GLOBAL REINSURANCE

EYES FOR THE STORMS

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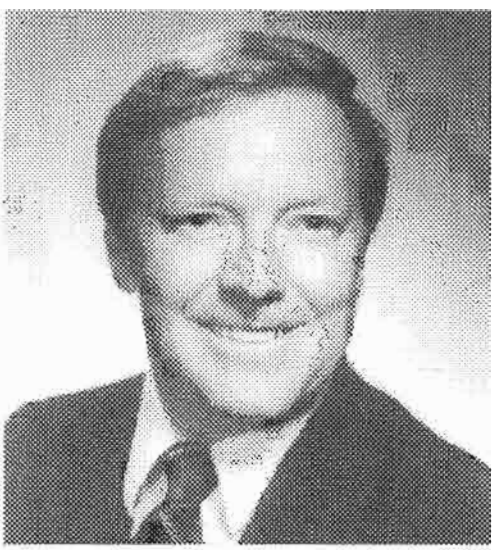

IT will soon be five centuries since Columbus discovered America via the Caribbean, so it is worth recalling that hurricanes were known in his day. The word, incidentally, seems to come from the names of Amerindian storm-gods.

Then it was a question of a few souls dwarfed in the open expanse by seemingly supernatural forces. Today, hurricanes are a major problem for the United States and other countries in the western hemisphere. They cost huge sums either through preventative action or in pay-outs by insurers for whom the least of the bill consists of claims on policies of lives cut short.

The economic and social cost is why there is a trio of centers run by the National Weather Service (NWS), which is an agency of the National Oceanic & Atmospheric Administration within the US Department of Commerce. Two of these are the National Severe Storm Forecast Center, located in Kansas City (Missouri), and the parental National Meteorological Center near Washington (DC). The third is the National Hurricane Center (NHC) based in Miami (Florida).

The responsibilities of the NHC are actually broader than providing forecasts and warnings for hurricanes — which can also be called tropical cyclones. Yearlong, it also sends out tropical analyses and interpretive messages as well as forecasts for public, marine and aerial benefit both by American and foreign users. The area of responsibility includes the tropical and subtropical regions of the North Atlantic and eastern North Pacific oceans as well as the Caribbean Sea, the Gulf of Mexico and the adjacent territories.

Yet the NHC is best known for predicting hurricanes and warning when they are imminent. This general service, provided through the US government, is used by insurance companies as well as most other private and public sectors with an interest in averting damage. Tailored products are sometimes provided through the private sector.

The programs of the NHC have become highly visible because of large losses of property and lives due to hurricanes in the past. A continuing concern is that potential loss due to these natural forces is increasing daily as a result of the growth in population — not only in the United States but elsewhere in this hemisphere. To understand the present and future structure and operations of the NHC, one needs the perspective of its history and the changing nature of the hurricane's threat to the citizens of the western hemisphere. This applies specifically to Americans along the Gulf of Mexico and Atlantic Coast.

Over two centuries ago, Benjamin Franklin discovered that hurricanes move from one place to another without being steered by winds on the surface. However, it was not until 1847 that a warning-system for hurricanes was first established in America. Primarily based on barometric readings, the display was established by a British officer, Lieutenant-Colonel William Reid while on duty in Barbados with the Royal Engineers. The first systematic scheme is believed to have been in Cuba during the eighteen-seventies. By observing upper and lower clouds, Father Benito Vines apparently issued routine warnings from Belen College in Havana.

In 1870 itself, the US Congress made appropriations for organizing a national meteorological service under the auspices of the Signal Corps of the Army. However, there was little warning five years later for a hurricane which killed 176 people in Texas, so 1890 saw the creation of the Weather Bureau henceforth under the Department of Agriculture.

It was the Spanish-American War of 1898 which brought about a comprehensive hurricane-warning service for America. Recalling 114 lives lost — from Florida to Pennsylvania — two years earlier, President McKinley declared that he feared a hurricane more than Spain's navy. Congress authorised funds to establish observing stations throughout the central and eastern Caribbean, including Willemstad and Santo Domingo.

After that war, more stations were established and the West Indian headquarters was transferred from Kingston to Havana. A system was also developed to give all the islands as well as ships of all flags the benefit of the Weather Bureau's hurricane-warning service. This recognition of international responsibility continues today under the auspices of the World Meterological Organization (WMO).

However, for the continental United States the forecasts and warnings continued to come from Washington (DC) and there were several instances of dissatisfaction among coastal communities right up to 1934 when Galveston — a sensitive area since 1901 when 6000 were killed without warning — sought an update on an alert. The map-plotter on duty wired back: "Forecaster on golf course — unable to contact".

The next year, Congress appropriated $80 000 for new centers in Florida, Massachusetts, Louisiana and Puerto Rico as well as the issuance of hurricane-advisories at least four times a day. In 1943 the primary office was moved from Jacksonville to Miami, where in 1966 the national hurricane-warning service was finally concentrated. Following further assumption of responsibilities, the National Hurricane Center now has a staff of 40.

Since originally locating in Florida, there has been a dramatic increase in the harnessing of technology to spot and track hurricanes as well as disseminate forecasts and alerts. There was reconnaissance by aircraft pre-war and the first planned and known flight into the eye of a hurricane was in 1943. By the fifties this was supplemented by radar and then the first meteorological satellite was put up in 1960 to be followed eventually by those with polar orbits and geostationary ones (in both cases visible and infra-red). And as from 1972, oceanic buoys became a vital part of the hurricane-warning system. The next generation weather radar (NEXRAD) systems in the modernised and restructured NWS are expected to play a major role in improving short-term warnings of flash floods, high winds and possible tornadoes as hurricanes decay.

Meanwhile the teletypewriter and radiosonde, introduced in the thirties, have given way to the computerized display of most conventional meteorological data and suchlike. This is known as the Automation of Field Operations & Services (AFOS) which remains the NWS' primary system of analysis and communications today — supplemented more recently by personal computers linked to the basic AFOS system.

However, even all these means — including statistical/dynamical models — are not enough for the skilled tracking and warning of hurricanes to keep pace with the growth of population liable to be affected. Take the number of Texans living in counties along the Gulf of Mexico. In 1910 they numbered only half a million, but today the total has reached almost five million. And whereas there were less than a milllion Floridans at the turn of the century, the Sunshine State is one of the fastest-growing in the nation with about 12

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million inhabitants — mostly on the seaboard.

Nor is the problem confined to the rapid increase in the permanent population of the USA's coastal counties prone to hurricanes. Taking into account the number of people there on a weekend, seasonal and holiday basis, the population increases tenfold or hundredfold and more on barrier islands such as Ocean City (Maryland), Gulf Shores (Alabama) and Padre Island (Texas).

Also, these areas are subject to inundation from the rapidly rising waters known as the storm surge associated with hurricanes that generally result in catastrophic damage and potentially large losses of life. Over the past several years, the warning system has provided adequate time for the great majority of the people on barrier islands and along the immediate coast to move inland when hurricanes have threatened. However, it is becoming more difficult each year to evacuate people from these areas due to roadway systems that have not kept pace with the rapid population growth. This condition results in the requirement for longer and longer lead times for safe evacuation. Unfortunately, these extended forecasts suffer from increasing uncertainty. Furthermore, rates of improvements in forecast skills have been far outpaced by rates of population growth in areas vulnerable to hurricanes.

The combination of the growing populations on barrier islands and other vulnerable locations, and the uncertainties in the forecasts poses major dilemmas for forecasters and local and state emergency management officials alike. How do you prevent complacency caused by false alarms and yet provide adequate warning times?

We have also been trying to get the insurance industry to be more active in developing and

applying reasonable building codes and practices – yet with little success. Sometimes insurers do not wish to issue policies on the barrier islands, but they are often obliged to by law through risk-pools in order to continue doing business in a particular state.

Preparations for hurricanes are expensive. When a hurricane is forecast to move inland on a path nearly normal to the coast the area placed under warning is about 300 miles in length. The average cost of preparation, whether the hurricane strikes or not, is more than $50 million for the Gulf Coast. This estimate covers the cost of boarding up homes, closing down businesses and manufacturing plants, evacuating oil rigs, etc. It does not include economic losses due to disruption of commerce activities such as sales, tourists cancelling reservations, etc. In some locations, the loss for the Labor Day weekend alone can be a substantial portion of the yearly income of coastal businesses.

An example of such losses were experienced along the Florida panhandle during Hurricane Elena in 1985. If the width of the warned area has to be increased by 20% because of greater uncertainties in the forecast, the additional cost for each event would be $10 million. If uncertainties in the hurricane strength require warning for the next higher category of hurricane (Saffir/Simpson scale, Hebert and Taylor 1988), then major increases in the number of people evacuated and preparation costs would be required. Of course, if these uncertainties meant that major metropolitan areas such as Galveston/Houston, New Orleans, Tampa, Miami, or a number of other major coastal cities would or would not be included in the warning area, the differences in preparation costs would be substantially more than the $10 million, and the number of people evacuated would be substantially more than the tens of thousands of people. For instance, in the case of the Galveston/Houston area, an increase in storm strength of only 20 miles h^{-1} (from a category-2 hurricane to a category-3 hurricane on the Saffir/Simpson scale) would require the evacuation of an additional 200 000 people. Likewise, if major industrial areas such as Beaumont/Port Arthur, Texas, or tourist areas such as Atlantic City, New Jersey were affected by these uncertainties, the financial impact would be quite large.

Economic factors receive serious consideration from NHC, and local and state officials not only for direct but also for indirect effects on people response. People will not continually take expensive actions which, afterwards, prove to have been unnecessary. If we consistently over-warn by wide margins, people will not respond and such actions could result in large loss of life. To maintain credibility with the general public, the NHC and local and state officials cannot treat all hurricanes as if they were Camiles, Gilberts or Hugos! Such an exaggerated approach may indeed provide maximum protection of life for a given event, but it endangers many more lives the next time when the threat may be even greater.

Hurricane Camille (1969) and Hugo (1989) were some of the most intense hurricanes to make landfall in the western hemisphere during the past three decades.

Finally, the hurricane problem is compoun-

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ded by the fact that 80% to 90% of the people who now live in the hurricane-prone areas have never experienced the core of a major hurricane (Saffir/Simpson scale-category 3 or stronger; Herbert *et al.* 1984). Many of these people have been through weaker hurricanes or been brushed by the fringe of a major hurricane. The result is a false impression of the damage potential of these storms. This frequently breeds complacency and delayed actions which could result in the loss of many lives. An example of the potential danger are those people living on barrier islands who might be reluctant to evacuate under "blue sky" conditions until they see the actual threat (waters rising and winds increasing). The result could be people trapped in those areas as waters cut off escape routes. This situation nearly happened for about 200 people on western Galveston Island during Hurricane Alicia of 1983.

This type of response primarily results from three major factors. First, major hurricanes are infrequent events for any given location. Second, for more than the past two decades, major hurricanes striking the United States coast have been less frequent than for the three previous decades. Finally, it has been during this period of low hurricane activity that the great majority of the present coastal residents moved to the coast.

Significantly, property damage spiraled upward in tandem with the coastal populations until the last two decades when it levelled off. In fact, if it had not been for the more than $7 billion loss caused by Hurricane Hugo in 1989, a significant decrease in losses would have been noted. This figure clearly demonstrates the improvement in the effectiveness of hurricane forecast warning, and response programs since the turn of the century. However, with the tremendous increase of populations in high-risk areas along our coastlines, the concern is that we may now not fare as well in the future when hurricane activity inevitably returns to the frequencies experienced during the forties, fifties and sixties.

Forecasts of the track for tropical cyclones have been improving at a slow but steady pace for at least the past three decades. Advancing technology is providing the opportunity to increase greatly the rate of improvement and to provide better products for warning along the coast and inland. However, the rates of forecast will continue to be much slowere than the rate of growth among the population in areas prone to hurricanes.

Unless adequate means of evacuation and/or places of refuge are provided for residents in existing and planned communities, on barrier islands and in other vulnerable coastal communities (which keep required time of evacuation to less than between 24 and 36 hours) greater over-warning could result in a significant increase in the loss of life due to hurricanes.

Yet developers and home-owners can mitigate much of the effects of damage to property through use of proper building codes and practices. The added cost of such practices is about 2% to 3% of the cost of the house. Proper zoning could also reduce costs.

This is where property insurers have to exert influence. It is certainly possible to put to buildings that will withstand the great majority of hurricanes, if there are proper set-backs, elevations and reinforcements, including shutters for all windows, against the forces of the wind. ■

Dr Robert C. Sheets FAMS has been director of the National Hurricane Center since 1988. He joined it eight years earlier, becoming deputy director in 1985 and acting director in 1987. After reading mathematics with physics at Ball State University in Indiana, he took further degrees in meteorology at the University of Oklahoma. He was with RCA before being an air weather service officer in the USAF from 1961 to 1964. From 1965 to 1980 he was with the National Hurricane Research Laboratory rising to scientist chief scientific officer. Besides frequently appearing on television and lecturing in many countries, he has written well over 50 articles on hurricanes; these have appeared in such publications as Science Annual *and* Weather & Forecasting.