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Case Study of River Bank Erosion in Vietnam

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Abstract: Mekong River is a vital natural resource for aquaculture, agriculture, forestry and industry in Vietnam. However, river bank erosion and sedimentation of Mekong River has caused detrimental effects on human life and the economy. The Vietnamese government has conducted a study employing Mike21 software and 3D movable riverbed models suited to the local conditions to predict future trends of river erosion and sedimentation in the area. This has improved support for decision-making including landuse planning and early-warning systems.

Keywords: River bank erosion, Mekong River, sedimentation.

INTRODUCTION

The Mekong River is one of the longest fresh natural rivers in the world, flowing across five countries. Starting from the Tibetan Plateau this river runs through China's Yunnan province, Vietnam, Laos, Cambodia and Thailand. Tributaries in the lower Mekong River can be categorized into two major systems: tributaries that scarify from the raining season and tributaries forming the low topography regions of lower rainfall. The landscape and course of the river are controlled by the complex geology and drainage system as well as anthropogenic activities such as agriculture and fishery. In the recent decade, river bank erosion and sedimentation have caused detrimental effects on human life and restrained economic growth. A national project of the Vietnamese Government called KC08-15 had been implemented to understand the behavior of river banks in the lower Mekong delta.

METHODS

Several methods were employed to predict future bank erosion. The trend of erosion rate was generated through historical satellite images to estimate the length of bank erosion, followed by probabilistic statistics.

Measured time	Section name	Measured discharge (m3/s)	Computed discharge (m3/s)	Difference (%)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 1: Results of discharge using Acoustic Doppler Current Profiler (ADCP) compared to that computed from the Mike21 software.

Information on erosional rate of the river bank was obtained through empirical methods involving experimental coefficients that employ formulas for various situations depending on characteristics of the area. The software called Mike21 and 3D movable riverbed models were used to obtain 1D, 2D and 3D as well as 4D models to simulate evolution of the river bank and river bed through time. Findings from the simulated model were then compared to field measurements.

PRELIMINARY FINDINGS

Some deviations were observed between the modeled information and field measurements, but the values do not exceed 0.25 m (Table 1). Despite the small difference, the results are only applicable for the short term. The model does not take into account factors such as human activities, building of new dams or hydroelectric power plant, impacts of soil characteristics and sand mining; all of which are of crucial importance. Key findings are illustrated in Figures 1-4.

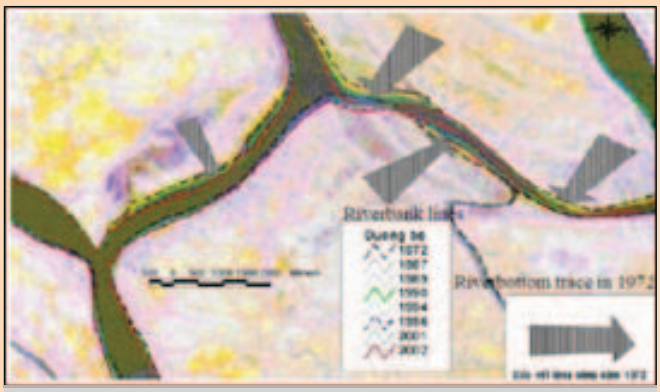

Figure 1: Satellite image showing evolution of the river bank of the Van Mao river from 1972 to 2002.

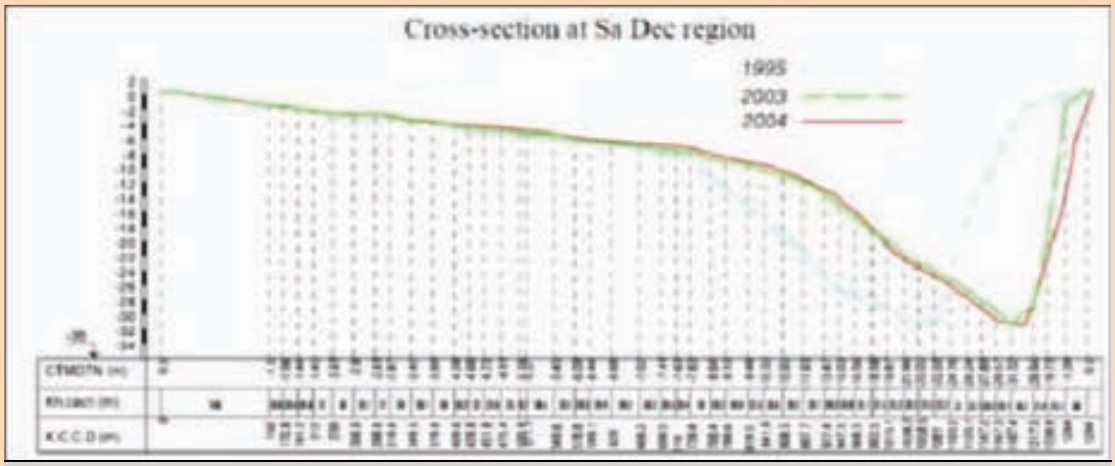

Figure 2: Cross section of the evolution of the Sa Dec river in the years 1995, 2003 and 2004 based on satellite image.

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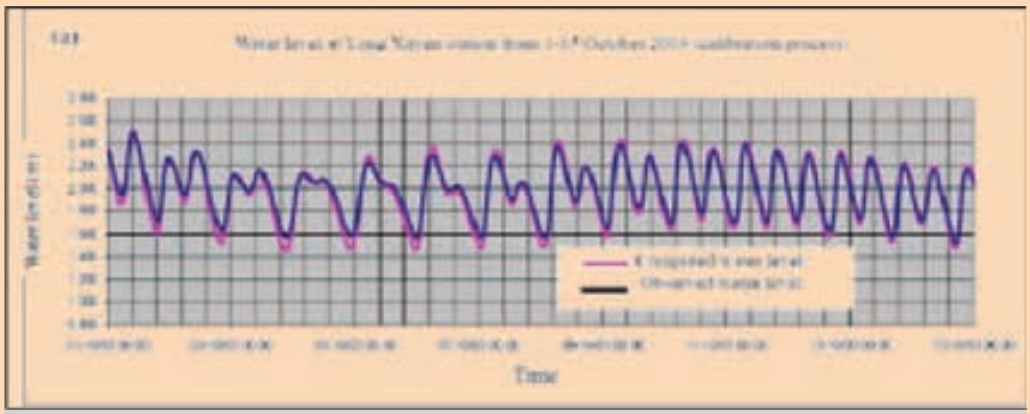

Figure 3: Comparison between measured and simulated water levels at Long Xuyen station.

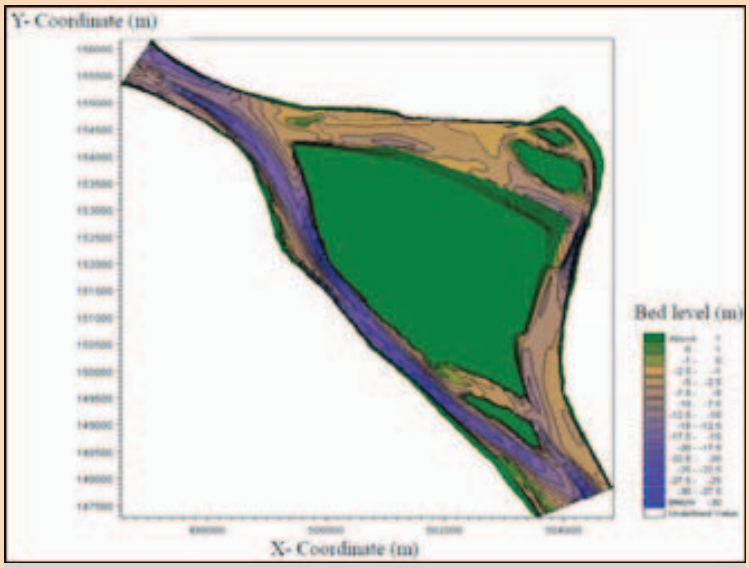

Figure 4: The estimated evolution of river bed levels over the span of two years.

Prior to this project, no scientific measurements were ever taken in this region to prevent the wide range of damage. Based on the findings of this pioneering research, the Vietnamese Government has established a localised model to estimate levels of damage, deterioration and sedimentation of the river bank. The findings have been useful for forming policies that better monitor the landuse, improve efficiency of resource management, and enhance restoration of the river bed system to facilitate transportation. The model also provides inputs for early warning systems. The Government is able to undertake measures according to the severity of hazards to reduce impacts, including relocating people away from high-risk areas. For example, a decision was made to move an entire township as the cost is less compared to implementing structural work to control erosion and river bank sliding.

REFERENCE

Le Manh Hung, Hitoshi Tnaka, Nguyen Trong Tu, and Nguyen Trung Viet, 2006. Prediction of River Bank Erosion in The Lower Mekong River Delta. Retrieved on April 18, 2018 from http://www.geologypage.com/2014/05/mekong- river.html.