



## CHAPTER I

### INTRODUCTION

Physical oceanographers nowadays believe that wind plays two roles when it blows over ocean surfaces. One role is to induce current<sup>1,2</sup>, the other is to generate waves<sup>3</sup>. When they deal with wind-induced current theoretically they consider waves to be turbulence. The most outstanding theory based on such a belief is the classical Ekman theory on wind drift proposed by Ekman in 1905<sup>4</sup>.

Ekman theory predicts that the velocity vector of the wind-induced current at the surface shall deviate, in the northern hemisphere, to the right of the wind-velocity vector by a fixed angle of 45 degrees<sup>5,6</sup>. The current velocity decreases in magnitude exponentially and deviates more and more from the wind direction as the depth increases. This current structure is known as "Ekman spiral"<sup>7</sup> (Fig 1).

In 1980, K. Neelasri<sup>8</sup> measured the current at eight stations in the upper Gulf of Thailand. He concluded that current structures are as predicted by Ekman theory.

In 1981, Jiraporn and Jia<sup>9</sup> investigated the effect of wind on the circulation of water mass in the upper Gulf of Thailand by a physical model study. They found that the direction of circulation is governed by the direction of the wind and the underwater topography.

In 1982, Jiraporn<sup>10</sup>, by comparing the result of the model study with Neelasri's measuring results, concluded that the spiral current structures found in the upper Gulf of Thailand could not be

created directly by wind stress as assumed in Ekman theory. Jiraporn also pointed out that the belief that oceanic surface current is driven by wind stress is in contradiction with the known wave generation process. He believes that wind energy could be transferred to the ocean only through the wave generation process, what thought to be wind driven current is actually wave-induced current. Based on such a belief he proposed a new theory called "Orbital Flow Theory" to replace Ekman theory on wind drift.

The orbital flow theory predicts that ,in the northern hemisphere, the velocity vector of the wave induced current at the surface shall deviate to the right of the wind velocity vector. However, the angle of deviation is not fixed to 45 degrees as predicted by Ekman theory. The current velocity decreases in magintude and deviates more and more from the wind direction as the depth increases. This current structure can also explain Nelasri's measuring results which had been concluded to followed Ekman theory.

The purpose of this reseach is to carry out experiments to verify the "ORBITAL FLOW THEORY".