Coast Effect on Typhoon Movement*

by

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Abstract

There seems to exist a remarkable coast effect on typhoon movement. Sometimes hurricanes are seen to advance parallel to the coast along Cape Hatteras. Similar, and more marked coast effect on typhoon movement can be seen along the coast of the Kwantō District (Greater Tokyo Area) in Japan. A simple dynamical explanation of this effect is offered.

Fig. 1. Hurricane tracks.

* This paper has appeared without the accompanying five figures in the *Proceeding of the Technical Conference on Hurricanes of the American Meteorological Society, held at Miami Beach, Florida, during November 19—22, 1958*, under the title: *Coast Effect on Hurricane Movement*.

Fig. 4. Selected typhoon tracks, 1912-1925.

Fig. 5. Selected typhoon tracks, 1926-1940.

When a hurricane moves northwards off Cape Hatteras, there is some noteworthy tendency in the hurricane tracks. For example, Fig. 1 is reproduced from Fig. 47 of the *Hydrometeorological Report No. 32 of the U. S. Weather Bureau*. There seems to exist a remarkable coast effect in the hurricane tracks, i.e. sometimes hurricanes advance parallel to the coast along Cape Hatteras.

In the Far East, in particular in the neighbourhood of Tokyo, a similar coast effect on typhoon movement can be found in more pronounced ways. For example, all paths of typhoons which passed through the hatched area off the Kwantō District (inlet of Fig. 2) during the period, 1926—1940, were compiled as shown in Fig. 2. Instead of the parabolic recurvature from a northwestward to a northeastward path that typhoons usually make, many typhoons turn from a northeastward to a northward path after passing the southeast corner of Honshu. Selected paths of typhoons of similar nature are reproduced in Figs. 3~5.

The problem of such recurvature is the most difficult one facing the meteorologist. Forecasters in Japan found that the typhoon will begin to react when it advances eastward and approaches to about 500 km to the south of Honshu, and a stationary front extending from east to west as a forerunner will begin to develop along the south coast of the Kwantō District in front of typhoon movement. At first, typhoons move eastward along this stationary front, and as they reach the

corner of Honshu, they turn from an eastward to a northward path.

The direction and rate of movement of a tropical cyclone depend upon the direction and speed of the air in which the storm is imbedded. There is sound physical basis for believing the air current over the land degenerates by friction. The winds over the ocean, which should be much stronger than those over the land, best approximate the direction of movement of the storm. It has been noted that most storms appear to advance along with the direction of winds in the right semi-circle, or, winds over the ocean in this case. There is some physical reason for believing that the coast effect is, to some extent, if not wholly, responsible for steering a typhoon following the coast line. The other alternative is the modification of the general circulation (northward movement of the westerly flow off the east coast of north-east Japan), which is produced by the existence of the Japanese Archipelago. Such modification could be the specific change to the steering winds of typhoons, causing the said coast effect on typhoon movement.

Reference

- MYERS, VANCE A., 1954: Characteristics of United States Hurricanes Pertinent to Levee Design for Lake Okeechobee, Florida, Hydrometeorological Report of U. S. Weather Bureau, No. 32, 1-106.

台風の移動に対する海岸線の影響

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台風が東北東にむかい関東附近の沖合を進むとき、関東附近を通りすぎた途端に、北にむきをかえて進むことが多い。アメリカのハリケーンも、ハツテラス岬で陸地にそつて海上を進むことがある。かかる熱帯低気圧の移動に対する海岸線の影響を簡単に力学的な説明をしてみた。