FIVE BEST

These books about weather truly shine, says meteorology maven **Christopher C. Burt**

1 The Elements Rage

By Frank W. Lane
Chilton, 1965

What interests most people about weather (as opposed to climate—"Climate lasts all the time and weather only a few days," as Mark Twain put it) is its extremes and curious phenomena. Frank Lane clearly had that in mind in the early 1960s when he undertook writing "The Elements Rage." Even if the science here is out of date, the drama of the stories never grows old. The book offers dozens of extraordinary black-and-white photographs and a fact-packed text, rich in anecdotes on matters well beyond meteorology—earthquakes, tsunamis, avalanches, volcanoes. As an inspiration toward appreciating how strange the natural world can be, the book set a standard that others, including myself, have attempted to emulate.

2 USA Today: The Weather Book

By Jack Williams
Random House, 1992

USA Today's weather page is without peer. No surprise, then, that one of the page's creators, Jack Williams, has put together the most graphically appealing and instructive book on American weather on the market today (I prefer the second edition, published by Vintage in 1997). It does a superb job of explaining meteorological principles for the general public and of laying out how weather systems work. Even if you're already familiar with the subject, there are enough other weather-related factoids (in the true USA Today tradition) to entertain the most knowledgeable of weather geeks.

3 Divine Wind

By Kerry Emanuel
Oxford, 2005

I'm not sure if there has ever been a book that integrated weather with art, literature and science so effectively as "Divine Wind." Kerry Emanuel, an eminent earth scientist at the Massachusetts Institute of Technology, brings these disciplines together elegantly in this book about hurricanes. The science of hurricanes is covered in great detail, interspersed with exceptional illustrations, literary excerpts and case studies of some of the most infamous tropical storms on record. One chapter relates the remarkable story of a hurricane in 1609 that separated the British vessel Sea Venture from its Jamestown-bound fleet and wrecked it on the shores of Bermuda. Presumed lost for many months, the crew miraculously survived—news of which excited all of England, including William Shakespeare, who used the story as the basis of "The Tempest."

4 The Rough Guide To Weather

By Robert Henson
Rough Guides, 2002

How, you may ask, could a travel publisher produce one of the best books about weather? The logic is there of course: Nothing can torpedo a holiday more effectively than lousy weather. But this book goes well beyond outlining what to expect weather-wise in Hawaii in December or Paris in July. It is a dense and informative treatise on global climate phenomena, and it explains how to interpret forecasts and climate models. The author, Robert Henson, is not only a meteorologist (at the National Center for Atmospheric Research) but also a lucid and engaging writer. As for the travel-guide aspect: Half the book is devoted to country-by-country climate descriptions and monthly weather data tables for more than 150 destinations. A terrific resource for both travelers and weather buffs.

5 Northeast Snowstorms

By Paul J. Kocin and Louis W. Uccellini
American Meteorological Society, 2004

If there were a gold standard for weather reference books, it would be the two-volume "Northeast Snowstorms." You may know Paul Kocin as the laconic "winter weather expert" who pops up on the Weather Channel whenever a blizzard is about to hit. Louis Uccellini is a senior official at the National Weather Service. Their book is scientific and not for everyone, but those who have the patience to dig through this compendium of Northeast snowstorm data will in short order be winter-weather experts themselves. It covers every snowstorm of any significance to affect the Mid-Atlantic and New England regions since the Blizzard of 1888, providing upper-air charts, snowfall maps and even satellite imagery for the more recent storms. It is an extraordinary reference work of any sort but a treasure for anyone who loves snowstorms or weather history.

Mr. Burt is the author of "Extreme Weather: A Guide and Record Book" (Norton).

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BOOK REVIEW

Storms and Claims

Kerry Emanuel, *Divine Wind: The History and Science of Hurricanes.* London & New York: Oxford University Press, 2005. 289 pp. $45.00.

MICHAEL SEAN QUINN, PH.D., J.D., CPCU, ETC.*

This is not only a well-written 32-chapter book, it is also a physically beautiful book, of a size that could be placed on home (or better yet, office) coffee tables of the genuinely sophisticated. The book is also helpful to those who deal with hurricane-based insurance claims—whether they are lawyers, adjusters, company officers, or serious claimants. I shall say a little about hurricanes and insurance in a subsequent section. No court cases will be discussed here.

The author is professor of earth, atmospheric, and planetary science at the Massachusetts Institute of Technology. I suspect he would better be called a "Professor of Big-Time Oceanic Weather," and the title would be both descriptive and well-deserved. The bibliography "Weather Professor Emanuel" has provided is extremely informative and, therefore, very helpful.

The prose in this book has several focal points: standard storm vocabulary, the history of hurricane studies, hurricane art, the history of significant hurricanes, and the ongoing science of studying hurricanes. For the most part, the chapters alternate back and forth between the science of hurricane studies and the history of actual hurricanes. Thus, one chapter is about the nature of storm surges and the next chapter is about the Great New England Hurricane of 1938. Another chapter is about how hunters after hurricanes learned how to use airplanes of various grades to conduct their search, while the next chapter is about Hurricane Camille.

Here and there the book concerns (or, at least, recounts) some of the ways in which the injuries and damages caused by hurricanes are actually the result

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of human errors of various sorts. In one place Emanuel observed that centuries ago the Mayans learned never to build on a shoreline of the Gulf of Mexico. Contemporary commercial cultures have not got this lesson into their heads yet, much less through them. Lessons of poor government vis-à-vis storms is not a prominent theme in *Divine Wind.* Still, it's to be found here and there. In the preface, for example, the author makes this remark: "Hurricanes have altered both natural and political geography, cutting new inlets with the same ease with which they dispatch entire navies." Of course, political geography also affects the effects storms have.[1]

In addition to its mostly understandable prose, the book also consists of photographs, drawings, paintings, graphs, diagrams, poetic literature, prose literature, lyrics for songs, and a movie poster. Professor Emanuel has collected photographs from a variety of sources for the most part, but many of the diagrams and graphs are his work, and it is work well done. One of the chapters consists entirely of interesting photographs. As indicated, most of the prose is quite understandable, although some of the reading has to be done slowly. The only exception occurs in a discussion of forecasting hurricanes, which involves a number of differential equations, not all of which are quickly to be understood by those of us who left college a while back and are not now scientists.

It is Professor Emanuel's "ambition to portray the hurricane as it is seen from the perspectives of history, art, and science, so as to form an integrated opinion of the phenomenon." At the same time, Professor Emanuel was quite clear that hurricanes are extremely dramatic phenomena. Here is how the preface of his book begins:

> Of all the natural phenomena that affect our planet, the hurricane is among the most deadly and destructive. Hurricanes have killed more people worldwide in the last fifty years than any other natural cataclysm, and a single storm—Andrew of 1992—was the most expensive natural disaster in history. At the same time, the magnificence of these great tempests have influenced artists, writers, and naturals all through time. . . Hurricanes have altered both natural and political geography, cutting new inlets with the same ease with which they dispatch entire navies. As destructive of human ends as they may be, they nonetheless play a vital role in certain tropical ecosystems and may, ironically, prove essential to the comparative stability of tropical climate.

This quote gives us a good description of where the book goes. This citation also indicates that not everything out of the area of science is universally

[1] See Ted Steinberg, *Acts of God: The Unnatural History of Natural Disaster in America* (2000). This book not only discusses hurricanes at some length, it discusses human involvement—whether by action or inaction–in creating damages from earthquakes, floods, tornados, and more. Interestingly, it focuses on the difficult and deficient history of FEMA; indeed, a congressional report is quoted as staying that FEMA was, during the 1980s, "turned into 'a dumping ground for political hacks.'" Perhaps it still is, at least until quite recently.

agreed upon. The statement that Hurricane Andrew of 1992 was the most expensive hurricane to ever hit the United States is subject to some disagreement.[2] Of course, this book was written (at least partly) in 2004 and published in 2005. Consequently, there is no discussion in the book—nor could there be—of Katrina or its sisters, Rita and Wilma.[3]

To review this book is to give an indication of the different kinds of questions asked in the book. Three types of questions will be counted here: linguistic, historical, and scientific. Some of the questions will have part of answers quoted along with them. After these three types of questions, and some of the answers, are reviewed, several of Professor Emanuel's accounts of significant storms will be summarized briefly.

Divine Wind is not a book about insurance. It does not discuss underwriting or adjustment problems nor does it discuss the relationship between big storms and either environmental pollution or economic/business problems. It does not emphasize the financial side of hurricane damage, although it is mentioned here and there. (Even before any adjusters could get a close look at New Orleans, "leading insurers and reinsurers were able to estimate their expected losses. Many drew on catastrophic models that use computer programmes to estimate the probability of a potential disaster, its severity, and if it occurs, its costs.... Swiss Re's catastrophic perils team consists of some 30 seismologists, climatologists, engineers, and mathematicians who analyze events, track data, and try to identify changes. [¶] To model hurricanes, the team crunches numbers for factors, such as maximum wind speed, duration, precipitation levels and location over deeper shallower water, which influences the potential damages from 'storm surge'.")[4] Nevertheless, in the end, it might be useful to mention a few hurricane-based legal cases and try to say a little something about insurance adjustment. This discussion will begin with the crucial idea of *storm surge*.

I. SOME *DIVINE WIND* QUESTIONS

The first category of questions pertains to linguistics or lexicography:

- Where does the word "hurricane" come from?
- What does the word "tropipaze" mean?

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[2]Book length publications have already begun. See Tom Piazza, *Why New Orleans Matters* (2005).

[3]One suspects that there will be a second edition for this book within the next few years. Here is the opening of the epilogue of the current edition. "*Divine Wind* goes to press during a year in which hurricanes have again exacted a terrible toll in human suffering. Jeanne, a mere tropical depression at the time, dumped stupendous quantities of rain in Haiti, killing more than two thousand and leaving countless more without homes. It then went on to become the fourth full hurricane to strike Florida in a period of a scant six weeks, a record for any one season, and pushing insurance payments in 2004 to more than $22 billion, beating the old record set by Hurricane Andrew in 1992. [¶] Halfway around the world, Typhoon Tokage became the seventh full typhoon and tenth tropical cyclone to hit Japan in 2004, also a new record, killing more than 55 and sending the year's tropical cyclone death total at around 150."

[4]"Models Mauled by Amplified Risks," *Financial Times* 13 (Dec. 20, 2005).

- "What is the hurricane-related meaning of the Japanese word 'kamikaze,' a word known to Americans from another context?"
- "What are the relationships between the words 'hurricane,' 'cyclone,' and "typhoon"?"
- "What does it mean to classify hurricanes in different 'categories' (i.e., I, II, III, IV and V)?"
- What is "double eye-wall structure?" What does this phrase mean?
- What is a *seiche*?
- "What are the relationships between the word 'hurricane' and the word 'flood'? Of course, there is a related scientific question: What are the relationships between hurricanes and floods?"
  (Answer: "Some of the worst flooding disasters in history happen when hurricanes or their remnants pass over mountains." If you wonder why, Professor Emanuel provides reasons.)
- "Is hurricane based flooding difficult to predict?"
  (Answer: "[S]ome of the highest hurricane death tolls result from inland flooding, which is more difficult to predict and whose danger is still underappreciated. While forecasters emphasize the danger of flooding, they continue to rate storms by their maximum winds, and media attention is focused almost exclusively on wind, waves, and storm surge. Reduction of death and injury from inland flooding will require both better education about its true dangers and improve rainfall forecasts.")
- What does "Loop Current" mean?
- "What is the relationship between 'Loop Current' and/or the Gulf Stream and hurricane movement?"
- What do "resurgence" and "forerunner" mean in the context of storm studies?

As already indicated, 16 of this book's chapters are devoted to various aspects of the science of hurricanes. Some of the aspects include anatomy (as it were), geography, process, origin, finding, tracking, storm surge, waves, rain, wind, and so forth. Fortunately, in much of the book Professor Emanuel's publisher has provided large margins on the beautiful pages so that, if the book is not a coffee-table decoration, there is plenty of room to take notes, ask questions, make comments, and so forth.

There are many other questions of lexicography pertaining to scientific usage. However, some of those should be treated more as scientific questions.

General Historical Questions. This list of questions pertains to general questions about hurricane history. They are not questions about what happened in this or that storm:

- "What is the highest hurricane wind ever recorded?"
  (Answer: "190 mph in Typhoon Tip, plus Hurricanes Allen and Camille, among others.")
- "What is the largest geographical hurricane-like storm ever recorded?"
  (Answer: "275 miles from the center to the edge.")
- "What is largest one-day rainfall ever recorded?"
  (Answer: "72 inches.")
- "What is the most deadly storm in history?"
  (Answer: "Bangladesh/East Pakistan—300,000 people in 1970.")
- "What is the highest storm surge ever recorded?"
  (Answer: "42 feet.")
- When did we start understanding how hurricanes work?
- Who are the significant hurricane scientists and mathematicians?
- Who are the historically greatest poets on hurricanes?
- Who are the historically greatest painters of hurricanes?
- In what year were the most famous hurricanes?
- "What has been the major cause of hurricane tragedies since 1950, or so?"
  (Answer: "The problem is forecast where the storms will go. Many of the great hurricane tragedies since the middle of the twentieth century can be traced to a failure to do this.")
- What is the Fujiwhara Effect?
- What was the significance of MIT professor Edwin N. Lorenz?
- "What is the history of the evolution of hurricane hunting and the science connected therewith?"
- What kills more people: hurricanes or flashfloods?
- What kills more people: hurricanes or lightning?
- "What is the most frightening aspect of most hurricanes?"
  (Answer: "No aspect of a hurricane is more frightening than its enormous waves. Many a ship has succumbed to them, and breaking waves are responsible for much of the damage ashore, even in storms that never make landfall. [¶] Waves higher than 60 ft. have been recorded in hurricanes, but worse than these colossal heights is the turmoil of the seas near the eye, where the wind direction shifts very quickly. Over the centuries, various strategies have been developed to help ships cope with large waves, but these are useless when waves are coming from many different directions, adding to one another and creating a state of maritime chaos. Adding to the sailor's[s'] misery is the horrifying prospect of a rogue wave, a solitary monster arising without warning from the general chaos and quickly overwhelming anything afloat, from a dory to a supertanker."

With respect to the last two questions, the asking of the questions suggests what the surprising answer is going to be. One wonders if that is true in every year. One also wonders, for example, if lightning has killed more people in 2005 in the United States than Hurricane Katrina. (It was recently estimated that Katrina killed 1,321 people, so far, in Louisiana alone.)[5]

Some Scientific Questions. In terms of general questions, scientific questions constitute the vast majority that is considered in *Divine Wind.* Here is a bunch of them, although by no means all:

- "Where do hurricanes tend to start?"
  (Answer: "The Tropics are primed to produce hurricanes. Like a coiled spring, the atmosphere-ocean system is poised to unleash huge reservoirs of energy. But, fortunately for us, hurricanes are unusual: only about 85 tropical cyclones develop globally each year, of which roughly half go on to become full-fledged hurricanes.")
- Why do hurricanes and their brothers and sisters—start where they do?
- "Why do hurricanes have to be triggered?" "And, in nature, what serves as the trigger?"
- "Under what circumstances can hurricanes form?"
- Why do hurricanes invariably and essentially involve wind?
- Why do hurricanes invariably involve rain?
- "Why are the points of origin for hurricanes so geographically restricted, at least when looking at the south-to-north area of the world?"
  (Answer: "Although some aspects of the transformation of atmospheric disturbance into tropical cyclones are relatively well-understood, the general problem of tropical cyclogenesis remains, in large measure, one of the great mysteries of the tropical atmosphere.")
- "What does the 'Stephan-Boltzmann' Equation have to do with understanding hurricanes?"
- Is there a maximum wind faster than which hurricane wind cannot, as it were, go?
- Is there a maximum speed at which a hurricane can travel in this or that direction?
- What is wind shear in the context of a hurricane?
- How do hurricanes begin?
- Are all hurricanes quite tall, as it were, from an atmospheric point of view?
- "How do higher atmospheres get 'hurricanized'?"
  (Answer: "The exact process by which the middle atmosphere becomes humidified remains an enigmatic. There are no doubt several

[5][No Title], *Wall Street Journal* 1 (December 17-18, 2005).

routes to genesis, and a variety of conditions can make the atmosphere more or less susceptible to genesis. . . .")

- "Does passing over a swamp diminish or enliven a hurricane?" (Answer: "When hurricanes pass over swamps instead of dry ground. . . , they can suck enough heat out of the swampy water to slow their decay. Even a foot of standing water holds enough heat to noticeably slow a storm's decay[.]")
- "Why do some hurricanes undergo rejuvenation?" (Answer: "Rejuvenation occurs when the hurricanes or their remnants interact with middle- and high-latitude weather systems—the familiar high- and low-pressure systems shown on television weather reports. These systems, known as *extratropical cyclones* and *anticyclones*, are responsible for more day-to-day variations in weather outside the Tropics.")
- Why do hurricanes move in predictable ways?
- "How many factors are involved in causing hurricanes to move in predictable ways, and what are they?"
- What causes hurricanes to cease?
- What is the importance of the "background flow" of a hurricane?
- What is "absolute vorticity"?
- "What is 'beta drift'?" (Answer: "Beta drift causes hurricanes to move even in an atmosphere otherwise at rest.")
- "What are the differences between waves and storm surges?" (Consider the following: "Hurricane waves pounding ashore, often riding atop a storm surge, release enormous quantities of energy accumulated over days or weeks at sea. So powerful is the pounding that it can sometimes be detected by seismographs thousands of miles away. Feared by mariners and beachfront residents alike, waves often administer the coup de grâce to ships and buildings battered by the storm's furious winds.") It is not clear how one would recognize the difference between a surge and a wave, especially if the insurer bears the burden of proof, as it usually does in exclusions.
- "Is there a measurable relationship between wind speed and wave speed?" (Answer: "Of all the waves in a hurricane, are those moving at about one-third the wind speed.")
- "What is the relationship between hurricanes and winds?" (Answer: "Hurricanes are usually thought of primarily as wind storms . . . . Yet some of the worst tropical cyclone catastrophes are caused not by winds, but by torrential rain. Curiously, some of the most devastating floods are produced by tropical cyclones of sub-hurricane strength.")

- What do chaos theories have to do with the science of hurricanes?

Divine Wind treats all of these questions and answers many of them.

II. SOME STORMS

At least 15 of the chapters in the book are devoted to particular storm specifics. Several of the chapters include more than one storm. Consequently, there is a discussion of approximately 18 to 20 hurricanes.

The first hurricane discussed occurred in 1259, when it sunk the navy of Kublai Khan, the grandson of Genghis Khan, who was attacking Japan from China and Korea. Interestingly, the second hurricane discussed occurred in 1274 and sunk this warrior's second attack fleet. The first fleet involved 900 ships and 40,000 men. A second invasion involved 100,000 men and even more ships than the first fleet. The first invasion lost 13,000 men to death, mostly from drowning. The second invasion also sustained massive casualties, both as to troops and as to ships. In both cases, these casualties were caused by the hurricanes.[6]

Professor Emanuel also devotes chapters to the hurricane that hit Columbus in 1502, a hurricane that caused the French to go up Florida in 1555, and several hurricanes that occurred in 1780. The 1780 hurricanes are known as the Savanna-la-Mar Hurricane, the Great Hurricane of 1780, and the Solano Hurricane. The first [1780] storm caused some 3,000 deaths, including 1,500 sailors. This storm "remains one of the worst disasters in Jamaican history." "The second of the three [1780] storms ... was the single deadliest storm ever to have affected the Western Hemisphere .... The Great Hurricane of 1780 took more than 22,000 lives and struck the nearly fatal blow to the economy of the Caribbean. It so decimated the British Fleet that the English presence in the western North Atlantic was thereafter significantly reduced .... Not for more than two hundred years would the death toll of an Atlantic hurricane exceed 10,000." Solano's Hurricane inflicted far fewer casualties. "It is most notable for having defeated a Spanish plan to take the Florida panhandle from the British." Solano was the Spanish admiral who was in charge of an armada of approximately 64 warships, transport ships, and supply ships. The ships carried 4,000 soldiers from Havana for Pensacola, and 2,000 died.

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[6]There was a similar duo of storms in 1942, Emanuel reviews these in a chapter entitled "Bull Halsey's Typhoons." The chapter contains marvelous pictures of American warships that had been injured by these big storms. Even though these storms were separated by more than 650 years, the problems they created for naval fleets at war were similar. In both cases, there were conflicting objectives; there was an overreliance on sketchy information; there was a tendency towards guesswork, and there was too great a desire to win in the immediate future.

The remainder of Professor Emanuel's historical foci are twentieth century storms. Several of these chapters will be recounted here at a little more length. These paragraphs are intended to be an invitation to read more in *Divine Wind*. It is far more detailed and elegant.

Galveston, Texas: 1900. This storm was a big deal. "The Galveston Hurricane of 1900 was *by far the worst* natural calamity in U.S. history. The city itself was almost completely destroyed, and the death toll of between 8,000 and 12,000 exceeded that of the 1906 San Francisco Earthquake, the 1889 Johnstown Flood, and the 1928 Okeechobee Hurricane *combined*."[7] "Between the badly bungled weather forecast of September 6 and the tragedy at Galveston two days later[,] lies a tale of individual courage and misjudgment, of bureaucratic envy and xenophobia." The errors involved were by no means only proximate to the storm. "The city was built on Galveston Island, a narrow, low sandbar separating the Gulf of Mexico from Galveston Bay, its developers having ignored stories that an 1841 storm had submerged the entire island to such a depth that ships could cross it."

According to Professor Emanuel, at the opening of the twentieth century the U.S. Weather Service was terribly concerned with avoiding the embarrassment of making mistakes and avoiding the kind of conflicts between government and private mercantile economy that storm predictions can cause. Storm predictions can cause economic changes. In any case, skilled and objective observers in Cuba knew exactly what the direction of the storm was likely to be, based upon empirical evidence. For some reason, the U.S. Weather Service was convinced that, although the storm had moved to the northwest and toward the Gulf consistently, it would in fact move to the Atlantic and strike the mid-south coast, if it survived at all.

Pretty much the entire city of Galveston was flattened. Several local observers managed to persuade a fair number of people to leave, but by no means everybody. "The scene of devastation presented itself to survivors when the sun arose on Sunday, September 9, beggars description. The wreckage of some 3,600 buildings stretched as far as the eye could see, while the air filled with the stench of decaying corpses. Yet, earlier reports that reached Houston that 500 people had died were considered gross exaggerations."

Another interesting error that contributed to the foul-up preceding Galveston's storm was the mistake about storm surges. According to Professor Emanuel, many believed that Galveston was not terribly vulnerable to hurricanes. Some then prominent scientists, several quite famous at the time,

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[7]For a recent account of the San Francisco earthquake, see Simon Winchester, *A Crack in the Edge of the World: America and the Great California Earthquake of 1906* (2005). See also Philip L. Fradkin, *The Great Earthquake and Firestorm of 1906: How San Francisco Nearly Destroyed Itself* (2005). This book was published by the University of California Press, and the author won a Pulitzer Prize while a journalist. For an earlier account of the 1906 events, see Dan Kurzman, *Disaster! The Great San Francisco Earthquake and Fire of 1906* (2001). Emanuel does not cite this text.

published papers arguing that storm surges of the type that "swept over the Ganges Delta in 1876, and killed more than 100,000 people, were impossible in places like Galveston, owing to the very gradual shoaling of the waters approaching the coast." This conclusion was dead wrong, not only historically but also scientifically. Shoaling (i.e., shallowing) waters keep warm water near the surface, and there is no cold water underneath them. Consequently, storms get stronger as they pass through shoaled waters, not weaker. Warm waters help hurricanes to come into being, to grow, and to rejuvenate. As we shall see, the concept of a *storm surge* is extremely important in thinking about hurricane insurance claims.[8]

Of course, even though hurricanes are essentially windstorms, they are not the only catastrophes to be caused by coming off the ocean. Tsunamis are also ocean-caused storms, although their origin is in the quaking of the earth, not the blowing of the wind.[9]

San Felipe Hurricane of 1928. This storm hit Puerto Rico first. Over 19,000 buildings were destroyed; 1,500 Puerto Ricans were killed, while 284,000 lost their homes. The storm received the name that it did because of the saint's day upon which it struck the island. Down to the present, this is the worst hurricane to hit Puerto Rico. Since Puerto Rico is mountainous, the storm was probably diminished as it left the island, although hurricanes hitting mountains frequently cause the worst flooding. "The renewed storm hit Palm Beach a few days later. Its sustained winds were 100 mph while the storm surge was 11 feet. In fact, people were killed; the coastal highway A1A was destroyed as were countless homes, including some of the most expensive mansions in the country."

The storm then headed inland and struck the south shore of Lake Okeechobee ("a Seminole word meaning 'Big Water.'") The water in the lake was already high. Because of the way hurricane winds circle, the wind came increasingly from the north, and "the water levels on the south shore began to rise even higher. By the time the eye passed directly over the lake late in the evening of September 16 [1928], the earth and dykes had given way, and a wall of water spread inland, driven by... 120 mph... winds."

The number of casualties is uncertain. The number of people reportedly buried just after the storm exceeds 2,400. Some of the lack of facts about the storm was that many of the people killed were migrant workers and black.

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[8]Emanuel cites *Isaac's Storm* of 1900, E. Larson's famous book about the Galveston storm. He does not cite, however, Patricia Bellis Bixal and Elizabeth Hayes Turner, *Galveston and the 1900 Storm: Catastrophe a Catalyst* (2000) published by the University of Texas Press. The authors of this book are professional historians from Houston, Texas, and their book is filled with wonderful photographs.

[9]See Dennis M. Powers, *The Raging Sea: The Powerful Account of the Worst Tsunami in U.S. History* (2005). This book concerns a tsunami that hit Crescent City, California in 1964. Obviously, there will be many more writings on the tsunami of Southeastern Asia in 2005. It's history turned "One Year Old" in December 2005.

"There can be little doubt that this was the second-worst hurricane disaster in U.S. history, exceeded only by the Galveston storm of 1900, and the second- or third-worst natural disaster, comparable to the Johnstown Flood of 1889, which killed more than 2,200."

Labor Day Hurricane of 1935. The storm just mentioned may have been the most severe in some ways, but it was not the most intense. "The most intense hurricane ever to affect the United States roared ashore in the middle of the Florida Keys on the evening of Labor Day, September 2, 1935, wiping several islands clean of all vegetation and buildings, and killing at least 423 people." It also destroyed a railroad running down the Florida Keys, which was never rebuilt. Many regarded this railroad to the Keys as an engineering marvel. "The finest Belgian and German cement was used for the bridge piers, the steel came from Carnegie, and the marl road bed fill was quarried and dredged from the Keys themselves." Then again, during the building of the railroad, from 1905 to 1912, "at least 200 workers lost their lives in the project, many during the hurricanes of 1906, 1909 and 1910." Several of the book's most interesting photographs are of this storm. Compare a postcard picture of the Key West extension of the Florida East Coast Railway with a train that had been sent in to rescue veterans who were working on a construction project in the keys. The other two photographs are of the labor camp utilized by the veterans of World War I. The veterans were in the Keys on some sort of New Deal welfare program. At least 259 of the casualties were veterans. "The storm dealt a particularly cruel blow to the veterans, who had survived the Great War, the Depression, neglect, and alcoholism, only to be whisked into oblivion by the strongest hurricane ever to strike the United States, while their overseers squabbled over who was going to make the decision to evacuate."

According to Emanuel, the Keys are in no better shape today than they were then. "[T]here are few buildings in the Keys today that would not be submerged by another such storm surge. The only option in the face of an approaching hurricane is to evacuate the entire permanent population of 85,000, plus as many as 50,000 visitors by mostly a two-lane road to the mainland. This would take at least 36 hours. [Significantly,] when Hurricane Andrew bore down on Florida in 1992, 30,000 residents of the Keys flatly refused to leave. Had that storm veered south, the death toll might have been in the thousands. [] It is a sad fact that the United States may not have seen its last Galveston."[10]

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[10]Emanuel recounts Hurricane Andrew later in the book. "While building codes actually became more stringent [during the twenty-five years between 1966 and Hurricane Andrew], enforcement waned, and by the late 1980's there were only sixteen inspectors for a population of well over one million. It was as though the storm gods had been priming south Florida for a catastrophe. [] That catastrophe was Hurricane Andrew, the costliest natural disaster in U.S. history and the third most intense hurricane ever to strike the country. Remarkably, only 26 died in Florida as a direct result of the storm, but tens of thousands were left homeless, and at least 40 more died in the aftermath. Andrew changed the face of south Florida, and brought about sea changes in the insurance and construction industries."

Great New England Hurricane of 1938. This storm is still the "greatest natural disaster in New England history, leaving 680 people dead amidst terrible wreckage. Like many natural disasters, the Great New England Hurricane was a lethal combination of meteorological chance and human error." The storm began near the African coast, came all the way across the Atlantic, shifted gradually north, and then sharply north starting on September 20. It hit the New England coast on September 22, 1938.

Hurricanes usually weaken as they cross to the north of the Gulf Stream. Cold waters lead to lesser storms. In this case, the wind was so powerful that the storm traveled quickly and did not weaken. The U.S. Weather Bureau did not expect this and was taken by surprise. Consequently, "the Great Hurricane of 1938 struck Long Island and New England without warning. The last major hurricane to affect the region was in 1815, and it had since become common [']wisdom[] that hurricanes avoided New England."[11]

In the relevant chapter, there are absolutely marvelous photographs of bridges being washed away, boats washed ashore, dozens of residences along the coast being smashed up, and Hartford, Connecticut, being soaked. This storm took 680 lives "and seriously injured another 1,750. More than 93,000 families suffered major property losses, including nearly 7,000 summer dwellings, 2,000 other dwellings, 2,600 boats, and 2,300 barns. Almost 26,000 automobiles were destroyed. Somewhere between 500,000 and 750,000 chickens were killed, as well as 1,675 head of livestock. The storm downed nearly 20,000 mi[les] of electric and telephone lines, cutting service to more than 80 percent of electricity customers and 30 percent of all telephones in New England. Railroad service between New York and Boston was halted for 7 to 14 days[,] while 10,000 filled in 1,000 washouts, replaced almost 100 bridges, and removed countless obstructions from the tracks, including 30 boats and one very large steamer . . . . All told, the storm did more than $300 million worth of damage in 1938 dollars, or about $4 billion in 1998 dollars, making it the sixth-costliest natural disaster in U.S. history. Had today's infrastructure existed then, it is estimated that the storm would have racked-up almost $18 billion in losses."[12] This is nothing in comparison to Katrina, or even Andrew.

Hurricane Camille of 1969. This storm took at least 150 lives, destroyed whole towns, completely eliminated entire fishing fleets, and was surely "one of the most violent storms ever to strike the United States[.]" The focal point of this storm, of course, was the Gulf coast of the state of Mississippi, as the media

[11]The previous chapter contains a marvelous painting by John Russell Bartlett entitled "The Great Gale of 1815." It depicts the hurricane hitting Providence, Rhode Island. The painting hangs at the Rhode Island Historical Society.

[12]Another book was recently published on this storm, no doubt after *Divine Wind* went to press. See Clerie Burns, *The Great Hurricane of* 1938 (2005).

world has reminded us all following Katrina. "[L]ike many great disasters, Camille was the result of the confluence of several improbable events."

For three days, beginning on August 15, 1969, Camille blew somewhat northwest from south of Cuba. It hit past Pass Christian, Mississippi, on August 18, 1969, went almost straight north through Mississippi, turned east across Kentucky and Virginia, went into the Atlantic late on August 20, and turned somewhat northeast.

At the point Camille came into Mississippi, it had "the highest storm surge ever recorded in the United States[;]" it measured 22.6 feet at Pass Christian and a little less nearby, but with wind of approximately 190 mph. (The book contains a stunning colored map showing the height of the storm surge.)

One of the most interesting things about Camille was that it was "something of a meteorological freak," so as a result, the Weather Service did not understand what was happening. The computer model set up at the time to map it misunderstood it, and therefore, mispredicted it. The basic problem was an inability to determine where the "Loop Current"/"Gulf Stream" was, how wide it probably was, and where Camille was in relation to the current. Camille "had killed at least 300 people and done billions of dollars in damages, leaving in grief a nation that just one month earlier had put the first man on the moon."

Emanuel discusses several other hurricane storms. One of them is Cyclone Tracy, which hit Australia in 1974. Another one is the Great East Pakistan Cyclone of 1970. The stories are fascinating and disturbing, and so well-worth reading. Obviously, Emanuel did not—since spatially he could not—discuss all the interesting hurricanes of the late twentieth century in his historical chapters.[13]

III. STORM SURGE

For reasons that will become apparent shortly, one of the most significant chapters in the book is entitled "The Storm Surge." It is followed by chapters entitled "Waves" and "Rain." (In the table of contents, the names of the chapters on science are in bold letters, while the names of the history chapters are in normal printed letters.)

The concept of a *storm surge* has been mentioned several times in this review. For reasons that will become significant presently, this is terribly important. "One of the most deadly but fascinating phenomena that accompany

[13] See Jim Carrier, *The Ship and the Storm: Hurricane Mitch and the Fantome* (2001). Emanual mentions this storm briefly several times, and it appears in "Appendix I: Notable Tropical Cyclones." Mitch is the strongest October hurricane on record, and it killed "more than 11,000 people, making it the second deadliest Atlantic hurricane in history."

hurricanes is the storm surge, usually experienced as a sudden rise of sea level near the time of maximum wind speed. This rise of the ocean, which may range from just a few inches to as many as... 42 ft., is historically the most lethal aspect of the hurricanes, having killed far more people than wind has. [] Storm surges... have been the main cause of death in the two worst hurricanes in U.S. history—the Galveston storm of 1900 and the 1928 Okeechobee Hurricane."

Hurricanes affect the elevation of water in the sea in two significant ways. The first way is a result of low pressure at and near the core of the storm. It actually "pulls water up, just like sucking water up a straw." That, however, is not the main cause of storm surge; winds are the second and main driver of storm surges; they exert stress on the water. "In deep, open ocean, this stress produces complex ocean currents with speeds of a few meters per second. These are associated with slight variations of the sea surface elevation." However, when the water shallows, the water will rise to much larger levels. In addition, as wind blows air on the surface, it circulates. It flows with the wind near the surface and then returns to near the bottom at or near the shore and flows back the other way. When this happens, the surface of the ocean "tilts upward in the downwind direction. This tilt is needed to balance the friction of the blowing wind: the tendency of gravity to level the water surface balances the force of the wind trying to pile water downwind[.]" The relationship between wind and water is obvious when this is done in a shallow tank, with a downwind wall. Significantly, where there is a shoreline, the ocean works in the same way. (Emanuel provides a striking cartoon illustrating this point.)[14]

Storm surges can be larger and larger and larger, depending on a variety of factors. Storm surges will be larger for storms approaching a coastline in a perpendicular way, when one or more of the following is true:

- the storm has a lower central pressure;
- the onshore component of wind speed is larger;
- the eye is larger (although there is not much effect for eyes larger than about 30 mi);
- the storm is approaching the coast faster;
- the seafloor shoals gradually; or the coastline is part of a bay that is as narrow as or narrower than the eye of the storm.

Different factors increase surge when a storm is moving parallel to a coast or is approaching it in an oblique way:

[14]There is an entire cartoon-novel done on floods. It is Eric Drooker, *Flood! A Novel in Pictures* (2001). This book may be—to some extent—about hurricanes, since part of it at least is about a big flood in New York.

- the storm is moving along the coast with the coastline to its right, in the Northern Hemisphere, or left, in the Southern Hemisphere;
- the storm is moving fast, if the coastline is to its right (Northern Hemisphere), or slowly, if the coastline is to its left (Northern Hemisphere); or the storm's eye is larger.

Obviously, a storm surge can vary from hurricane to hurricane.

There are other factors that influence the power of storm surge. One of them is "the normal ebb and flood of the astronomical tides." Another is wave behavior. "Atop the storm surge ride enormous waves driven by the hurricane's winds. These act as battering rams, greatly increasing the destruction caused by the storm surge flooding. The combination of storm surge, huge waves, howling winds, and flying debris, makes survival extremely problematic for those unfortunate enough to be caught in a low-lying coastal terrain during a hurricane." What is important to notice about this language is that there are a number of different types of events happening in hurricanes that are not the same sort of thing and that do not have the same names. These are waves, tides, surges, floods, and so forth. The significance of these conceptual differences—and potential confusions—will become apparent presently.

Distinguishing amongst these various types of events or processes is connected to another problem. The problem is this: How are they connected? Emanuel indicates in several places that storm surges can cause floods. One is not quite sure if, when, or how this happens. Does the storm surge *become* a flood or *cause* a flood? How can one tell the difference? Where is the line? We shall see this is important in practical terms presently.

IV. KATRINA-RITA-WILMA (THE "THREE WITCHES"[15]) CLAIMS

The year 2005 has not been a wonderful year for insurance companies in at least some ways. Katrina is expected to cost insurers something like $45 billion, according to Swiss Re.[16] Other than the cost of Katrina, there are the other two sister hurricanes, the tsunami in southern Asia, the earthquake in

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[15] Vitaliy Katsenselson, "Natural Disasters May Herald a 'Hard' Market," *Financial Times* 11 (January 4, 2006). The author teaches at the University of Colorado–Denver, among other things.

[16] [No author listed] "Catastrophes Drain Insurers of 80 Billion in Costly Year," *Wall Street Journal*, C11 (December 21, 2005). See Andrea Felsten, "Insurers Face Record $80 bn Bill for 2005," *Financial Times* 19 (December 21, 2005). (Many of the numbers in this paragraph come from the research of Sigma, which is the research arm of Swiss Re). Losses from Katrina have frequently been underestimated. See Dave Lenckus and Mark A. Hofmann, *Katrina Ravages Coast*, 1 (September 5, 2005). This article projected insured losses at up to $35 billion. A variety of estimates were projected shortly after Katrina. Within a month of the loss, for example, AIG thought that its losses might be as high as $1.2 billion. See Ellen Kellerher, "AIG Estimates $1.1bn Loss After Katrina," *Financial Times* 19 (September 21, 2005). By mid-November, some reinsurers were indicating that they too would sustain substantial losses. Patrick Jenkins, "Hurricanes Hammer Hannover Re," *Financial Times* 19 (November 11, 2005).

northern Pakistan, and so forth. (The last of those named has caused 78,000 deaths.) Before 2005, Andrew in 1992 was the most expensive catastrophe in which a good deal of insurance was involved, costing $22 billion. It was followed by the September 11, 2001, terrorist attack of New York City, which cost another $21 billion.

One of the most interesting problems regarding the costs of these storms is going to be environmental damage a storm, at least in part, causes to the areas it passes through. This is particularly significant in the case of Katrina and its passage through New Orleans and the southern Louisiana area. There are already substantial environmental problems in that geographical region, some of which have been discussed at considerable length.[17]

[17]Craig E. Colten, *An Unnatural Metropolis: Wresting New Orleans from Nature* (2005). This is an extremely interesting book for those working on Katrina-related problems. It is a history of levees and drainage problems, and it considers wetlands-related public policies and actions at some length. Professor Colten, from the geography department at LSU-Baton Rouge, also discusses the history of hurricanes and New Orleans, as well as the history of local flooding. The book starts by saying, "Since a sizable portion of the city rests below sea level and collects whatever water is not pumped out, managing the surplus fluid is critical .... Wresting the site from its watery excesses and the associated problems was, and remains, a central issue in this city's existence." It ends by saying, "Massie and shallow Lake Pontchartrain makes the city vulnerable to natural disasters. Should a Class 5 hurricane blow water over the lakefront levees, the city could find itself under water for months. Evacuation would face serious bottlenecks due to the limited number of escape routes across the water-logged terrain—and some of those raised highways could be over-topped by storm-driven waves. . . . Global warming and sea level rise make this grim forecast all too likely." There are other sources of problems in the area, as well. Some of them are discussed by Professor Colten. The bibliography contained in the footnotes of *An Unnatural Metropolis* is very helpful. Interestingly some the roadways in and near New Orleans have suffered from the problems Colten describes generally. See John Schwartz, "I-10 , Another Victim of the Storm, Enjoys a Quick Rebirth," *New York Times* A-10 (January 3, 2006). There are other recent sources as well. See Steve Lerner, *Diamond: A Struggle for Environmental Justice in Louisiana's Chemical Corridor* (2005). See also Barbara L. Allen, Uneasy Alchemy: Citizens and Experts in Louisiana's Chemical Corridor Disputes (2003). Both of the last two books are published by MIT Press as part of their "Urban and Industrial Environments" series. Professor Steinberg noted the New Orleans hurricane problem in his *Acts of God*, supra n. 1. Damage from petroleum and related causes is substantial as the result of hurricane-caused land-based property damage, not to mention oil in the Gulf. Betsy McKay, "Katrina Oil Spill Clouds Future of Battered Suburbs, "*Wall Street Journal* A-1 (January 3, 2006) ("When the levees that protected the community gave way, . . . about 1800 homes were inundated with flood-waters carrying nearly 11 million gallons of oil from a nearby refinery. Thick black crude seeped into homes and yards. . . . Four months after Katrina hit, oil remains in hundreds of homes and yards. . . . Katrina triggered 575 petroleum and hazard chemical spills, according to the National Resources Defense Counsel. . . Ten of the biggest spills in Louisiana caused by the hurricane added up to about eight million gallons. . . ." The crude oil contained, as such oil often does, "benzene and chemicals called polycyclic aromatic hydrocarbons, or PAHs[, some of the last of which are carcinogens].") Incidentally, to return to the Colten book, it contains a number of historically interesting maps of New Orleans, its levees, its drainage systems, and related wetlands. Very recently at least two editions of another book were put together late in 2005 by the editors at *Time Magazine*. One is entitled *Hurricaine Katrina: The Storm That Changed America*, and Wynton Marsalis—the famous musician—wrote an introduction for at least what I am calling the "Second Edition," which concerned both Katrina and Rita. This book contains a number of helpful photographs, a simple explanation of parts of the drainage-pumping system, and several very helpful maps. There is another, shorter paperback of photographs and a little prose to be found on some magazine stands. Its full title is (at least) *Remembering Katrina: A Pictoral Record—The Gulf Coast Changed Forever*. Curiously there is no obvious publisher information, except for price.

Considerable oil spillage problems were caused in the Gulf of Mexico[18] and the Louisiana coast line, including its bayous and its marshlands, have been recognized as a problem for some time.[19] Of course, there are similar problems associated with the Mississippi River, as there have been for many years.[20]

The cost of Katrina-Rita-and-Wilma could reach a total together of $80 billion, at least in contemplated claims, although it is not clear that all of this will be covered, and it is clear that not all injuries and damages caused by these storms will be covered. (At least some courts will say that floods are not covered at all—no way—and some lab animals destroyed by the storms are not included within any policies. Of course errors like that may lead to contra intermediary or risk management litigation.) The three storms hit 2 million homes, more than 40 oil rigs, and 150 offshore platforms.[21] Costs will probably continue to rise over the next decade or so. Storm losses tend to come in long cycles. Even more significantly, if the increase in serious hurricanes derives from global warming, and similar environmental changes, then the cyclical storm pattern may alter itself from its traditional cycles. This could substantially increase the price of insurance and reinsurance over both the short run and the long run. In the short run, reinsurers have taken enormous losses, and some reinsurers, such as Munich Re, have "pushed through premium increases at more than 400 percent on oil rig cover, [for example,] the business part is hit by the storms [of 2005]."[22] At least some insurance executives are saying publicly that Katrina was not a "natural disaster," aka "act of God," but was due to governmental error with respect to levee development and maintenance. The CEO of Liberty Mutual was reported in the November 28, 2005, *National Underwriter* as having made such a remark.[23] (Interestingly, his remark did not focus on the Army Corps of Engineers, as many other recent remarks have.)

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[18]Julian Borger and John Vidal, "Katrina Oil Spills May be Among Worst on Record," *Guardian* (September 16, 2005). The actual extent of oil spillage, as described in the above-mentioned article, and declared by the U.S. Coast Guard, states that 6.5 million gallons of crude oil had been spilt. The largest oil spill in U.S. waters was the Alaskan oil spill in 1989 from the *Exxon Valdez*.

[19]See Joel K. Bourne, Jr., "Gone with the Water," *National Geographic Magazine* (October, 2004). This article, together with its lengthy bibliography, can be found on the internet.

[20]See John M. Barry, *Rising Tide: The Great Mississippi Flood of 1927 and How it Changed America* (1997, Simon & Schuster).

[21]Andrea Felsten, Patrick Jenkins, and Haig Simonian, "An Ill Wind: Why the Rising Cost of Cover for Natural Disasters Will Alter an Industry," *Financial Times* 13 (December 20, 2005).

[22]Id. See Patrick Jenkins, "Munich Re Lifts Oil Rig Rates 400%," *Financial Times* 22 (November 8, 2005).

[23]Susanne Sclafane, Insurers Skeptical About New Cat System, 109 *National Underwriter* 10 (November 28, 2005).This article reports Edmund (Ted) Kelly, the CEO of Liberty Mutual as making the following statement in a speech at the Seventeenth Annual Property-Casualty Industry Conference: "'Katrina was not a natural disaster. Katrina was a disaster of federal management of the levee system.... It was a federal disaster caused by federal mismanagement.'" *Id.* at 24.

It is perfectly clear that the word "flood" is ambiguous. It is also clear that it is used in a variety of ways and in a variety of circumstances. In *Webster's Third New International Dictionary*, first published in 1986, the word "flood" has two separate entries. According to the explanatory notes at the beginning of the dictionary, this means that there are two separate words, with separate histories, and identical spelling. The dictionary calls these "Homographs." Here are some of the entries for "^{1}flood" in *Webster's Third*:

1: archaic: a body of moving water (as a river or stream) esp. when large

2a: the flowing of the tide

2b: the highest point of a tide

3a: a rising or overflowing of a body of water that covers land not usually under water

3b(1): an outpouring of considerable extent

3b(2): a great downpour

4: the element water

5a: a great stream of something (as light or lava) that flows in a steady course

5b: a large quantity widely diffused

6: floodlight

A list of definitions for "^{2}flood" is as follows, in part:

1a: to cover or overwhelm with a flood

1b: to cover or cause to be covered with water or other fluid

2: to fill more or less completely with water or other fluid

2a: to increase the elevation of the water in (a channel) esp. in splashing logs or nullifying the effectiveness of a fall over a dam

2b: to supply to (the carburetor of an internal-combustion engine) an excess of fuel sufficient to raise the fuel level of the float chamber above the fuel nozzle

2c: to fill (as a compartment of a submarine) with water admitted from the sea

2d: to fill (an oil sand) with water to expel the oil

2e: to apply excessive ink to in printing

3a: to fill to full capacity or to excess

3b: to distribute something in or provide with something in large quantities

Obviously, some of the main differences between "^{1}flood" and "^{2}flood" are related to the fact that the former is a noun while the latter is a verb.

Nevertheless, even the noun has internal ambiguities. Section 2 in the definition is quite different from §3. Further, it is perfectly clear that §2 refers to *tides*, and therefore not to *storm surges*. It is also perfectly clear that §3 infers to *overflows*. This would not include breakthroughs involving shattered levies. Section 4 is ambiguous taken by itself, while neither §5 nor §6 applies to water resulting from hurricanes.

With respect to "[2]flood,"—the verb—§1 and §2 are not the same. The former refers to *flooding* and *overwhelming*, while the latter refers to *filling*. The same problems exists for parts of §3. It has much more to do with *overflow*—and water over the top—than it does with such a thing as levees bursting.

Significantly, definitions in other complex and thorough dictionaries are similar with respect to ambiguity. At the same time, it is quite all but true that if water, with some thickness, gets all over everything at or near the ground, then what we have is a flood, at least so far as popular and common usage is concerned. Nevertheless, it is perfectly clear that language is often used in informal ways, and it is perfectly clear that genuine distinctions are utilized in, for example, the sciences, and that they are not used correctly or in the same way in popular usage. On the other hand, the history of case law when using the term "flood" tends towards broad, informal, popular, and wide usage.

These problems could arise in connection with some insurance policies. Consider, for example, an endorsement to be found in at least some policies issued by Nationwide Insurance Companies. This endorsement, H-60107, is entitled "Hurricane Coverage and Deductible Provision Endorsement." It defines the term "hurricane" as meaning "a storm system declared to be a hurricane by the National Hurricane Center of the National Weather Service." It then defines the term "windstorm" to mean "wind, wind gusts, hail, rain, tornados or cyclones caused by or resulting from a hurricane." The endorsement then provides the following "Hurricane Coverage": "coverage under this policy includes loss or damage caused by the peril of a windstorm during a hurricane." It includes damage to a building's interior or property inside a building, "caused *directly* by rain, snow, sleet, hail, sand or dust[,] if *direct* force of the windstorm first damages the building causing an opening through which the above enters and causes damage." (Italics added.) However, the section entitled "Hurricane Coverage" contains an exclusion, although it is not entitled "Exclusion." Here it is: "Hurricane Coverage does not include loss caused by flooding, including but not limited to flooding resulting from high tides or storm surges." (Note the use of the phrase "storm surge.)"

This policy language contains some curious problems. One of the most interesting is the definition of "windstorm." It includes not only wind, but hail and rain, as well. The term "windstorm" does not include either snow or sleet. However, if rain damages the outside of a building and either sleet or snow damages objects inside the building, then there is coverage. Even odder

yet, the word "windstorm" includes any cyclone caused by or resulting from a hurricane. This is extremely odd, since, at least according to Emanuel, and most other sources, hurricanes and cyclones are the same thing.

It is perfectly clear from the exclusionary language, as well as the coverage section, that storm surges are covered, at least so long as they are storm surges and not floods. It is also perfectly clear that high tides are covered, although not floods caused by high tides. Presumably, waves moving on the top of storm surges would also be covered to the extent that they cause losses. Obviously, to the extent that Endorsement H-60107 covers buildings along the Gulf Coast, if those buildings were damaged by Katrina or Rita, they would be covered up to policy limits.

One of the most serious issues facing policyholders is the so-called "Concurrent Causation Rule," which is being supported energetically by the insurance industry and which has made progress in some states. A literal version of the rule is to be found in the interim exclusionary provision then applied to "Water Damage" which is a defined term, as we shall see presently. According to that language, losses are excluded when caused by "Water Damage" "regardless of any other cause or event contributing concurrently or in any sequence to those losses[.]" In other words, if water damage and something else together, temporally, cause a loss, then it is excluded; if some event causes "Water Damage," and the "Water Damage" is not covered, then there is no coverage, even if there would be coverage for the loss caused by the chain of events, even if losses caused only by the first event would be covered; and furthermore, if "Water Damage" caused some event or other, which normally would be covered, the losses caused by the normally covered event would not be covered, because the event in question was caused by "Water Damage."

If the words "flood," "waves," "tide," and "storm surge," do not have the same meaning, then what is to be done with the very standard exclusion which is common in many property policies, whether homeowners policies or commercial property policies. Here it is:

> We, the insurer, do not insure for loss caused directly or indirectly by any of the following. Such loss is excluded regardless of any other cause or event contributing concurrently or in any sequence to those losses, these exclusions apply whether or not the loss or event results in widespread damage or affects a substantial area...: "Water Damage"

The last two-word phrase is defined in the policy, as already indicated. Here it is:

> "Water Damage" means: a flood, surface water, waves, tidal water, overflow of a body of water, or spray from any of these, whether or not driven by wind[.]

(There are more features involved in the definition of "Water Damage," but they need not concern us here. Obviously, a *storm surge* is not the same as

a flood, a wave, a tide, or anything else listed in the definition of "Water Damage." If the policy is construed literally, flood caused by storm surge would not be covered and the waves on top of storm surge—if they did damage isolatable from the surge itself—would not be covered. However, any damage done by the storm surge itself would be covered.)

Problems associated with the word "flood" are even more severe. If one reads any thorough dictionary, it is perfectly clear that the word "flood" is ambiguous, although courts have not heretofore recognized that fact, or even implied it. Moreover, the actual definition of "Water Damage" includes both the word "flood" and the words "overflow of a body of water." It follows from this fact, that a flood is something other than an overflow. It is also clear that water breaking through levees is not the same thing as an overflow, because it is not an *over*-flow, but a bursting through.

It is clear, of course, that if wind caused damage, which was not caused by water, then there would be coverage for it. Consider, for example, what would be true if the wind blew a house down, before the water washed it away. Or, consider what would be true if the wind blew a roof off, before flooding affected the remainder of the house. Or, consider what would be true if flooding caused a house to float upward, and then wind blew it into another house.

CONCLUSION

Obviously, in the trials of these coverage cases, it will be necessary to understand hurricanes and how they work. Emanuel's book, *Divine Wind*, will be valuable for both lawyers (no matter what side they are on), adjusters,[24] public adjusters, commentators, historians, and—of course–policyholders. Dozens of insurance lawsuits have already been filed; one lengthy one filed by a lawyer for himself is handwritten and barely legible, if that.[25] Obviously some of them will involve flood, wind, rain, wave, and storm surge issues. They will also involve pollution issues.

The "Big Easy" continues to have problems. Trash is still to be found, as it were, all-over-the-place in some parts of the city and region.[26] The police

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[24]See Phil Gusman, "Katrina: Devastation on the Gulf Coast," 53 *Claims* 24 (October 2005) (suggesting, in part, that New Orleans Katrina disaster is reminiscent of the 1953 levee failures in the Netherlands).

[25]For copies of most of the "Katrina-Based Cases" filed in 2005, see www.michaelseanquinn.com. They included the handwritten pleading. It also included several Mississippi cases, although there are none included from Alabama. Consider also the Schillerstrom cartoon in the November 28, 2005 issue of *Business Insurance*. It pictures a house flooded by "Katrina Lawsuits" with male person marked "*Insurers*" standing on the roof and holding the following sign: "*Read the Policy*!" *Id* at 8. No reference is made the concept of *storm surge*.

[26]Clifford J. Levy, "Wrestling With Memories Amid Mounds of Trash," *New York Times A-12* (December 28, 2005)

may be taking their job a shade too intensely,[27] and that will lead to new Katrina-"caused" suits next year or the year after. And the "American Red Cross is borrowing $340 million against a $1 billion line of credit to keep operations going on the Gulf Coast[,] after it has already "spend more than $1 billion aiding Gulf Coast residents."[28]

Not everything is ruined, of course. Insurance companies may make lots of money in 2006 if the storms of 2005 do not recur, since prices will rise dramatically and there will be a 'hard market.' The New Orleans housing market is surprisingly buoyant.[29] School children are coming back although only by the hundreds, and some of them come mournfully.[30] Law clerks for Fifth Circuit judges in New Orleans are returning, including the circuit's "mediation lawyer." The Louisiana governor, Kathleen Babineaux Blanco, after making a fool of herself, is trying to make a comeback.[31] And a substantial number of sex criminals—and other accused felons—have fled the scene.[32] Apparently they are not returning. Of course New Orleans itself remains interesting to many outsiders as the result of its stormy history. Adjusters are to be found in a variety of places, of course. Tourists are also now visiting it in order to see the results of recent storms, and there are even tours.[33] FEMA has hired archeologists for a variety of reasons.[34] One doubts that their work will be of interest to insurers, and I doubt that their writings will ever match that of Professor Emanuel.

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[27]Shoot-To-Kill Police Policy Under Scrutiny, *Miami Herald: International Edition* 5A (December 30, 2005).

[28]Richard M. Walden, "In Charity, Too, The Rich Get Richer" [Editorial Page Article], *New York Times* A-19 (January 3, 2006)

[29]Gary Rivlin, "In New Orleans, Housing Sales Are Bright Spot, "*New York Times* A-1 (January 1, 2006).

[30]Susan Saulny, "Students Return to Big Changes in New Orleans," *New York Times* A-1 (January 4, 2006).

[31]James Dao, "After Storm, She Tried to Mend State, and Career," *New York Times* A-1 (December 30, 2005). And tourist districts are trying to bring the crowds back. Andrew Ward, "New Orleans Pins Hopes On New Year Revels," *Financial Times* 4 (December 30, 2005).

[32]Kevin Freking, "Sex Criminals Who Fled Katrina Feared On Loose Across the Nation," *San Francisco Chronicle* A-4 (December 31, 2006).

[33]Christopher Cooper, "Even After the Storm, New Orleans Visitors Can't Stay Away," *Wall Street Journal* A-1 (December 27, 2005). Tours have not begun in the countryside where Rita did a good deal of property damage. See Jere Longman, "With Coastline in Ruins, Cajuns Face Prospect of Uprooted Towns," *New York Times* A-1 (December 27, 2006). (Consider what was said about Cameron Parish, west of New Orleans near the Texas line. "Rita's storm surge of 17 to 20 feet again made clear just how vulnerable this low-lying parish is to hurricanes." Id. at A-18.)

[34]John Schwartz, "Archaeologists in New Orleans Finds a Way to Help the Living," *New York Times* D-1 (January 3, 2006).