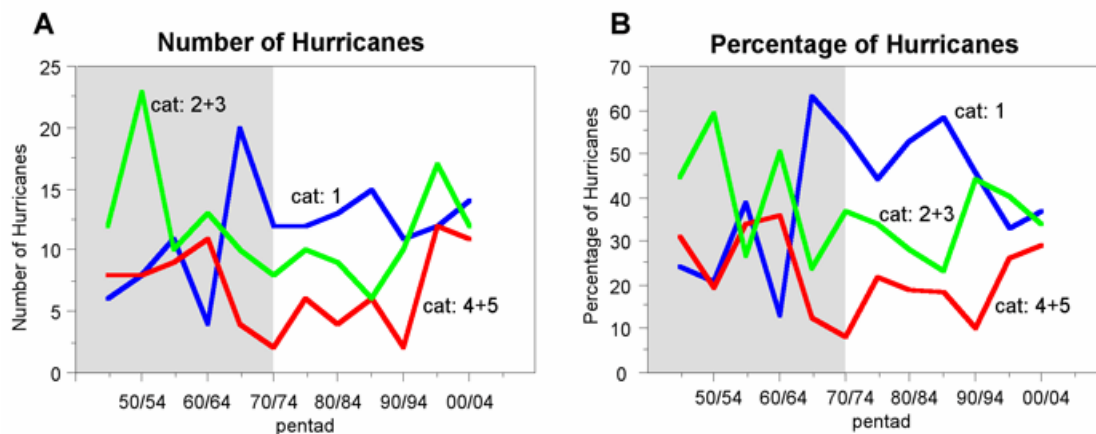


Figure derived from National Hurricane Center data
Source: Patrick Michaels

Michaels comments: “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.”

Since hurricanes are heat engines, it is likely that global warming will increase the number, strength, and/or formation area of hurricanes *to some extent*. But by how much is unclear. Thomas Knutson of NOAA and Robert Tuleya of Old Dominion University estimated in a 2004 study that a 2.0°C rise in maximum SSTs would increase hurricane wind speed by about 6 percent over 80 years.¹² “That means,” Patrick Michaels comments, “global warming is likely to be responsible, right now, for at best, an increase of about 0.6% in hurricane wind speeds—raising a decent hurricane of 120 mph to 120.7 mph, a change too small to measure.”¹³

Knutson and Tuleya came to pretty much the same conclusion: “From our standpoint, the small 0.9 degree Fahrenheit warming observed in the Atlantic since 1900 implies only a 2-3 miles per hour intensity increase to date. Such a small increase is hard to detect. It is difficult to attribute the upswing in strong hurricane activity this past season to global warming. Season-to-season variability is very large.”¹⁴

Another modeling study, Bengtsson et al. (2006),¹⁵ projects no increase in tropical storm severity from global warming:

- “There are no changes in the extremes of tropical storms [in our model

projection] in spite of increased tropical SST by 2°–3°C.”

- “The Atlantic [tropical] storms are reduced in number, in particular the stronger ones, while the storms in the eastern Pacific are virtually unchanged though there is some indication of fewer extreme storms. In the western Pacific there is little change. It is interesting to note that the change in SST by between 2° and 3°C *has not had any influence on the numbers and intensities of the more powerful tropical storms.*”

Since the Kyoto Protocol would avert an immeasurably small amount (0.07°C) of global warming by 2050,¹⁶ Kyoto-style approaches can provide *no protection* from hurricanes in the policy-relevant future. Therefore, it is disingenuous for activists to claim that a hurricane-warming link justifies changes in U.S. energy policy. Indeed, hyping the hurricane-warming link can be counterproductive. If people seek protection from hurricanes in climate change policy, they are apt to neglect the preparedness measures that can actually save lives.

Ten hurricane scientists, including Kerry Emanuel and Peter Webster, recently issued a “Statement on the U.S. Hurricane Problem.”¹⁷ The scientists urge policymakers not to let the debate about the “possible influence” of global warming on hurricane activity “detract from the main hurricane problem facing the United States: the ever-growing concentration of population and wealth in vulnerable coastal regions.” Contributing to that problem, they argue, are federal and state insurance and disaster-relief programs that “subsidize” development in high-risk areas. Although optimistic that “continued research will eventually resolve much of the current controversy over the effect of climate change on hurricanes,” they emphasize that, “the more urgent problem of our lemming-like march to the sea requires immediate and sustained attention.” They consequently call upon policymakers to undertake a comprehensive evaluation of “building practices, and insurance, land use, and disaster relief policies that currently serve to promote an ever-increasing vulnerability to hurricanes.” This science-based perspective on hurricane risk is absent from *AIT*.

AIT: “In 2004, Florida was hit with four unusually powerful hurricanes.” (*AIT*, p. 83)

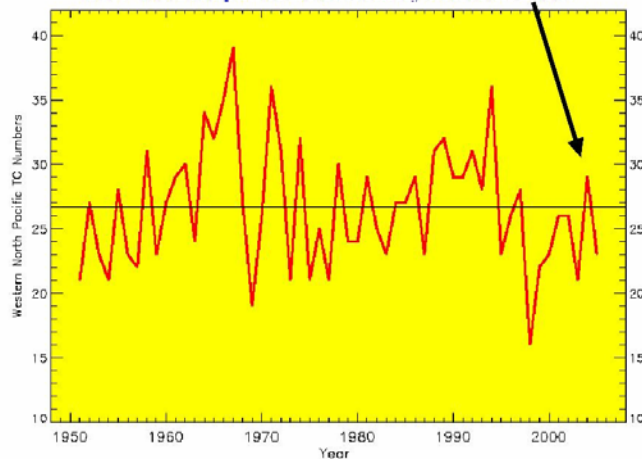
Comment: Yes, but was that due to global warming? Satellite measurements show that, in 2004, the Atlantic hurricane basin had the coolest June-July-August (season 3) since 2000, and the 8th coolest since 1979.¹⁸ No hurricanes may landfall in the United States in 2006. Is that evidence against a link between global warming and hurricanes?

AIT: “...that same year, Japan set an all-time record for typhoons. The previous record was seven. In 2004, 10 typhoons hit Japan.” (*AIT* p. 83)

Comment: The Figure below shows the number of tropical storms and typhoons (Tropical Cyclones, or TCs) over the Western North Pacific, from 1950 through 2005. The data simply do not reveal a linear trend corresponding to the gradual increase in atmospheric CO₂ levels. Besides, whether a particular storm “hits” Japan—its

trajectory—depends on local meteorological factors, not average global temperatures.

Direct TC data from Western North Pacific (1951-2005) do not confirm the impression given by Gore for tropical cyclones and typhoons over WNP/Japan to be extremely active in 2004!



Tropical cyclones near Japan were more frequent in the 1960s
Source: Matsuura et al. (2003), updated February 2006¹⁹

AIT: “In the spring of 2006, Australia was hit by several unusually strong, Category 5 cyclones, including Cyclone Monica, the strongest cyclone ever measured, off the coast of Australia—stronger than Hurricanes Katrina, Rita, or Wilma.” (AIT, p. 82)

Comment: Monica attained wind speeds of 180 mph, making it the strongest cyclone of 2006. Whether it was the strongest cyclone ever measured is unclear. At least five U.S. hurricanes had equal or greater wind speeds, including Hurricane Dog, attaining a wind speed of 185 mph on September 6, 1950, and Hurricane Camille, attaining a wind speed of 190 mph on August 17, 1969.²⁰

More importantly, Australia’s hurricane season in 2006 was not exceptional. According to NOAA, “The tropical cyclone season in the Australian region has been near average with the development of 12 storms, two more than average. Although final assessments of tropical cyclone strength are continuing, it is thought that 25 percent of these storms reached Category 5 strength on the Australian scale.”²¹

AIT: “Textbooks had to be re-written in 2004. They used to say, ‘It’s impossible to have hurricanes in the South Atlantic.’ But that year, for the first time ever, a hurricane hit Brazil.” (AIT, p. 84)

Comment: Gore gives the impression that Hurricane Catarina, the first hurricane on record to make landfall in Brazil, arose from abnormally high SSTs due to global warming. In reality, in 2004, January and February (Brazil’s summer months) “were the coldest in 25 years,” according to climatologist Pedro Leite da Silva Dias of the

University of Sao Paolo. SSTs were also cooler than normal. However, the air was so much colder than the water that it caused the same kind of heat flux that fuels hurricanes in warmer waters. At the same time, wind shear, which disorganizes hurricanes, was weaker than usual. “Before long,” says Bob Hensen of the University Corporation for Atmospheric Research, “the heat flux and light shear gave birth to a system that bore the satellite earmarks of a hurricane.”²² To blame rising CO₂ levels for Catarina, Gore would have to argue that global warming cooled the water and made the air even colder.

AIT: “And then came Katrina....The consequences were horrendous. There are no words to describe them.” (*AIT*, pp. 94-95)

Comment: The consequences of Katrina were horrendous, but it is sheer demagoguery to blame CO₂ emissions for the devastation. Kerry Immanuel, the very scientist whose work Gore cites to claim a “strong...emerging consensus” that global warming is increasing hurricane duration and intensity, cautioned against attempts to link Katrina or other recent Atlantic storms to global warming. In an interview that occurred while Katrina was still raging, Immanuel stated: “So, of course, it’s tempting. We have had this very active last ten years, along the U.S. and gulf coasts to blame that on global warming, but looking at it statistically, that’s a very difficult connection to make. I think what you are seeing mostly is a natural cycle in this case.”²³

More importantly, Katrina was the worst natural disaster in U.S. history not because the hurricane was so powerful—it was a category 3 storm by the time it made landfall—but because the federal government had failed to build adequate flood defenses for New Orleans. My colleague, John Berlau, chronicles this sad tale in an important new book.²⁴

In a nutshell, policymakers knew for decades that the city’s existing system of canals, dikes, flood walls, and levees was inadequate to protect New Orleans. In the 1960s and 1970s, the Corps of Engineers proposed to build large steel and concrete gates to prevent hurricane force winds from driving storm surges into the Lake Pontchartrain and across into New Orleans. Local politicians and Louisiana’s congressional delegation were on board with this proposal. However, environmental pressure groups blocked it. Katrina devastated New Orleans because the levees, battered by storm surges, broke, allowing the Lake to pour into and inundate the city.

The flood control system proposed by the Corps would in all likelihood have prevented the enormous loss of life and record-breaking economic losses. Green politics, not fossil fuel emissions, were the “anthropogenic” factor that turned Katrina into a horrific catastrophe.

AIT: “And before Wilma left the scene, something new happened: We ran out of names. For the first time in history, the World Meteorological Organization had to start using the letters of the Greek alphabet to name the hurricanes and tropical storms that continued on into December—well past the end of the 2005 hurricane season.” (*AIT*, p. 103)

Comment: NOAA's Web site explains that if there are more than 21 named tropical cyclones in the Atlantic basin in a season, additional storms will be assigned letters from the Greek alphabet. The use of Greek letters to name storms in 2005 was "the first time in history," as Gore says, but the practice of naming storms only goes back to 1953.²⁵ Hurricane detection capabilities have improved dramatically since the 1950s, to say nothing of prior decades. So although 2005 had a record number of *named* Atlantic basin hurricanes, this does not tell us much beyond the fact that 2005 was a very active hurricane year.

Furthermore, 2005 was not the first year hurricanes and tropical storms continued into December. It also happened in 1878, 1887, 1888, 1925, 1953, 1975, 1984, 1989, 1998, 2001, and 2003.²⁶

¹ Patrick Michaels, "Donald Kennedy: Setting Science Back," *World Climate Report*, January 20, 2006, <http://www.worldclimaterreport.com/index.php/2006/01/20/donald-kennedy-setting-science-back>.

² Robert Hart, *Hurricanes: A Primer on Formation, Structure, Intensity Change and Frequency*, George C. Marshall Institute, 2006, p. 2, <http://www.marshall.org/pdf/materials/409.pdf>.

³ Richard Lindzen, "Climate of Fear: Global warming alarmists intimidate dissenting scientists into silence," *Wall Street Journal*, April 12, 2006, <http://www.opinionjournal.com/extra/?id=110008220>.

⁴ Emanuel, K., 2005a. Increasing destructiveness of tropical cyclones over the past 30 years. *Nature* 436: 686-688.

⁵ Pielke Jr., R. A., C. Landsea, M. Mayfield, J. Laver, and R. Pasch. 2006. Reply to "hurricanes and Global Warming—Potential Linkages and Consequences". *Bulletin of the American Meteorological Society*, 87,628-631.

⁶ Congressional Briefing, Center for Science and Public Policy, May 1, 2006.

⁷ Klotzbach, P.J., 2006. Trends in global tropical cyclone activity over the past twenty years (1986-2005). *Geophysical Research Letters*, 33, L010805, doi:10.1029/2006GL025881.

⁸ Ren, F., G. Wu, W. Dong, X. Wang, Y. Wang, W. Ai, and W. Li. 2006. Changes in tropical cyclone precipitation over China. *Geophysical Research Letters*, Vol. 33, L20702, doi:10.1029/2006GL027951,2006.

⁹ Webster, P.J., G.J. Holland, J.A. Curry, and H-R. Chang. 2005. Changes in tropical cyclone number, duration, and intensity in a warming environment. *Science*, 309, 1844-1846.

¹⁰ Patrick Michaels, "Global Warming and Hurricanes: Still No Connection," *Capitalism Magazine*, September 24, 2005, <http://www.capmag.com/article.asp?ID=4418>

¹¹ http://www.aoml.noaa.gov/hrd/data_sub/hurdat.html

¹² Knutson, T.R. and R.E. Tuleya. 2004. Impact of CO₂-induced Warming on Simulated Hurricane Intensity and Precipitation: Sensitivity to the Choice of Climate Model and Convective Parameterization. *Journal of Climate*, Vol. 17, No. 18: 3477-3493, <http://www.gfdl.noaa.gov/reference/bibliography/2004/tk0401.pdf>

¹³ Patrick Michaels, "Global Warming and Hurricanes: Do Not Believe the Hype," *World Climate Report*, October 31, 2005, <http://www.worldclimaterreport.com/index.php/2005/10/31/hurricanes-and-global-warming-do-not-believe-the-hype>.

¹⁴ Michelle Nery, "The Inside Track on Hurricane Season," *Quest*, Fall 2005, <http://www.odu.edu/ao/instadv/quest/hurricane.pdf>.

¹⁵ Bengtsson L., K.I. Hodges, and E. Roeckner. 2006. Storm Tracks and Climate Change. *Journal of Climate* 19: 3518-3543.

¹⁶ Wigley, T.M.L. 1998. The Kyoto Protocol: CO₂, CH₄ and climate implications. *Geophysical Research Letters*, vol. 25, pp. 2285-88. For this estimate, Wigley assumes a climate sensitivity of 2.5°C for a doubling of CO₂ concentrations over pre-industrial levels.

¹⁷ http://wind.mit.edu/~emanuel/Hurricane_threat.htm.

¹⁸ John Christy, personal communication, October 6, 2004.

¹⁹ Matsuura, T., M. Yumoto, and S. Iizuka. 2003. A mechanism of interdecadal variability of tropical cyclone activity over the western North Pacific. *Climate Dynamics* 21:105-117.

²⁰ <http://lwf.ncdc.noaa.gov/oa/satellite/satelliteseye/educational/cat5hur.html>.

²¹ NOAA Magazine, <http://www.noaanews.noaa.gov/stories2006/s2632.htm>.

²² Bob Hensen, "What Was Catarina? Forecasters, researchers debate nature of Brazil's mystery storm," *UCAR Quarterly*, Summer 2005, <http://www.ucar.edu/communications/quarterly/summer05/catarina.html>.

²² www.nhc.noaa.gov/aboutnames.shtml.

²³ "Is global warming causing more devastating hurricanes worldwide?" Democracy Now! August 29, 2005, <http://www.democracynow.org/article.pl?sid=05/08/29/145206>.

²⁴ John Berlau, *Eco-Freaks: Environmentalism Is Hazardous to your Health!* (Nashville, TN: Nelson-Current, 2006), pp. 175-202.

²⁵ www.nhc.noaa.gov/aboutnames.shtml.

²⁶ UNISYS, Atlantic Tropical Storm Tracking by Year, <http://weather.unisys.com/hurricane/atlantic/index.html>.