

# Preparing for the Past: Global Warming and Response to Hurricanes in the U.S.

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## INTRODUCTION

Recent experiences in the United States with intense hurricanes Hugo (1989) and Andrew (1992) have prompted reconsideration by public and private officials of a number of hurricane-related preparation and response strategies. In addition to existing uncertainties surrounding hurricane policies, there is an emerging concern about a changing climate. Such concern has contributed to uncertainty about how best to act to reduce vulnerability to hurricanes. A central question that needs to be asked in the context of U.S. hurricane practices is as follows: Does global warming matter? A look at the hurricane problem facing the U.S. suggests that as much can be learned from looking at the past as it can be learned by speculating about the future.

### Societal Vulnerability to Hurricanes

The United States has become more vulnerable to hurricanes during several decades of relatively low hurricane incidence. Two key reasons center on demographic changes and climate fluctuations.

#### Demographic Changes

Coastal populations in U.S. counties from Texas through North Carolina have increased dramatically in recent decades. According to the U.S. Census Bureau, the combined population of Dade, Broward, and Palm Beach counties in south Florida,

with more than 4 million residents in 1990, was greater than any one of 29 U.S. states. About the same number of people now live in Dade and Broward counties as lived in all of the 109 coastal counties from Texas through Virginia in 1930.

Table 1 shows that the number of large population areas along the southeast U.S. Atlantic and Gulf Coasts has increased dramatically over the past twenty years. An effect of population growth is to create more coastal locations that are vulnerable to a hurricane impact.

Increasing population leads to increasing property at risk to hurricanes. A study under way by Applied Insurance Research in collaboration with the Insurance Institute

for Property loss Reduction reports that the amount of insured property along the U.S. Atlantic and gulf coasts has increased much faster than has the population, even after accounting for inflation. The total amounts of insured property are staggering. Over \$3.1 trillion worth of property was insured in 1993, an increase of 69% (50% excluding inflation) over the 1988 total of about \$1.9 trillion. The 1988 total represented an increase of 64% (35% after inflation) over the 1980 total of about \$1.1 trillion. Insured property is an important component of societal concern about its vulnerability to hurricanes.

#### Climate Fluctuations

Hugo and Andrew notwithstanding, the 1970s, 1980s and 1990s have seen fewer hurricanes than previous decades. Consider that from 1930 to 1959, 25 major hurricanes struck the U.S.; From 1960 to 1989, only 15 made landfall. Figure 1 shows hurricane landfall for Florida for the periods 1941-1950 and 1971-1980. In the earlier decade 20 storms made landfall, in the later decade there were only 4. It is clear that, with respect to major hurricanes, the climate has already changed. Unfortunately our good climate fortune in recent decades has led, in many cases, to complacency about vulnerability to hurricane impacts.

### Future Hurricane Incidence and Global Warming

In an effort to understand how climate might change in response to increasing levels of atmospheric carbon dioxide – popularly known as global warming – scientists have developed computer models of the Earth's atmosphere. Using such models, some scientists have suggested that the number of hurricanes, their intensity, and landfall frequently may increase due to global warming, while other scientists have suggested that Atlantic hurricanes would decrease. Many groups affected by hurricanes are paralyzed by this scientific uncertainty. But, do we have to know the future to improve present-day hurricane preparation and response strategies? ➤

Table 1. US Coastal population growth, 1970-1990, by number of counties from Texas through North Carolina (95 total) with populations greater than 250,000 and 100,000 and less than 50,000.

COUNTIES WITH	YEAR	1970	1990	Example of a storm that made landfall in such a county and total damages in 1993 US Dollars
Population greater than 250,000		9	18	Hugo (1989) \$8.2 billion
Population greater than 100,000		21	36	Frederic (1979) \$3.8 billion
Population less than 50,000		54	38	Andrew (1992, Louisiana) \$1.0 billion

Given the extensive social and demographic changes since the 1930-1959 period of relatively high hurricane incidence, it is not only important, but imperative to ask whether our current hurricane preparation and response strategies would stand up should the high incidence of landfall along the Atlantic and gulf coasts return. We do not need a model to tell us that hurricane frequencies vary. Based on the fact that during various periods in the historical record hurricane numbers, intensities, and landfall frequencies have been both depressed as well as elevated from the long-term average in the historical record, one can assume that they will eventually rise again. It, therefore, is prudent to consider current hurricane-related policies under the conditions of past climates and present demographics. This approach is generally called the "forecasting by analogy" method of analysis. When one does so, the results are frightening. Research suggests tens of billions of dollars in costs if a major hurricane were to strike a major U.S. metropolitan area; \$52 billion for New Orleans, Louisiana; \$80 billion for Galveston-Houston, Texas. Estimates of \$50 billion or more in damages resulting from a single storm are becoming commonplace. The fact is that either Hugo and Andrew, as bad as they were, could have been very much worse had they not made landfall over relatively lower populated areas, as compared to nearby locales. There is reason to believe that Andrew was only twenty miles away from being a \$50 billion storm.

**What Can be Done?**

Before asking if we are prepared for the future, we ought to ask if we are prepared even for past known events and climate fluctuations. The future is uncertain, the recent past, however, is certain. Once we consider ourselves "prepared for the past" - so to speak - we can seek additional proactive improvements for the future. It would be tragic to ignore the qualitative as well as quantitative base of experience that is readily available. Besides, for many public and private decision makers the cause of increased hurricane incidence is of less importance than whether the incidence of such extreme meteorological events will increase. While analysis of hurricane incidence based on global warming remains inconclusive, history tells us with some degree of certainty that the incidence of hurricanes will eventually increase. What will we do if the next several decades were to witness the hurricane activity of the 1940s and 1950s? The historical record shows that, in the twentieth century, an average of 2 major hurricanes have struck the U.S. coast every 3 years. Based on this historical record, if the average damage due to each major hurricane were \$4.5 billion, then the

U.S. would suffer \$3.0 billion in hurricane-related losses per year. Hurricanes Hugo and Andrew suggest that an estimate of \$4.5 billion per major storm may be too low. If the average damage due to a major hurricane is instead \$7.5 billion, for example, then the annual damages suffered by the U.S. would be at least \$5.0 billion. And these figures neglect minor hurricanes and the case of a higher-than-average incidence of landfalling hurricanes. Are we even prepared for the historical average, much less the worst case scenario? I suggest

that we are not. Is there risk in "preparing for the past"? The worst case scenario may be that we over-prepare for hurricanes. But due to the increased exposure of U.S. coastal locations due to demographic shifts, many actions to better prepare for hurricanes could be taken before we become over-prepared. The alternative is that we ignore the past and focus on knowing the future, and in the process miss the most important and reliable information available to improve our hurricane preparedness and response strategies.

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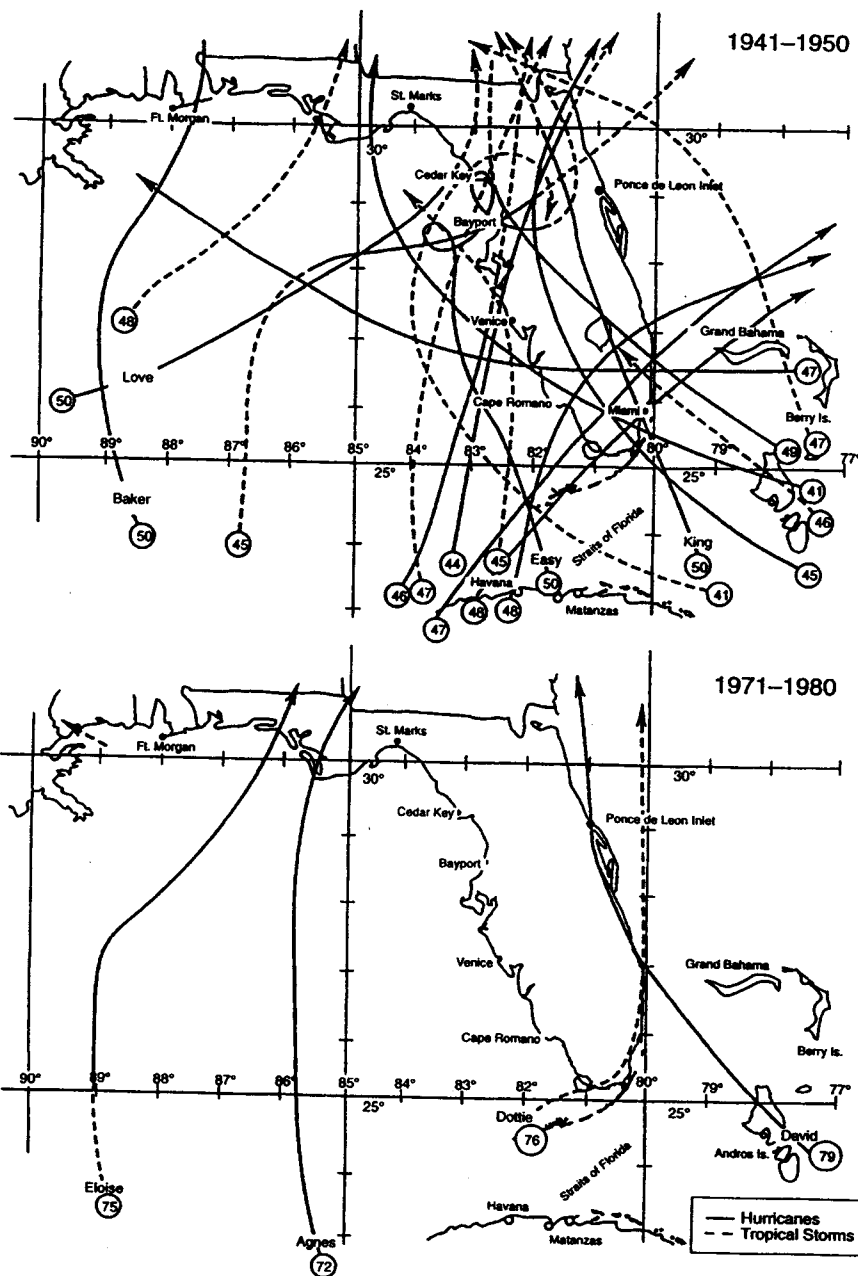


Figure 1. A climate change - Landfalling hurricanes and tropical storms in Florida for 1941-1950 and 1971-1980. Source: F. Doehring, I.W. Duedall, and J.M. Williams. Florida Hurricanes and Tropical Storms, 1871-1993: An Historical Survey. (Florida Sec. Grant Program, TP-71).