

## 山脈对風風影响的实验研究(二)

THE EFFECTS OF MOUNTAINS ON A TYPHOON VORTEX AS  
IDENTIFIED BY LABORATORY EXPERIMENTS

PART II. THREE-DIMENSIONAL BARRIERS

(鮑咸平) (黃榮鑑) (左競競)

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This paper continues the former study of the experimental performed series for investigating the interaction between the typhoon vortex and Taiwan island. An essentially two-dimensional free vortex in an otherwise uniform flow past a three-dimensional barrier is studied and three different three-dimensional symmetrical models resembling the general shape of Taiwan are used. Results show that the phenomena of blocking and deflecting, and its moving path of the free vortex are similar for these three barriers. The vortex movement seems to be strongly dependent on the approaching path way of the vortex relative to the barrier. Comparisons are also made between the experimental results and field data. It is found that the flow patterns and the moving paths of the free vortex are reasonably similar to the actual track of typhoon vortex.

This suggests that the laboratory modeling may be a reasonable tool to predict the movement of typhoon vortex when it is in the vicinity of the island.

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## I. Introduction

In this study, we continue the experimental performance for investigating the interaction between the typhoon vortex and Taiwan island. Three-dimensional symmetrical barriers resembling the general shape of Taiwan island are used to replace the previous study of a two-dimensional elliptical barrier. Owing to its strong two dimensional characters, the typhoon was simulated as before by an essentially two-dimensional concentrated vortex in a flume. Various cases for different shapes of barrier, approaching paths of vortex, and angles of incidence were investigated. All these barriers symmetric with respect to some plain are short and can be immersed in the flume water. So not only the deflecting but also the climbing phenomena of the typhoon vortex can be observed in the laboratory.

The basic objectives are still to find (a) the general flow patterns of the typhoon vortex when interacting with the barriers, (b) the moving paths of the typhoon vortex (c) the sensitivity of the typhoon vortex to

the shapes of the barriers, and (d) the influence of approaching paths and angles of incidences of typhoon vortex on the interaction.

After the comparison with the actual field data, we believe that for the problems concerned, the laboratory modeling is certainly a valuable research tool, although the neglect of the latent heat and the Coriolis force had set some limits to it.

## II. Experimental Set-up and Procedures

The experiments were carried out in the same flume as mentioned in the previous study. The two-dimensional concentrated vortex was effectively created by suddenly moving an airfoil at an angle of attack. A vortex was shed instantly off the trailing edge of the airfoil, while another vortex of opposite sense was also shed as soon as the airfoil was brought from motion to rest. In order to dislodge the opposite sense vortex, the airfoil was kept moving for a considerable distance before it was brought gradually to rest; thus the second vortex was far apart from the first one and was also very much weakened and diffused.

A Nikon F 2 camera of 50 mm lens with MD-2 motor drive was used to record the development of the flow field. The flow was made visible by a suspension of small (0.1 ~ 0.5 mm) Pliolite S-5 beads which was illuminated by a horizontal sheath of light from two sides. Two light boxes were used for illumination; each one has horizontal openings at

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### 山脈對颱風影響的實驗研究

#### 摘 要

本文為繼續從事有關颱風渦旋與台灣島交互作用的模擬實驗研究，利用三種相似於台灣地形的三維度障礙體和一個二維強渦流的交互作用，分別探討颱風渦旋受阻的路徑趨向及其一般動態及表面流態，實驗結果顯示，當颱風趨近台灣島時，其路徑與趨近方面甚有關係，由實驗結果與實際颱風資料比較，顯示模型實驗似可提供一可靠且有效的方法來預測颱風在台灣島附近的運動情形。