Weather Note

THE EFFECT OF DIFFERENTIAL FRICTION BETWEEN LAND AND WATER ON THE MOVFMENT OF DONNA IN THE VICINITY OF EASTERN NORTH CAROLINA

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Manuscript received March 27, 1961; revised May 1, 1961]

The small-scale irregularities in the movement of hurricane Donna over eastern North Carolina in September 1960 support the conclusion of Dunn et al. [1] on the effects of differential wind friction between land and water surfaces. They suggested that the increase in surface friction and the greater cross-isobaric flow over land contributed to an increase in pressure in the forward right quadrant. This increase in surface pressure caused a temporary deviation to the left and brief slowing in the forward speed of the hurricane. The duration of these small-scale irregularities was contingent upon the time required for the core of strongest wind to move inland. These vacillations were noted by Dunn et al. [1] in the tracks of hurricanes Connie, Diane, and Ione and by Dunn [2] in the track of Donna.

The unusually large dimensions of the eye in the vicinity of North Carolina make Donna a remarkable hurricane to illustrate the concept of differential friction. The magnitude of time and distance elements of deviations in the storm track are large enough to evaluate quantitatively.

The track of the radar fixes of the center of Donna over eastern North Carolina (fig. 1) deviated inland to the left about one degree of latitude, which is approximately the same as the reported diameter of the eye. The forward speed (see data table in fig. 1) slowed from 27 kt. over water (segment E to F) to 13 kt. over land (segment B to C).

The differential friction effect reversed as the hurricane moved off shore. The decreasing friction over water permitted the winds to increase and become more nearly parallel to the isobars off shore. According to the suggested hypothesis, this flow results in a depletion of air near the coast. This depletion of air causes the hurricane to be temporarily displaced to the right, and simultaneously to accelerate forward briefly. The radar fixes of Donna in figure 1 illustrate the turn to the right and the forward acceleration to an average speed of 38 kt. between points C and D (see data table in fig. 1). Both the magnitude and geographical position of the observed vacillations over eastern North Carolina are in agreement with those suggested by the differential friction hypothesis.

REFERENCES

1. Gordon E. Dunn, Walter R. Davis, and Paul L. Moore, "Hurricanes of 1955," *Monthly Weather Review*, vol. 83, No. 12, Dec. 1955, pp. 315-326.
2. Gordon E. Dunn, "The Hurricane Season of 1960," *Monthly Weather Review*, vol. 89, No. 3, Mar. 1961, pp. 99-108.

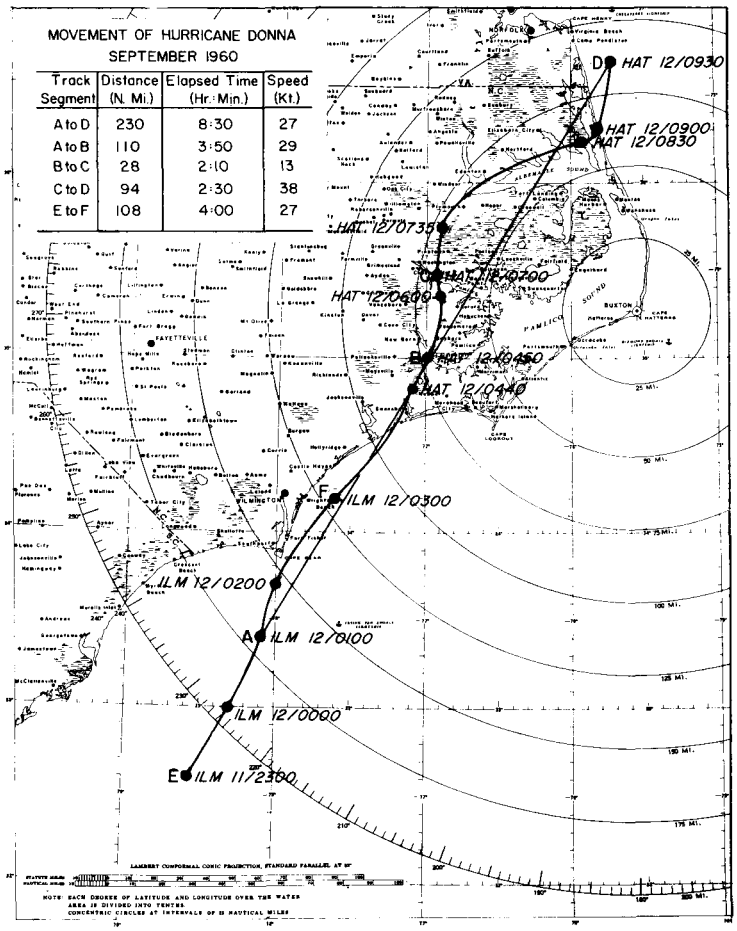

FIGURE 1.—Track of radar fixes on center of hurricane Donna, 2300 GMT September 11 to 1930 GMT September 12, 1960.