# Proceedings of the 22nd IAHR-APD Congress 2020, Sapporo, Japan Numerical analysis on impacts of the project of north branch narrowing on sediment distribution GUO CHUANSHENG (China Institute of Water Resources and Hydropower Research, P. R. China), TANG LIQUN (IWHR, P. R. China), TANG

## Introduction

The north branch of Yangtze estuary starts in the west from Chongtou(CT), the western end of Chongming Island, to the estuary Lianxinggang(LXG) in the east. With a total length of 83 km, it is a first-class branch channel of Yangtze estuary. Since 18th century, the mainstream of Yangtze River has diverted to the south branch, hence the runoff into the north branch has gradually decreased, causing an overall appearance of sedimentation and shrinkage in the north branch. Shanghai and Jiangsu Province implemented a middling narrowing project in the north branch of Yangtze estuary.

**Based on the two-dimensional mathematical model of** tidal current and sediment, a simulation model of sediment transport in Yangtze estuary region has been established in this paper, and the changes in sediment transport in the north branch after the implementation middling narrowing project have been of the numerically simulated and analyzed, aiming to provide scientific basis for progressing the regulation project more rationally and comprehensively.



### REFERENCES

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# Model Verification

The model validation was performed using the measured water level, flow velocity, and sediment concentration of large and small tides in December 2012. The tide level data in the corresponding period were collected from national or local basic tide stations. These data were used to validate the model, and some results are illustrated in Figure 2. Some simulation results are illustrated in Figure 3 and Figure 4. The results indicated that the simulated tide level, flow velocity and direction, and sediment concentration had good consistency with the measured data, which could truly represent the flood-ebb fluctuations of the north branch and indicate the characteristics of tide movement in Yangtze estuary.





				-						provide the provid					project.
Figure 5. Tidal current field in the spring tide flooding period.										Flood tide peak sediment concentration $(10^4 \text{ kg/s})$			Ebb tide peak sediment concentration $(10^4 \text{ kg/s})$		
										Before	After		Before	After	
Table 1. Section peak flow changes before and after the project.										narrowing	narrowing	Change	narrowing	narrowing	Change
										project	project	Ũ	project	project	C C
								Chongtou	Spring tide	0.872	0.742	-14.84%	1.126	0.958	-14.86%
		Flood tide	Flood tide peak flow $(10^4 \text{ m}^3/\text{s})$			Ebb tide peak flow $(10^4 \text{ m}^3/\text{s})$		section	Neap						
		Before	After		Before	After		Santiaogang section	tide Spring tide Neap tide	0.848	0.720	-15.01%	0.434	0.357	-17.54%
		narrowing project	narrowing project	Change	narrowing project	narrowing project	Change			1.795	1.894	5.52%	3.081	2.747	-10.83%
hongtou section	Spring tide	1.437	1.605	11.72%	0.73	0.566	-15.05%			1.746	1.585	-9.17%	1.166	1.002	-14.01%
	Neap tide	0.768	0.790	2.94%	0.42	0.336	-3.87%								
ntiaogang section	Spring tide	6.241	5.812	-6.87%	1.05	3.170	3.43%								
	Neap tide	3.176	3.058	-3.70%	0.59	1.727	0.85%								

> (1) The middling narrowing project did not change the flow pattern of flood/ebb tide, and the flow characteristics of flood/ebb tide in the south and north branches were basically unchanged.  $\geq$  (2) After the implementation of middling narrowing project in the north branch of Yangtze estuary, the river channel of north branch was narrowed and the dynamic force of tide intrusion was diminished, leading to the decline in the high tide level of spring tide in the north branch, which benefited the coastal protection against the tide. Meanwhile, the increase in flow velocity and the decrease in the sediment concentration were also beneficial to the sediment prevention and elimination of the river channel.

(3) The implementation of middling narrowing project in the north branch of Yangtze estuary had basically no effect on the tide level and sediment concentration distribution in the south branch and the entrance area.