A BRIEF HISTORY OF THE UNITED STATES HURRICANE WARNING SERVICE

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Prior to the establishment of a Federal Weather Service under the Signal Corps in 1870, there had been only one hurricane disaster in the previous two decades, and there is no evidence that either the Weather Service or the public at that time were 'hurricane conscious'. However, in August 1873 the Signal Corps did begin obtaining weather reports from Havana and Santiago, Cuba, and from Kingston, Jamaica, shortly thereafter. The printed weather map on September 28, 1874, was the first to show a hurricane, which, on that date, was centered off the coast between Jacksonville and Savannah.

The Rev. Benito Vines of Belen Observatory, Havana, Cuba, issued a hurricane warning for Cuba on Sept. 11, 1875, and this may have been the first formal hurricane warning issued in the western hemisphere.

On Sept. 16, 1875, a savage hurricane destroyed Indianaola, Texas, without much warning, killing 176 persons. General public dissatisfaction with weather forecasting by the Signal Corps resulted in the creation of the Weather Bureau in 1890. Shortly thereafter the transmission of West Indian reports to the United States discontinued because of doubt about the legality of spending money for weather stations outside the country, an item of about $3000. The following year the legality of such a procedure was firmly established and six stations, scattered throughout the Antilles, began transmitting one observation a day. In 1888 and 1889 San Juan and Antigua were added to the list.

When the Spanish American War broke out in 1898, a serious concern about possible hurricane effects on the war effort developed. President McKinley, recalling the 1896 hurricane which killed 114 persons from Florida to Pennsylvania, declared that he feared a hurricane more than the Spanish Navy. Up to that time hurricane warnings had been issued only for United States coastal areas but now a more extensive system was set up to include warnings for shipping and the military. A hurricane forecast center was installed at Kingston but was transferred to Havana on February 1, 1899, and all areas in the West Indies were given the benefit of the hurricane warning service. The warning service was extended later to Central America and Mexico and continues up to the present time, although Mexico and some of the larger Caribbean Islands now make their own warning distribution.

The most disastrous hurricane in the United States from the standpoint of loss of life struck Galveston, Texas, on Sept. 8-9, 1900, killing some 6000 persons. There is no record of any

formal hurricane warning reaching the Galveston area, although advices of a hurricane warning service was transferred to Washington, D. C., and concentrated there until 1935. On one storm in the early 1900s, reports from the Lesser Antilles indicated the existence of a tropical cyclone in the vicinity and during the following week, at one time or another, hurricane warnings were ordered up from Charleston, South Carolina, to Brownsville, Texas, only to have the hurricane finally show up at Bermuda.

In 1910 a severe hurricane moved across western Cuba, battering Havana on October 14 and 15, then disappearing over the Gulf of Mexico. On October 17 Havana was surprised by an apparently new hurricane which then moved northward over the Florida peninsula causing 30 fatalities and heavy damage. Ship reports received later by mail definitely proved that the first storm had moved on a broad loop in the southeastern Gulf and it was the same storm striking Havana and to some extent Key West twice.

One might easily conclude hurricane forecasters were never right during this period. However, it is usually the 'busts' that result in some action to improve the service and unfortunately the public remembers the forecast mistakes rather than the forecast successes. It should also be remembered that even violent hurricanes may be comparatively small, often only 100 to 150 miles in diameter. Many may move through the sparse island network without detection. More remain out over the open Atlantic. Not until August 26, 1909, did the SS Cartago, near the coast of Yucatan, radio the first ship report indicating the existence of a hurricane. Thus forecasters usually had little or no information about the location of the hurricane or its direction and rate of movement and were often unaware of its existence. Yet under these severe handicaps warnings for many hurricanes were suprisingly adequate.

During the first quarter of the present century hurricane activity was at a minimum. For example in 1914 there was only one tropical storm and it was not of hurricane intensity. Most of the major storms affected only the western and central Gulf coasts.

In 1921 a rather severe hurricane struck the Tampa Bay – Tarpon Springs area. This storm was well forecast. In late September 1924 a tropical storm moved inland near Cedar Key accompanied by torrential rain and gales with no warning. On November 30 – December 1, 1925, a tropical storm of about hurricane intensity moved inland just south of Tampa with no warning, killing a number of persons.

The first in a series of great hurricanes struck the Miami area on September 18, 1926. Forecasters were aware on the 16th of a hurricane passing some 75 to 100 miles north of Puerto Rico but only one additional report from the vicinity of the storm reached the forecast center in Washington until the hurricane came ashore on the southeast Florida coast two days later. This report came from Nassau indicating the wind had reached 80 m.p.h. from the northeast at 7 a.m. on the 17th. On this date in Miami the barometer was somewhat below normal and the northeast wind a little gusty but otherwise there were no indications of an approaching hurricane until after 7 p.m. when the barometer began falling rapidly. During the day complacent Miamians went about their business as usual. There had been no hurricanes in the area for 20 years, and 95% of the residents had never been through one. The forecaster on duty in Washington at 10 p.m. had put on his topcoat and, having completed his evening forecasts, prepared to leave. He hesitated, removed his coat, and went back to the forecast desk and dictated a hurricane warning for South Florida. The warning reached Miami shortly after 11 p.m. Mr. Richard Gray, a meteorologist in charge, promptly

hoisted ... hurricane flags at the Post Office and then went to the display tower on Miami Beach to do the same. By the time he reached the beach around midnight the wind was already blowing so hard he required assistance to hoist the flags. By 1:00 a.m. winds reached hurricane force along the beached, but most Miamians had gone to bed unaware of the rapidly approaching destructive storm.

In 1928 an equally severe hurricane came ashore at Palm Beach and drowned about 1800 persons around Lake Okeechobee. The intensity and progress of this hurricane was well forecast although no one anticipated the Okeechobee disaster.

The largest number of known Atlantic tropical storms — twenty-one, 9 of them hurricanes, developed in 1933. In mid-August a rather severe hurricane struck the North Carolina and Virginia Capes without hurricane warnings and later the eye passed over Washington D. C. Approximately a month later a hurricane of equal intensity approached Cape Hatteras and this time the Weather Bureau went all out in warning the coast, Chesapeake Bay and the Washington area. The hurricane promptly recurved out over the open Atlantic barely touching Cape Hatteras.

A tropical storm formed in late August 1934 in the central Gulf of Mexico and on a Sunday forenoon the Washington forecaster issued a hurricane warning for the Upper Texas coast. Since there would be no additional observations until 7 p.m. the forecaster, as usual, went home, planning to return in the evening to issue the regular and hurricane forecasts. In Galveston, which had continued to be a very sensitive area since the 1900 disaster, the populace scanned the sky for indications of the forecast hurricane. It was moving more slowly than the morning advisory indicated and weather conditions remained serene. Finally by mid-afternoon the anxious Chamber of Commerce wired the Washington Weather Bureau for the latest information. The map plotter on duty honestly but indiscreetly wired back: "Forecaster on golf course — unable to contact." In Galveston the weather remained quiet but temperatures in the Chamber of Commerce rose rapidly.

Long before the end of the 1934 hurricane season widespread criticism of the hurricane service reached Congress and the President. The Presidential Science Advisory Board was asked to analyze the problem. Its recommendations included decentralization of hurricane forecasting, a 24-hour teletype writer hookup along the Gulf and South Atlantic coasts, weather observations in the hurricane area at 6-hourly intervals, hurricane advisories at least 4 times a day and a more adequate upper air observing network. Most government agencies were aware that Congress usually cut new money requests in half, and therefore, would ask for twice as much as needed. Congress was aware of this and everyone was happy since government bureaus got as much money as needed and congress could claim a savings of 50%. Unfortunately Weather Bureau administrators were inexperienced in these fiscal maneuvers. They arrived at a very conservative cost estimate of the new program, decided Congress would not accept the amount and whittled away here and there, finally cutting it about half to $96,400. Congress cut the request to $80,000 and the Weather Bureau ended up with less than half of the amount needed to put the recommendations into effect. New hurricane forecast centers were established at Jacksonville, New Orleans, San Juan and Boston. Because of inadequacy of money, the teletype circuit had to be terminated at Jacksonville. The Jacksonville center was given two forecasters to cover all analysis and forecasting 24 hours a day and seven days a week. By the end of the first hurricane season both forecasters were ready for hospitalization.

From time to time more money became available and improvement in the hurricane warning service began to accelerate. In 1937 a radiosonde network was established and hurricane forecasters for the first time were able to analyze, to some extent, the tropospheric currents which steer the hurricane. In 1934 Col. Joseph P. Duckworth made the first intentional plane reconnaisance into the eye of a hurricane and in 1944 regular aircraft reconnaisance was begun by the military. Now the forecaster knew the location of the storm and often its intensity when he made his forecast for the next 24 hours. In 1955 Dr. Robert H. Simpson inaugurated the National Hurricane Research Project at West Palm Beach, now located in Miami, to learn more about the physics of hurricanes and better methods of forecasting them.

By 1960 a radar fence had been constructed along the Atlantic and Gulf coasts. Areas for a radius of 200 to 250 miles are kept under constant surveillance. On April 1, 1961, the first weather satellite was placed in orbit and now no tropical cyclone can escape detection. Within the past few years new and more sophisticated satellites have become available and photographs of the storm can be obtained every twenty minutes or so, if desired.

Electronic computers can now provide forecasts which are very helpful although the formula and necessary data for computing hurricane movement still leave much to be desired.

In 1943 the hurricane forecast center at Jacksonville was moved to Miami under the leadership of Grady Norton. Grady possessed a very delicate touch with hurricanes and was a master in timing his warnings and in communications with the public.

Grady Norton died in 1954 and was succeeded by the author in 1955. Shortly thereafter Miami was designated as the National Hurricane Center and community preparedness was emphasized.

Dr. Robert H. Simpson became director of NHC in January 1968. Under his leadership progress computerization of hurricane forecasting and analysis and use of satellite data has accelerated. Tropical meteorologists from all over the world come to Miami for training. Hurricane modification experiments have been performed on several storms. Results have been termed 'promising but inconclusive'. Hurricane control seems many years away. However, there is every reason to believe gradual improvement in hurricane forecasting will continue. Public response to hurricane warnings will likely continue to be a problem for a long time.

THE AUTHOR

Gordon E. Dunn, a native of New England, entered the National Weather Service (then known as the Weather Bureau) at Tampa in 1925. During that year he discovered his first hurricane, an unannounced one that inpinged upon the coast near Tampa on November 30. His perspicacity won him an early transfer to Washington, where virtually all the Bureau's forecasting took place at that time. There he was trained as a forecaster by some of the best synoptic meteorologists of the time, being able to observe many of the events leading to the establishment of the hurricane service in 1935. Gordon Dunn was designated to assist the late Grady Norton in operating the service at Jacksonville that year. Later he was transferred to Chicago. During the war he saw service in the Pacific and following his return to civilian service he took charge of the weather station at Chicago, until his transfer to Miami to direct the National Hurricane Center in 1955.

Dunn has received high honors, including the Department of Commerce Gold Medal for exceptional service. He has travelled widely during government service and since retirement in 1968.

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