Response of Hydrodynamic on Abrupt Changes of Bathymetry in the Pearl River Delta

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ABSTRACT

Due to the sand excavation and reclamation the hydrodynamics changed obviously in this region over past 30 years. To understand the hydrodynamics in different bathymetries, a 2-D flow and sediment numerical model covered the entire Pearl River Estuary was established. Because of the influence of topography, the net discharge in Humen and Jiaomen decreased while Modaoman increased during the wet seasons. In the dry and wet seasons, Western side played a dominant role in controlling the water transport, however, the surface water of Southern side moved seaward in wet season and moved landward in dry season.

KEY WORDS: Abrupt changes in bathymetry; numerical model; Pearl River Delta; net discharge; water transport.

INTRODUCTION

The Pearl River Delta (PRD) is a dynamically complex estuarine system located in the northern continental shelf of the South China Sea (SCS). From 1986 to 2003, the amount of sand up to 7 x 10⁷ m³ every year, which leaded to a direct result of riverbed undercutting from 0.59m to 1.73m in West River, 0.34m to 4.43m in North River and 1.77m to 6.48m in East River(Luo et al., 2007). Our team members also study the main river channel talweg and width-depth ratio from 1999 to 2005 in the PRD and find that the underwater terrain of main channel incised, the channel volume increased and width-depth ratio increased during the wet seasons. In the dry and wet seasons, Western side played a dominant role in controlling the water transport, however, the surface water of Southern side moved seaward in wet season and moved landward in dry season.

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STUDY AREA

The Pearl River is the biggest river in southern China with the basin area of 442,100 km², which originated from Maxiong Mountain in the Yunnan-Guizhou Plateau. It traverses all the southern China from west to east, and with the Yangtze river, Yellow River, Huaie river, Haishe river, the Songhua river and Liaohe are said the China's seven major rivers(Chen et al., 2010). The Pearl River basin consists of a tidal river network and an estuary, which is mainly comprised of the West River, North River and East River. A large amount of nutrients from these rivers and wastewater discharges in the PRD transports through multiple river channels in the river network, passes to the Pearl River estuary through eight river outlets (Fig. 1), and ultimately transports to the SCS(Hu et al., 2009).

Fig.1 Map showing the Pearl River Delta coastline, bottom topography, major rivers, major cities and survey stations in the river network.

In recent years, because of its unique natural geographical conditions, the PRD region has become one of the most economically developed regions in China. As the economy develops fast, the sand excavation and reclamation, waterway regulation and tideland reclamation also develop quickly. Then a series of problem has appeared. Because of the