



EXPERIMENTAL STUDY ON SEDIMENT RESUSPENSION IN TAIHU LAKE UNDER DIFFERENT HYDRODYNAMIC DISTURBANCES*

QIAN Jin, ZHENG Sha-sha, WANG Pei-fang, WANG Chao

Key Laboratory of Integrated Regulation and Resource Department on Shallow Lakes, Ministry of Education and College of Environment, Hohai University, Nanjing 210098, China, E-mail: hhuqj@hhu.edu.cn

(Received June 16, 2011, Revised October 26, 2011)

Abstract: Contaminants resuspension in sediments induced by wind-wave could influence the water quality in shallow lakes. Resuspension of surface sediments from the Zhushan Bay, Taihu Lake was simulated under different wind forcing by using a pneumatic annular flume in this study. Acoustic Doppler Velocimeter (ADV) was used to measure flow velocity at each wind speed, and the characteristics of sediment resuspension were studied with the layered sampling technology. The experimental results show that the flow velocity increases with wind speed obviously and 6m/s is a critical wind speed which affected hydrodynamic conditions significantly. The distribution of flow velocity and water depth is different from that in ordinary open channel. With the enhanced hydrodynamic factors, the Suspended Solids Concentration (SSC) in water increases accordingly, and the incipient velocity of sediment resuspension is about 0.21 m/s. Based on the analysis of wind speed and average SSC in water column, the quantitative relationship is obtained. The SSC of the bottom layer is higher than the content of surface layer under different hydrodynamic conditions, and there are similar distributions between SSC and flow velocity in different water layers.

Key words: hydrodynamic disturbance, sediment, resuspension, wind speed, flow velocity

Introduction

Because of long fetch and shallow depth, shallow lakes are more susceptible to sediment resuspension. Sediment resuspension plays a key role in the shallow lake ecosystem, it may redistribute settled materials, increase water turbidity, and thus affect light conditions, nutrient fluxes, photosynthesis and hydrophytes community structure^[1]. In recently years, contaminants release with the process of sediment resuspension becomes the main internal source in shallow lakes^[2-4]. In order to estimate the amounts of released pollutants, we should understand the process of sediment resuspension. Although several hydrodynamic processes

can intervene on sediment resuspension, wind-wave disturbance is usually the dominant process in shallow lakes. Hence, the study of relation between flow velocity and sediment resuspension caused by wind wave is of great importance.

Sediment resuspension is a natural process occurring when bottom shear stress is sufficiently large to disrupt the cohesion of sediment. Sediment transport under different flow conditions were well reported in previous studies^[5], which described the incipient motion of sediment under different hydrodynamic situations. Wind has a significant effect on flow velocity in shallow lakes^[6]. The wind surface stress induces an energetic wave-affected layer to change the hydrodynamic processes. The small depth in shallow lakes often generates a completely mixed water column during the resuspension events.

In the investigations, it is difficult to calculate the amount of internal source release exactly in shallow lakes, and the detailed research of the relationship among wind speed, flow velocity and sediment resuspension is relatively few. Of course, there was some scholars studied a part of this problem. To study sediment resuspension in water-sediment system under

* Projected supported by the National Key Basic Research Development Program of China (973 Program, Grant No. 2008CB418203), the National Key Program of National Natural Science Foundation of China (Grant No. 50830304) and the National Natural Science Foundation of China (Grant No. 50909035).

Biography: QIAN Jin (1974-), Male, Ph. D., Lecturer

Corresponding author: WANG Pei-fang,

E-mail: pfwang2005@hhu.edu.cn