SEA LEVEL RISE OF THE ZHUJIANG RIVER DELTA AND NEOTECTONICS

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ABSTRACT: A linear regression analysis of 28 selected tide-gauge stations of the Zhujiang Estuary shows that there has been a tendency of local sea level rise at a rate of 2.028 mm per year. The origin of the variation is significantly attributed to the local tectonic movement of discrepant fault-block. Based on this, four types of relative local sea level changes are classified. According to calculation, half of the fertile land, or 800 km² of the delta plain will have been submerged by sea water by about 2040. This will yield a significant influence on the economic construction and human activities.

KEY WORDS: sea level rise, the Zhujiang River Delta, neotectonics

I. INTRODUCTION

At present, the changing geographic environment shows two significant impacts on human society: ever-warming climate mainly due to the influence of emissions of CO₂ and chloro-fluorocarbons¹, resulting in the greenhouse effect, and sea level rise due to thermal expansion of the ocean, increased precipitation, and particularly the increased melt water of mountain glaciers and polar ice. These two aspects are closely related to the development of modern society. For example, there has been a conspicuous effect of urban heat island in Guangzhou since 1980 owing to the rapid development of the industry of the city. The centre of the heat island is located in the central area of the city with a diameter of 12 km. The atmospheric temperature in the city proper is 2°C higher than that in the suburbs. Although there is still a contention about the range of rising temperature, the tendency of global ever-warming climate will last because the flux of CO₂ to the atmosphere increases...
continuously due to the ever-increasing extraction of fossil fuels and over cultivation in the woodland areas.

The average rate of concurrent worldwide rise of sea level had been estimated by some researchers to be reaching over 42 cm from 1985 to 2085[21]. It was also estimated that a global rise of sea level will have ranged from 0.5 m to 1.5 m by the end of the next century[3]. It is difficult to separate tectonic, oceanographic, and eustatic components of change in relative sea levels. But our description provides sufficient evidence to show the importance of tectonic activities that may produce local rise or fall in relative sea level in the delta region. For example, on March 19, 1962, an earthquake of magnitude 6.1 took place in Heyang County which is located by the northeastern side of the delta and caused a deformation of the local crust. It was reported that this earthquake was related to the over storage of flood water which initiated the activity of the NW Faults in Xinfengjiang Reservoir area. Seismic events also attacked some delta areas to cause the deformation of the crust.

II. GENERAL TENDENCY OF SEA LEVEL RISE IN THE ZHUJIANG ESTUARY

We used least-square linear regression trend for 28 tide gauge stations of the delta that spanned from 1950 to 1985, to calculate the number indicated in a linear regression line, obtaining the ratio of elevation velocity of each station. We found that there had been an elevation tendency of different degrees at most (23) of the stations. The average elevation rate in the estuary is about 2.028 mm/a. According to the different ranges of elevation of the 23 stations, the areas of sea level rise are divided into 3 types (Table 1): areas of conspicuous rise (greater than 4.5 mm/a), areas of medium rise (2.0 - 4.5 mm/a), and areas of slight rise (0.1 - 2.0 mm/a). Data from other 5 stations show a tendency of local sea level fall with rates from -0.1 mm/a to -2.0 mm/a (Table 1, type 4).

Based on the above data, it is suggested that there has been a concurrent tendency of sea level rise compared with many other big delta regions. For example, a regression line of the duration from 1910 to 1936 shows the rise of water level at Tanggu Station of the Huanghe River Delta. A similar case also took place in the Wusongkou section of the Changjiang River during the period of 1917 - 1939. Some researchers prejudged that there will be an widespread inundation over parts of the Nile Delta and the Bengal Delta during the next century[11].

According to Li Pingri[4], there has been at least 5 high stands of sea level above the present one in the Zhujiang River Delta since the beginning of the Holocene. During the period of 8,000 - 7,000 yr. B.P., the sea level rose rapidly at a rate of 21.6 mm/a. At about 6,000 yr. B.P. the ancient sea level was some 1 m higher than the present one. The fact that the high stands of sea level took place during the warmer durations indicates the climatic influence.