The Effects of Mountains on a Typhoon Vortex as Identified by Laboratory Experiments

*Hsien-Ping Pao**

The Catholic University of America, Washington, D.C. 20064

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Abstract

In this study laboratory experiments were performed by introducing an essentially two-dimensional concentrated vortex which interacts with a two-dimensional elliptical barrier resembling the general shape of the island of Taiwan. Comparisons are made between the experimental results and field data. It is found that the general behavior and the accompanying surface flow patterns of a typhoon vortex, when interacting with the mountainous island of Taiwan, can be reasonably simulated in the laboratory. In the case of deflected flows, the typhoon vortex resembles a two-dimensional vortex past an equivalent two-dimensional mountain barrier and its pathline seems to be not sensitive to the typhoon strength. It is suggested that laboratory modeling may provide a reliable and effective way for predicting the movement of a typhoon vortex when it is in the vicinity of the island.

1. Introduction

Increasing awareness of and interests in the topographical effects on the atmospheric flows in recent years have led to numerous studies and investigations by many scientists around the world. It has also been recognized that mountain ranges do have strong interaction with and influence over typhoons and hurricanes. In certain cases the blocking and deflecting effects of the mountain barriers become very prominent. The mountain effect usually manifests itself in the form of floods and disasters for certain areas. In the Pacific area, the mountain range of Taiwan stands out. It reaches a height well over 3,000 m above sea level. During every summer and early fall, the island of Taiwan has stood in the pathway of numerous violent typhoons in the last two decades for which observations have been quite extensive.

The problem of typhoon vortex passing over the central mountain range of Taiwan has been studied previously by Wang (1954, 1963), and Hsu and Wang (1960). Their works were mainly concerned with field data and their interpretations. More recent-

*On sabbatical leave; now visiting at the Institute of Physics, Academia Sinica, Taipei, and Institute of Naval Architecture, National Taiwan University, Taipei.