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Should We Expect More Hurricane Seasons Like 2004?

By

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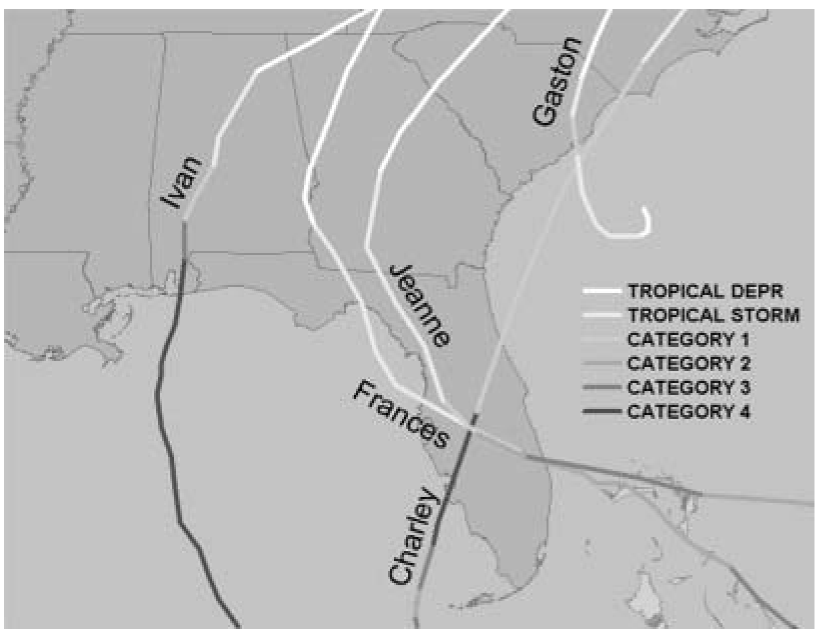
AIR Worldwide Corporation (AIR) is a leading risk modeling company whose solutions are used by insurers, corporations and governments to manage the financial impact of catastrophes and weather. In 1987, AIR pioneered the application of probabilistic modeling for the purpose of quantifying potential losses from extreme events. Utilizing the latest science and technology, AIR currently models the impact of natural catastrophes in more than 40 countries and the risk from terrorism in the United States.

Abstract: Based on the devastating impact of the 2004 hurricane season, questions abound as to whether last year's storms represented a rarified occurrence period or the beginning of an ominous pattern of severe weather in the years ahead. The following commentary will discuss those prospects, including the need for preparation.

Introduction

In the aftermath of the 2004 U.S. hurricane season, the industry is turning its attention to the season's impact on insurance and reinsurance practices and the catastrophe models on which insurers and reinsurers rely to manage their hurricane risk. In this article, we recap the 2004 season and examine how unusual it was from both a frequency and insured loss standpoint, including whether global warming had an impact on the frequency or severity of storms. Finally, we discuss the season's impact on catastrophe risk management practices and how companies can analyze and better prepare for future multiple event seasons.



The Season in Brief

On Friday, August 13th Hurricane Charley headed towards Florida's west coast. As few as 6 hours before landfall, Charley was forecast by the National Oceanic and Atmospheric Administration's National Hurricane Center (NHC) to make landfall near the Tampa/St. Petersburg area as a Category 2 hurricane on the Saffir-Simpson scale. However, 4 hours before landfall the NHC reported that Charley's intensity had increased to Category 3. Just 15 minutes later, in a highly unusual and unscheduled advisory, NHC announced that Charley was now a Category 4 storm, packing winds of 145 mph and heading further south than expected—straight for Charlotte Harbor and Punta Gorda.

As the storm intensified, it became more compact. At the time of landfall, around 5:00 p.m., the storm's radius of maximum winds was just 6 nautical miles. Charley was also moving at 25 mph—fast for a storm at this latitude—and was in and out of Florida in little time, cutting a narrow swath of damage from coast to coast. In the end, because of its small size and fast forward speed, Charley caused less damage and lower insured losses than might normally be expected from a powerful Category 4 hurricane. Nevertheless, it was the most intense storm to make landfall in the U.S. since Hurricane Andrew and was also responsible for the largest loss of the 2004 storms—currently estimated at $7.5 billion by ISO's Property Claim Services (PCS) unit.

Gaston, which made landfall in South Carolina on August 29, was little more than a distraction from the recovery efforts underway in Florida. With winds barely reaching 74 mph, the National Oceanic and Atmospheric Administration reclassified Gaston from tropical storm to hurricane status only in late November after a review of Doppler radar observations. PCS currently estimates losses at $65 million, mostly from flooding.

Hurricane Frances struck Florida's east coast just three weeks after Charley, on September 5. Although, Frances lost intensity and made landfall on Florida's east coast as a Category 2 hurricane, it was much larger than Charley and covered most of the Florida peninsula. Unlike the speedy Charley, Frances lumbered across Florida at just 7 mph, battering properties with damaging winds for a full 24 hours. AIR Worldwide's post disaster survey team saw evidence that the duration of Frances' winds, in addition to the storm's peak wind speeds, had a significant effect on the resulting damage. By virtue of its size and slow forward speed, Frances caused more damage and higher insured losses than might normally be expected from a Category 2 storm. PCS currently estimates insured losses of $4.6 billion for Frances.

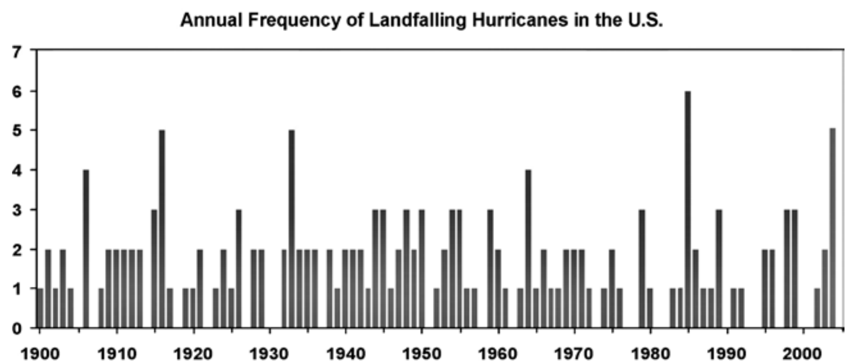
On September 16—less than two weeks after Frances made landfall—Hurricane Ivan arrived on the Gulf Coast as a Category 3 storm after causing widespread destruction in Grenada, Jamaica and the Cayman Islands. Ivan's actual landfall was in Alabama, but a majority of the losses occurred in the Florida panhandle around Pensacola. Many of the properties along this section of the Gulf Coast are more vulnerable than those in southern Florida due to differences in construction mix and building codes. Therefore, although Ivan impacted a less populated area with lower property values than either Charley or Frances, losses were second only to Charley—$7.1 billion according to PCS—and more than 60% occurred in Florida.

On the very day that Ivan made landfall in Alabama, Tropical Storm Jeanne was causing devastation on the island of Hispaniola in the Caribbean. Floridians breathed a sigh of relief as Jeanne headed away from the U.S., rambling on a circuitous and seemingly harmless path in the open Atlantic. But Hurricane Jeanne found its way back to Florida and made landfall within a few miles of Frances' landfall point on September 25 as a Category 3 hurricane. Jeanne was more intense than Frances, but was not as large or as slow moving. PCS currently estimates insured losses of $3.4 billion for Jeanne.

How Unusual was the 2004 Season?

Four of 2004's landfalling hurricanes were significant events, both in terms of their intensity and in terms of the damage and loss they inflicted. Though none came close to matching the damage totals caused by 1992's Hurricane Andrew, together the 2004 storms will cost insurers at least $23 billion. This represents the largest single season loss total since 1992 when Hurricane Andrew's losses, combined with those of Hurricane Iniki in Hawaii, caused the equivalent of some $30 billion damage based on today's property exposures and values.

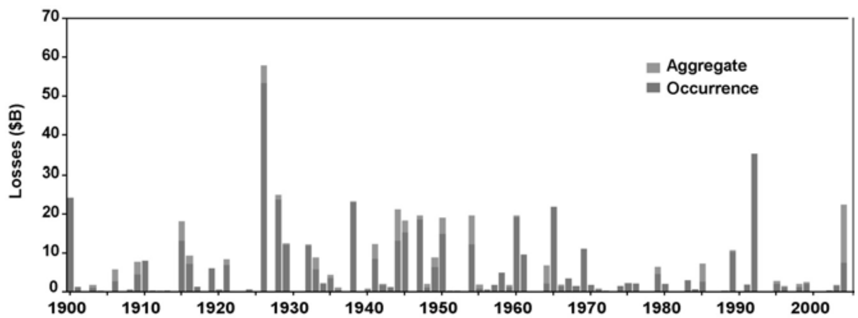
However, if we take a broader view, the 2004 season becomes somewhat less unusual. It is one of four since 1900 in which five or more hurricanes made landfall in the U.S., an average of about one every 25 years.



While only three hurricanes made landfall in Florida, the state clearly bore the brunt of the four major storms. Although not a frequent occurrence, four hurricanes have been known to impact a single state. In 1886, four hurricanes made landfall in Texas and three additional hurricanes made landfall in Florida along the Gulf coast.

In terms of insured losses, 2004 was above average, but not highly unusual. Many published reports have been issued comparing this season's losses with historical losses. However, those comparisons typically use the original losses or the original losses updated for inflation only and are therefore misleading since they do not account for growth in the number and value of properties that would be affected. By resimulating all historical hurricanes of the past 104 years, insured losses can be estimated for each of the historical storms were they to recur at today's property exposures and values, as shown in the following figure. Using this approach, AIR Worldwide has determined that 2004 is one of eight years in which losses would have exceeded $20 billion. The year with the largest loss would be 1926, when a Category 4 storm hit the Miami area.

Estimated Losses from Historical Storms Based on Current Numbers and Values of Exposed Properties



The largest-loss storm in each year (the occurrence loss) is also shown relative to the total, or aggregate, losses. What is more unusual than either the number of storms or the total loss is that the losses this past season were much more evenly divided between the hurricanes than in previous years, in which one storm tended to dominate total hurricane losses.

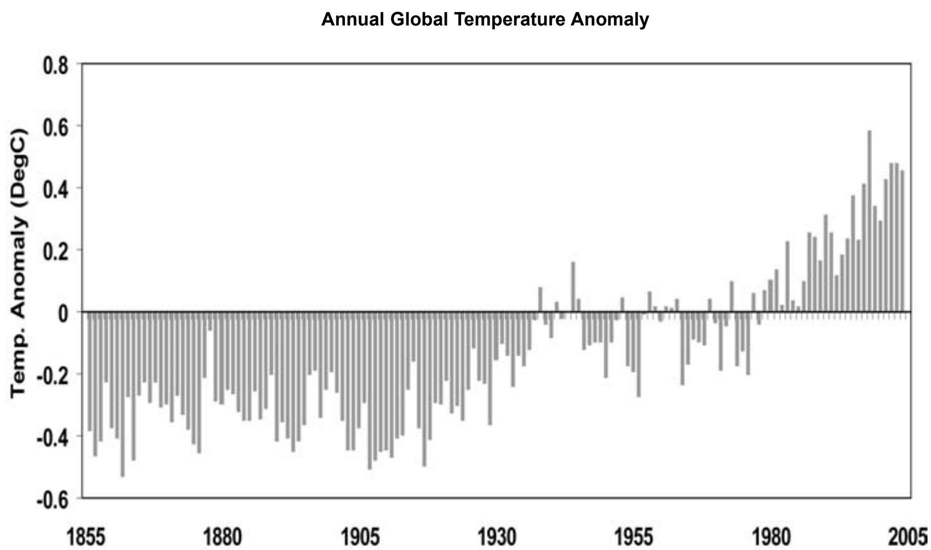
The AIR hurricane model estimates that a single year with five or more hurricane losses of at least $25 million (PCS's definition of a catastrophe) in the U.S. has a return period of only about 34 years. A similar calculation for Florida only reveals that the expected frequency of four hurricane losses in that state in a single season is about once every 150 years—still within the range to which most insurance companies manage their catastrophe risk

Results from the AIR hurricane model also indicate that insurers can expect to see an aggregate loss exceeding $20 billion about once in 13 years for the U.S. and about once in 24 years for Florida only. Clearly, from a risk management point of view, losses of this magnitude should not be considered rare.

Impact of Global Warming

The 2004 hurricane season has led some to ask—and others to conclude—that global warming is having an impact on the frequency and severity of tropical cyclones. Although the debate on global warming has continued for several decades and growing evidence indicates that the earth's atmosphere has indeed been warming over time, the relationship between global warming and the frequency and intensity of hurricanes is more difficult to quantify.

The chart on the following page provides average annual global air temperatures since 1860. The data show that, over that period of 150 years, the earth's climate has undergone cycles of warming and cooling. From about 1850 to about 1950, the earth was in a relatively cool period. Over the next 25 years, until about 1975, that cooling period changed to a period of average temperatures. But, over the last 28 years, earth's atmosphere has clearly warmed such that since 1998 we've seen the five warmest years on record.



The interactions between the earth's atmosphere, ocean systems, land surface, and space are quite complex. For example, there is significant feedback that occurs within the earth's environment: the atmosphere interacts with the ocean, while radiation from outer space supplies heat to the atmosphere, land and ocean surface. In the end, weather is the result of the atmosphere's attempt to equalize global energy imbalances. For example, there is much more heat in the tropics because more radiation from the sun is received along the equator. The formation of tropical storms is one way the atmosphere collects this excess heat and transfers it. Because changes in any one of these subsystems, like the average air temperature, feeds back on each of the environment's subsystems, the response of the atmosphere to a change in one of the subsystems is very complex.

To address the effect of global warming on hurricane frequency, consider the following example of feedback. Global warming results in the increase in atmospheric temperatures, which in turn increases the evaporation of ocean water into the air. This results in an increase in water vapor available for the formation of clouds and precipitation, a necessary component for hurricane formation. A simple conclusion we might reach is that more hurricanes will form as a result of this increase in available water vapor.

On the other hand, more clouds forming globally will lead to a decrease in solar radiation reaching the surface, thereby reducing the temperature of the ocean and decreasing the frequency of hurricanes. But, clouds also cause atmospheric warming via the greenhouse effect by partly preventing the escape of earth's heat to space. All of these effects feedback and compete with one another, making it difficult to determine whether hurricane frequency will ultimately increase or decrease due to global warming.

How will global warming affect the intensity of hurricanes? Global warming will increase the average temperature of the ocean surface resulting in more energy for tropical cyclones and stronger storms. At the same time, however, warming air temperatures in the tropics is known to increase vertical wind shear or the rate at which the wind speed changes with height. Wind shear is destructive to tropical storms, and will hence reduce the average intensity of a hurricane. Again, we see that even if we accept that global warming is occurring, the environmental system responds to it in nonlinear and complex ways.

So, what is the impact of global warming on the frequency and severity of hurricanes? There is currently no consensus in the scientific community, where studies point to conflicting effects, or no effect at all. While there are certainly ways in which the by-products of global warming could increase the frequency and intensity of hurricanes, it is still unknown what the net effect of global warming is on either of these aspects of tropical cyclone activity.

Impact of the 2004 Season

In 1992, the insurance industry was unprepared for the devastation that Hurricane Andrew wrought on South Florida. It was a defining moment for the industry and, in the aftermath of Andrew, building codes were strengthened, the Florida Hurricane Catastrophe Fund was created, and probabilistic catastrophe modeling became the industry standard technology for managing the risk from extreme events. As a result, the industry was much better prepared for the 2004 season. One telling metric: at least eleven insurers went out of business after Andrew, while just one declared insolvency as a result of the 2004 hurricanes.

Can we expect further changes as a result of last year's hurricanes? Already, Florida's legislature has modified the state's hurricane insurance regulations to protect homeowners from the possibility of multiple deductibles, even reimbursing those who paid multiple deductibles in 2004. And while improved building codes adopted since Hurricane Andrew generally proved to be effective, there may well be further review of regional differences in building codes.

Preparing for the Future

The focus since Hurricane Andrew has largely been on preparing for the next "big one," whether hurricane or earthquake. The 2004 hurricane season may well join Hurricane Andrew as a defining moment for the way insurers manage catastrophe risk, in that it was a painful reminder that insurers must also assess and manage the risk of multiple moderate losses that can quickly mount up.

Fortunately, the same robust catastrophe modeling technology insurers use to estimate occurrence losses can also be used to estimate losses resulting from multiple event seasons—for a single peril or even across multiple perils. One approach to creating hurricane models, for example, involves the generation of a large catalog of simulated years of hurricane activity. Each storm in this catalog has a range of parameters that defines the life cycle of a hurricane, including date of landfall, central pressure, radius of maximum winds, and storm location. This approach makes it extremely easy for companies to determine the probability of multiple-event seasons, either for the industry as a whole or for individual company portfolios. Models using this approach can also produce both robust occurrence and aggregate loss estimates across multiple perils and for individual events within a multiple event season. Taking advantage of these capabilities, insurers can avoid having to purchase extra coverage midseason at unfavorable prices.

While the 2004 season was certainly an active one, it was not extraordinary and insurers should be prepared for such seasons in the future. Companies that take full advantage of their catastrophe modeling systems to account for the probability of multiple event seasons will be better positioned to handle the financial impact of future catastrophic events.