

A STUDY ON THE RELATIONSHIP BETWEEN THE ROTATION OF BINARY TYPHOONS AND STEERING CURRENT

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ABSTRACT

Many studies show that, within a certain distance (ca. 700–800 n mi), two typhoons forming a binary typhoon (BT) system would rotate as a whole and attract each other, which is known as "Fujiwhara Effect" (FE). This paper indicates that only 30.3% of BTs has experienced remarkable cyclonic rotation with a 12-hr angle $\geq 10^\circ$ when two components are less than 20° lat apart, and that the probability is much higher with the eastern component in the NE than in the SE quadrant for the western one, implying the steering effect of the environmental flow field (EFF) on them.

47 observations from 13 BTs are separately used for calculating the angular velocity due to FE and EFF and the results are compared. The conclusion can be stated as follows: FE is dominant with the centers of two elements below 7° lat apart; the EFF steering current plays a major role when they are in the range of $7\text{--}15^\circ$ and for a distance above 15° the principle of FE holds no longer.

1. INTRODUCTION

It is a well-known fact that BT (binary typhoon) is one of the major problems concerned with the typhoon's stagnation, looping and other behaviors in its course. As early as 1921–1923, Fujiwhara^[1] noted that, when one vortex approaches the other, they will go around the common mass center counterclockwise in the Northern Hemisphere or attract each other, which is the famous FE (Fujiwhara Effect). Later, Haurwitz^[2] calculated angular velocity of a BT by assuming the tangential wind speed distribution in a typhoon to be identical with that of Rankine Model. Brand^[3] indicated in 1970, based on many case studies, significant increase in the angular velocity with reduction of the center-to-center distance for a BT system, thus giving a concept in synoptics that when two typhoons are close enough to each other, interaction occurs, but the rotation as a whole is prevalent.

In the 1960s Chinese meteorologists made preliminary study of the tracks of BTs^[4,5] and since the 1970s much research has been done on it synoptically, dynamically and climatologically^[6–12]. A general conclusion is achieved^[13,14] that when typhoons' centers are within a distance of 20° lat, such interactions occur as stagnation, looping, cyclonic/anticyclonic rotation as a BT, mutual attraction and even mergence. But the track for each