

An aerial photograph of a river delta, likely the Yangtze River Delta, showing a large, turbid, brownish plume of sediment extending from the river into the surrounding greenish-blue water. The plume has a distinct, elongated shape with some internal structure. The surrounding water is a darker greenish-blue. The land area on the left is brownish and appears to be a mix of urban and natural land.

Under the influence of human activities, what changes happened to the TMZ and associated mouth bars?

上海

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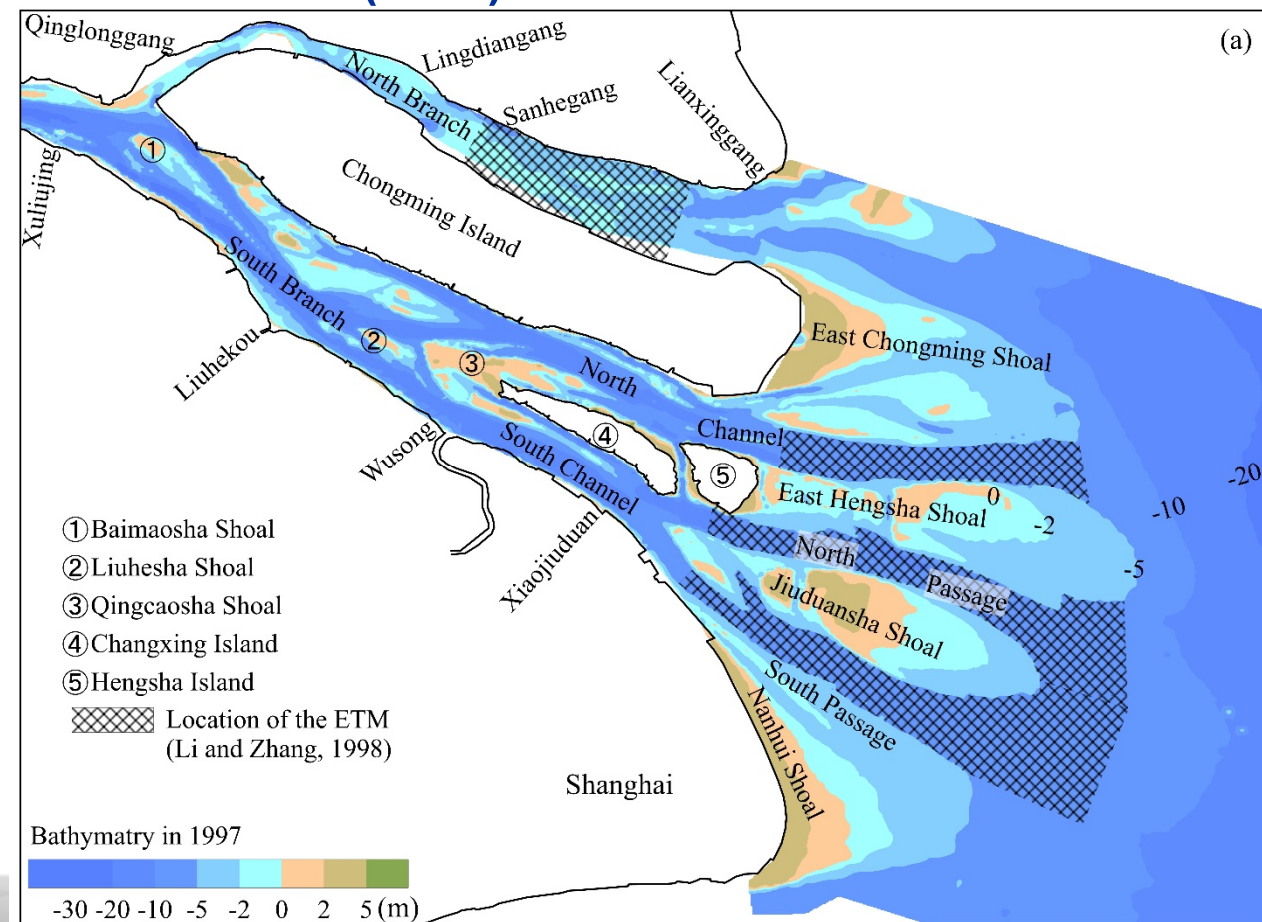
East China Normal University

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Introduction

Yangtze Estuary is a typical bifurcated mega-estuary, with three-order bifurcation and four-outlet.

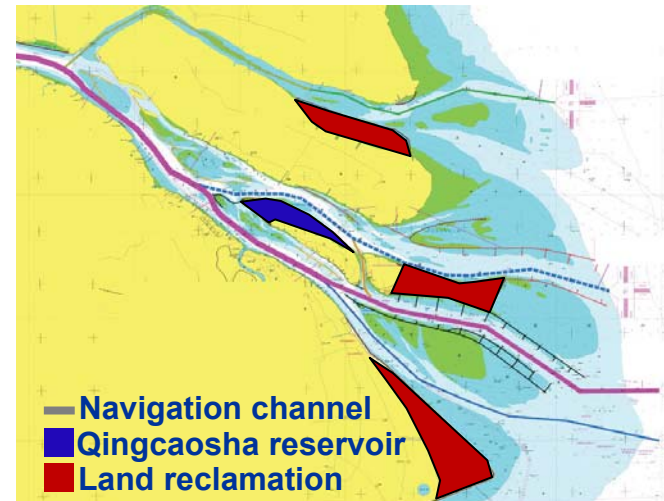
- shoal iterating with channel
- turbidity maximum zone (TMZ) and associated mouth bar well developed



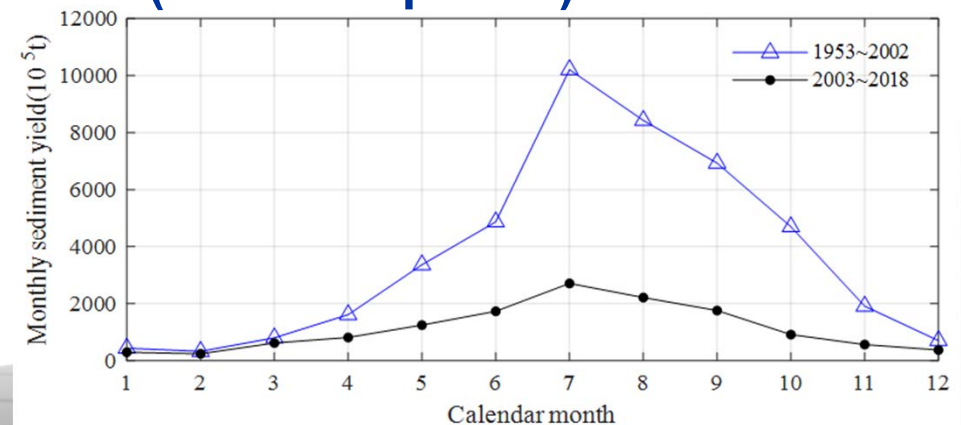
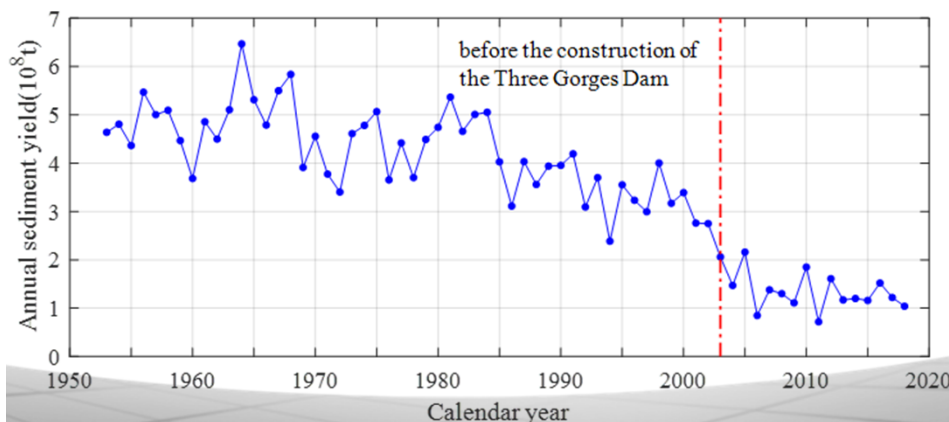
Introduction

Yangtze Estuary suffers from serious human interferences:

- Dam regulation
- Land reclamation
- Deep-Waterway Project



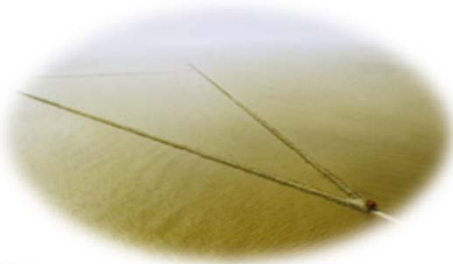
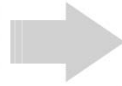
Both yearly and monthly fluvial sediment load into the Yangtze Estuary indicate significant variations since 2003 (TGD completed).



Fluvial suspended sediment load into the Yangtze Estuary (Datong Station)

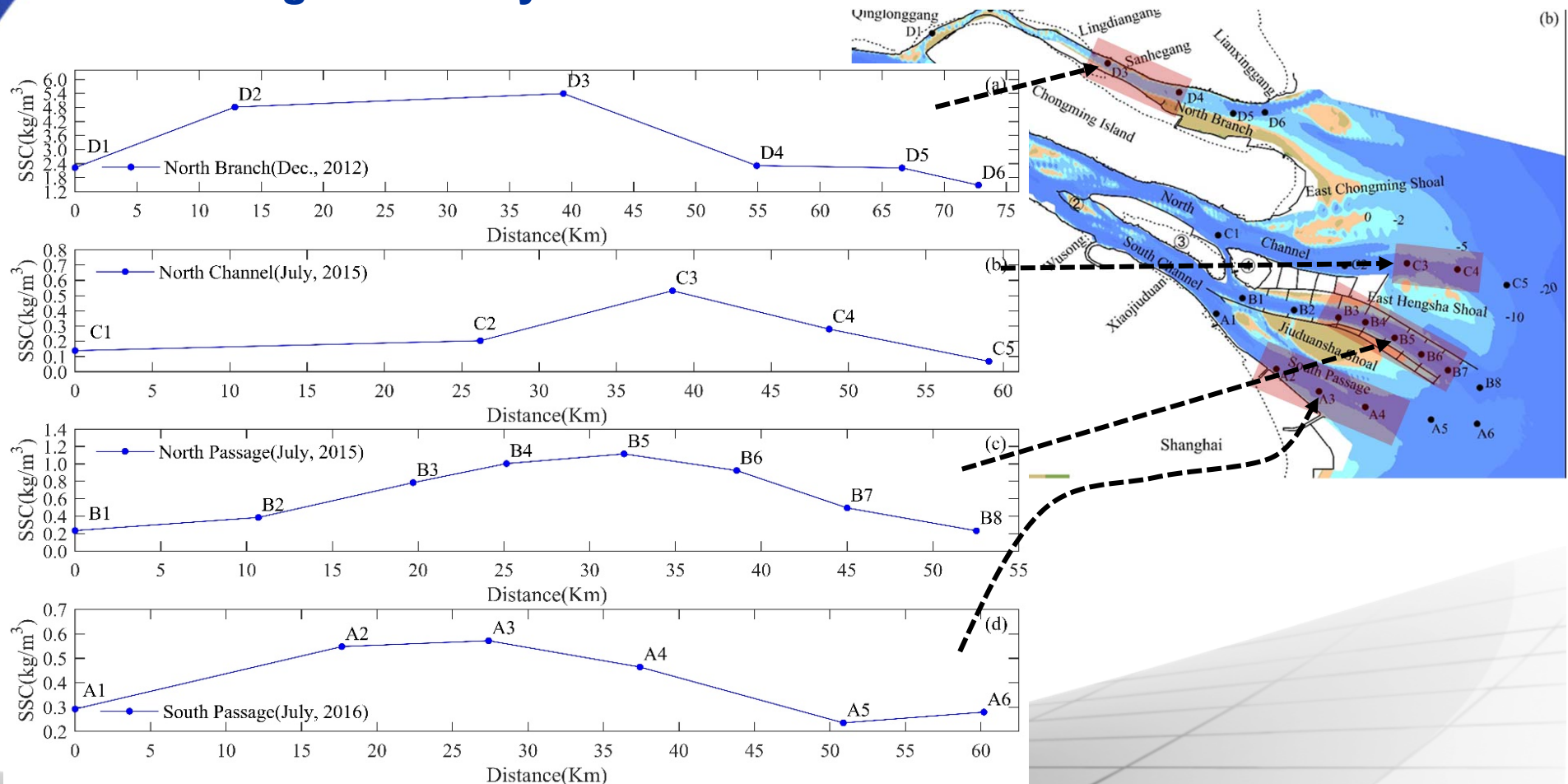
Introduction

**Under the influence of human activities,
What changes happened to the TMZ and associated mouth bars?**



Results

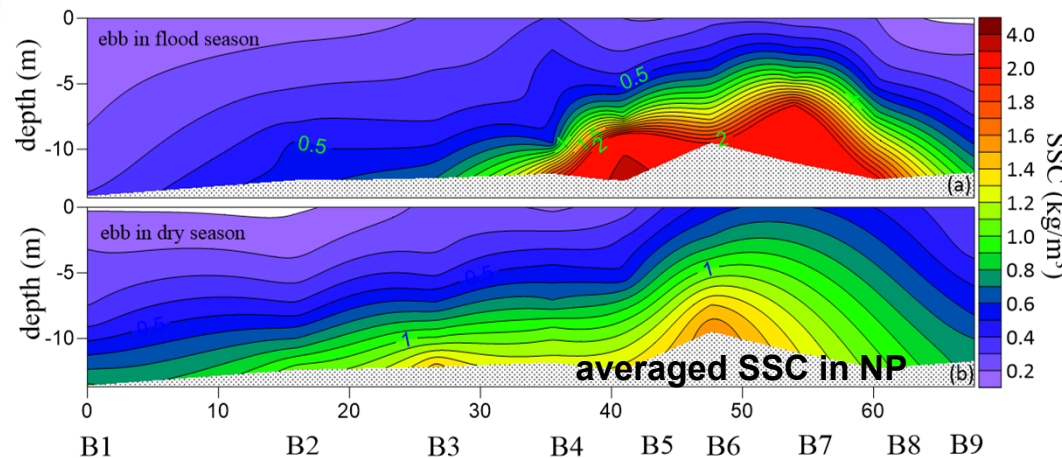
- TMZ already steadily exists in the lower reach of the Yangtze Estuary



Vertical distribution of sediment concentration in Yangtze Estuary

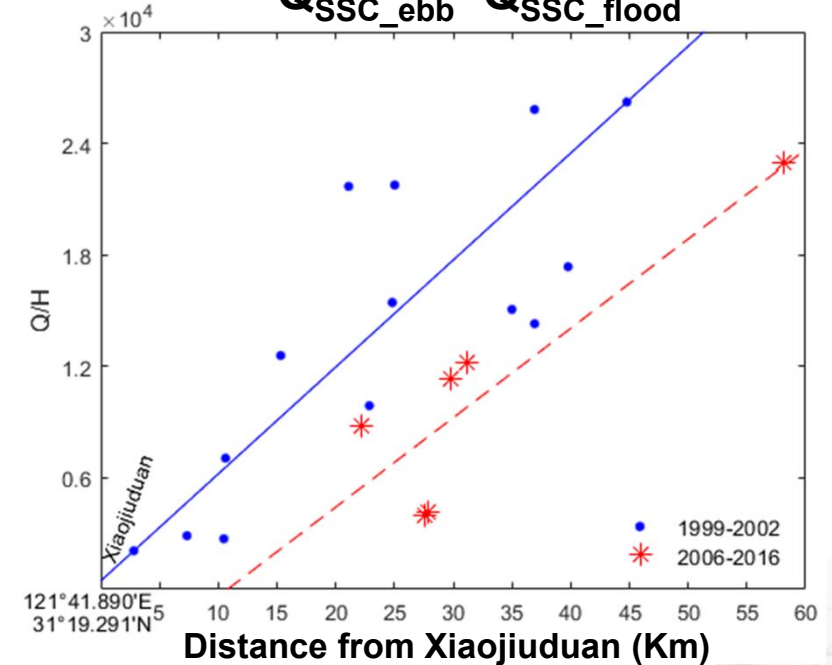
Results

- Location of the TMZ is related to the ratio between fluvial discharge and estuarine tidal range.



At sediment stagnation point:

$$Q_{SSC_ebb} = Q_{SSC_flood}$$



The relationship between the location of sediment stagnation point in SP and the Q/H ratio

Q : discharge at Datong station

H : tidal range at Zhongjun station

D : Distance from Xiaojiudian to sediment deposition point in SP

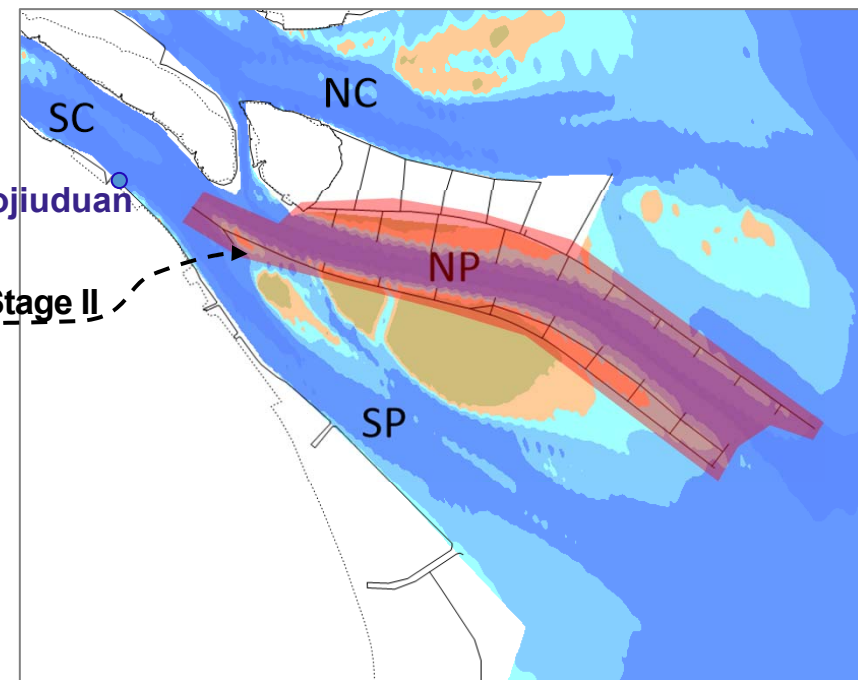
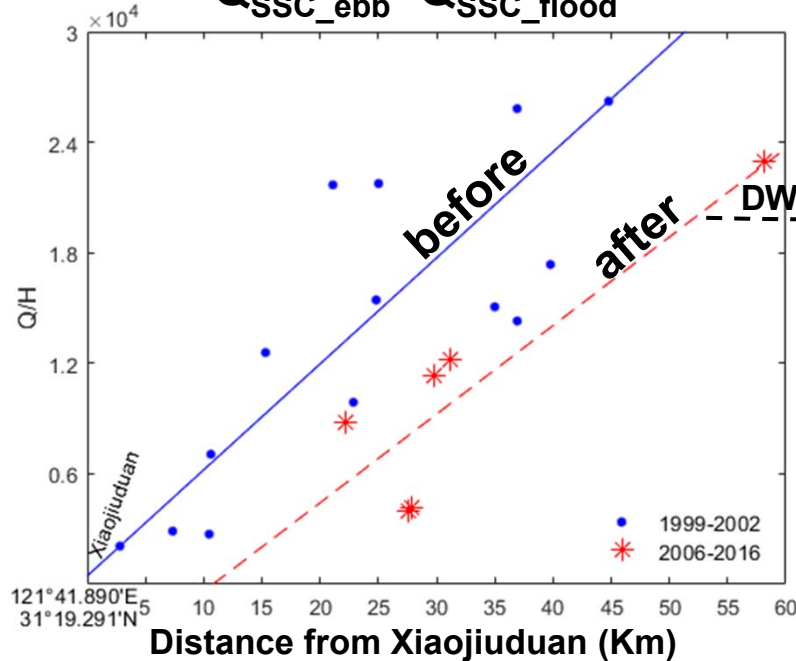
Results

Human interferences affect the spatial-temporal variation of TMZ:

- Location of the TMZ migrated downwards in SP due to the construction of the Deep-Waterway Regulation Engineering Stage II.

At sediment stagnation point:

$$Q_{SSC_ebb} = Q_{SSC_flood}$$



Q: discharge at Datong station

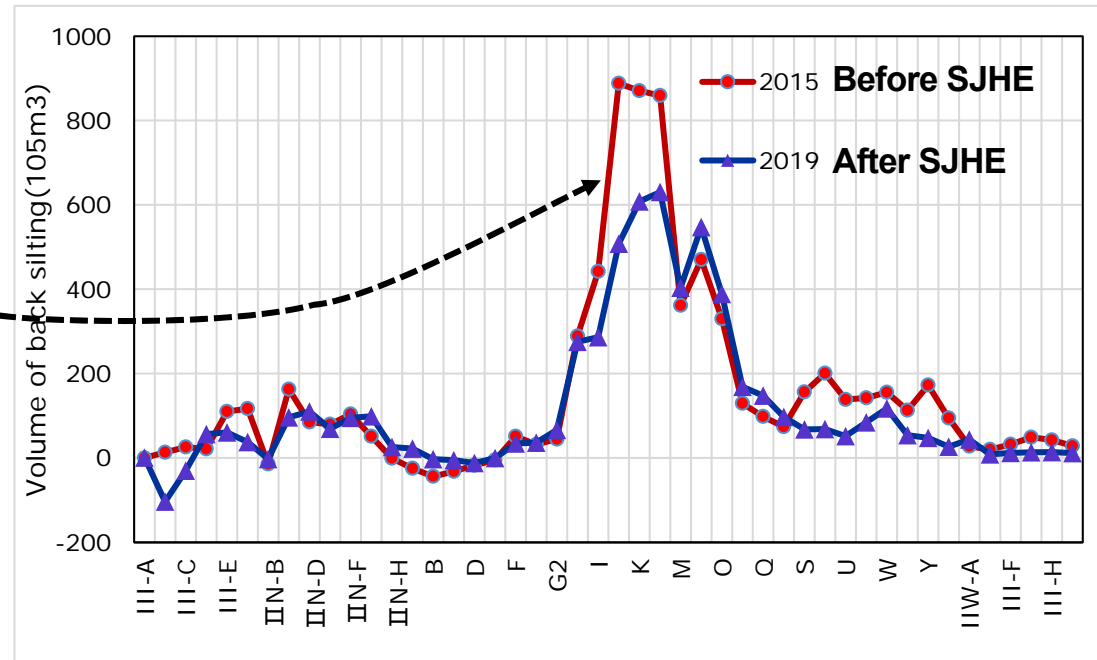
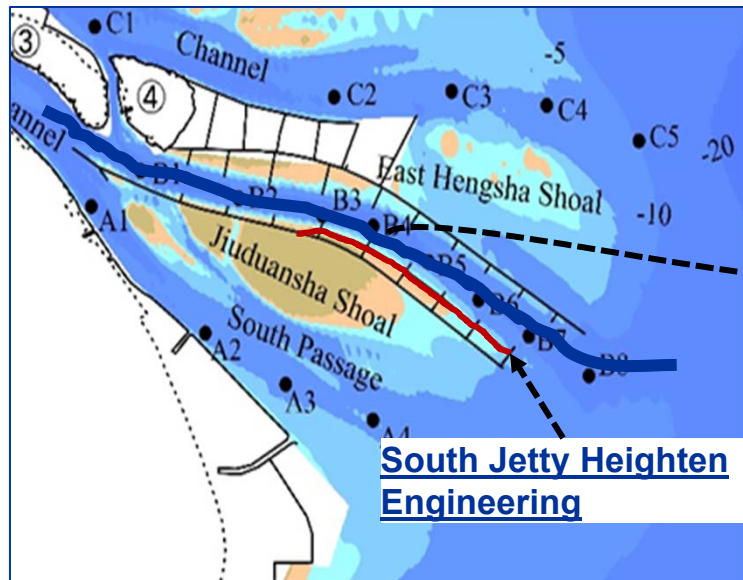
H: tidal range at Zhongjun station

D: Distance from Xiaojiudian to sediment deposition point in SP

Results

Human interferences affect the spatial-temporal variation of TMZ:

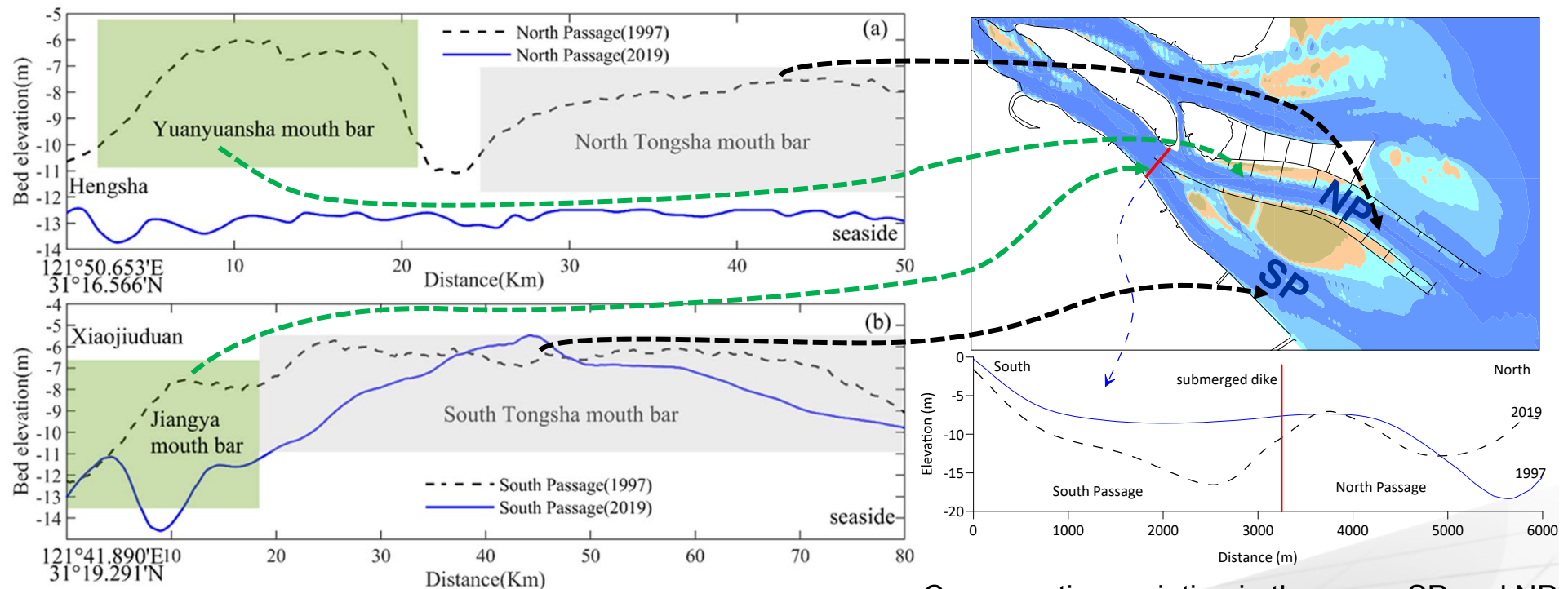
- the dredging volume decreased by 24% in 2019 when the south jetty heightened from 2.5 m to 3.5 m (2016), which blocked the fluvial sediment input and decreased sediment deposition.



Yearly dredging volume distribution in the North Passage

Results

Mouth bar in the upper reach of the South Passage and the North Passage disappeared due to the influence of recent projects.

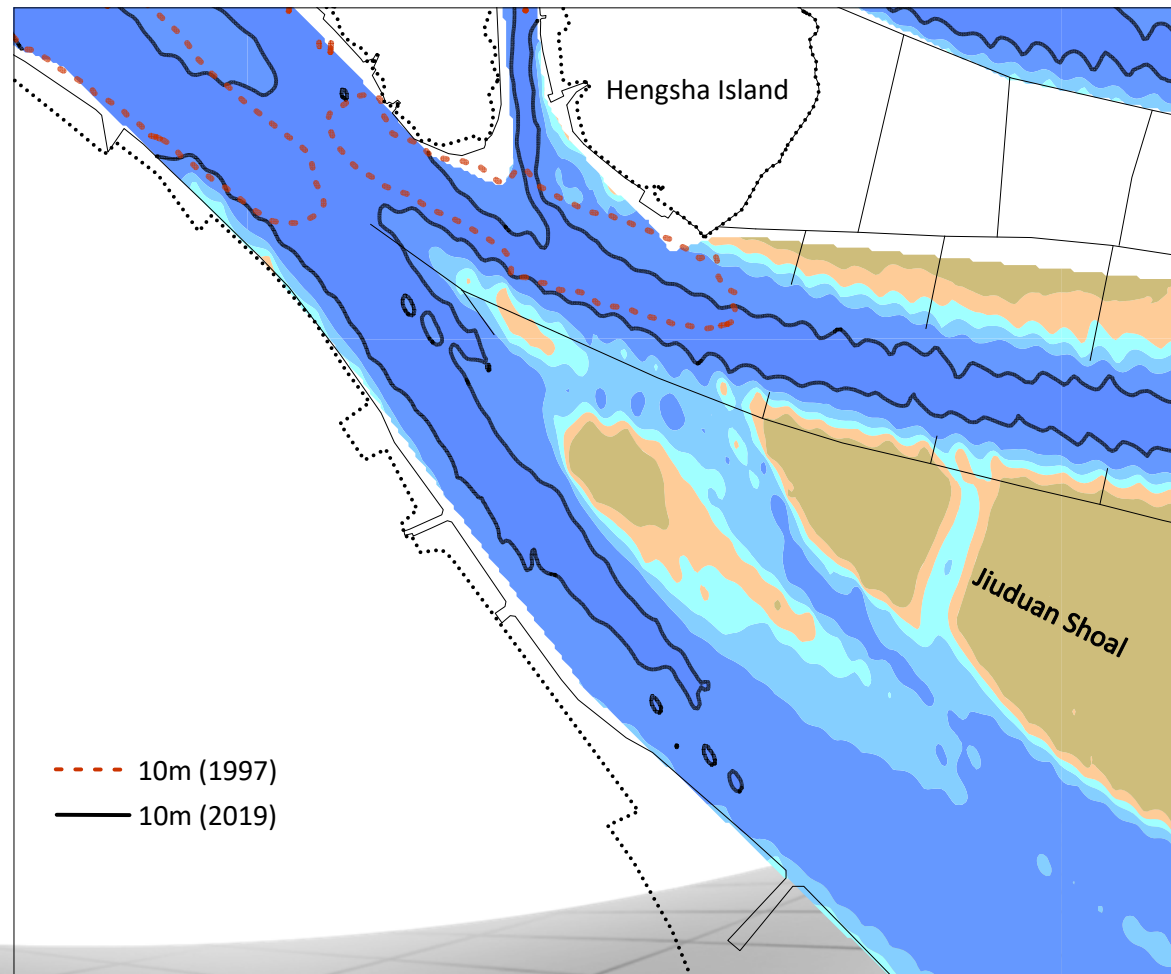


Longitudinal topographic profile of the SP and NP

Cross section variation in the upper SP and NP

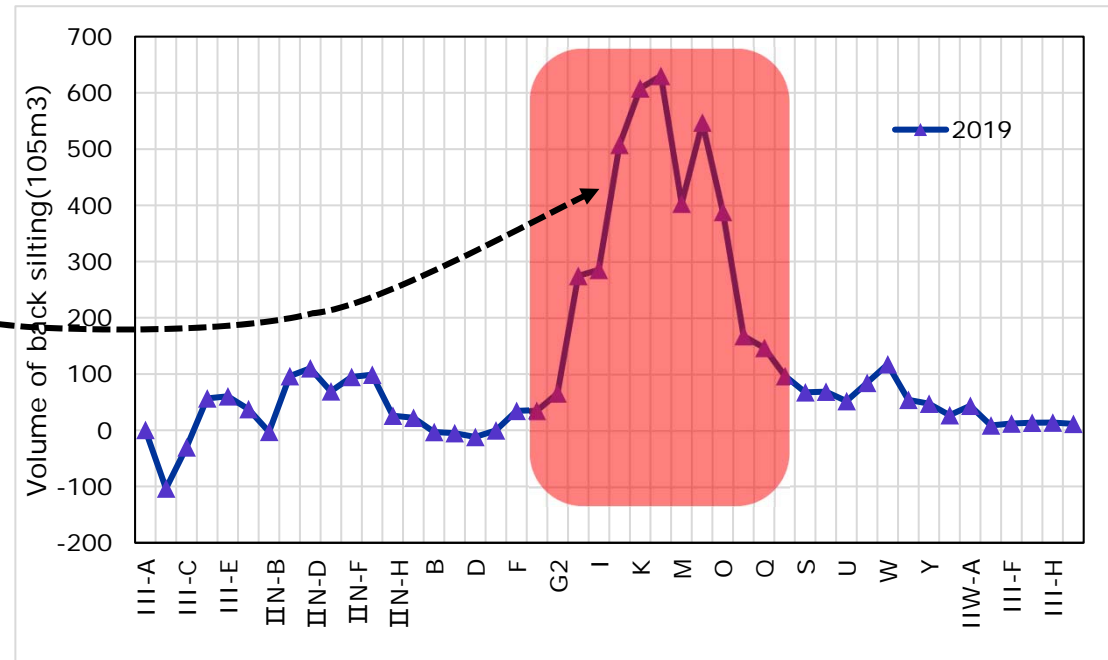
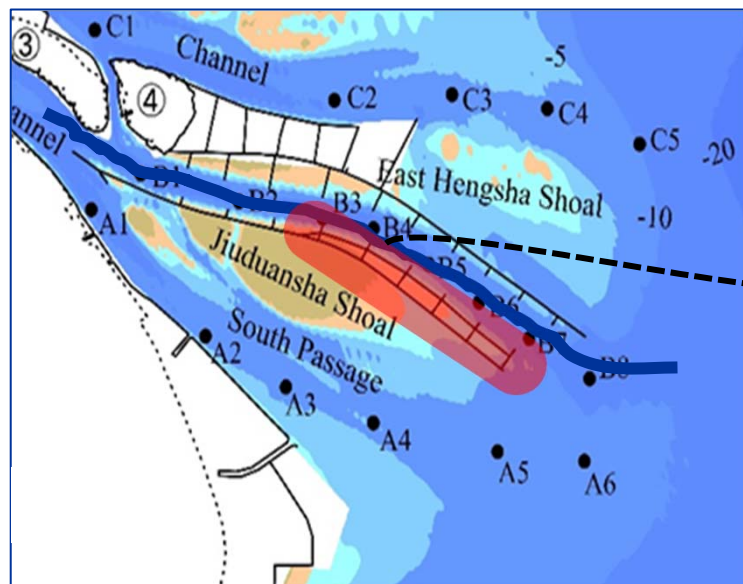
Results

Mouth bar in the upper reach of the South Passage and the North Passage disappeared due to the influence of recent projects.



Results

Due to the waterway dredging works in the North Passage, there exists an invisible mouth bar that appeared as a peak dredging volume.

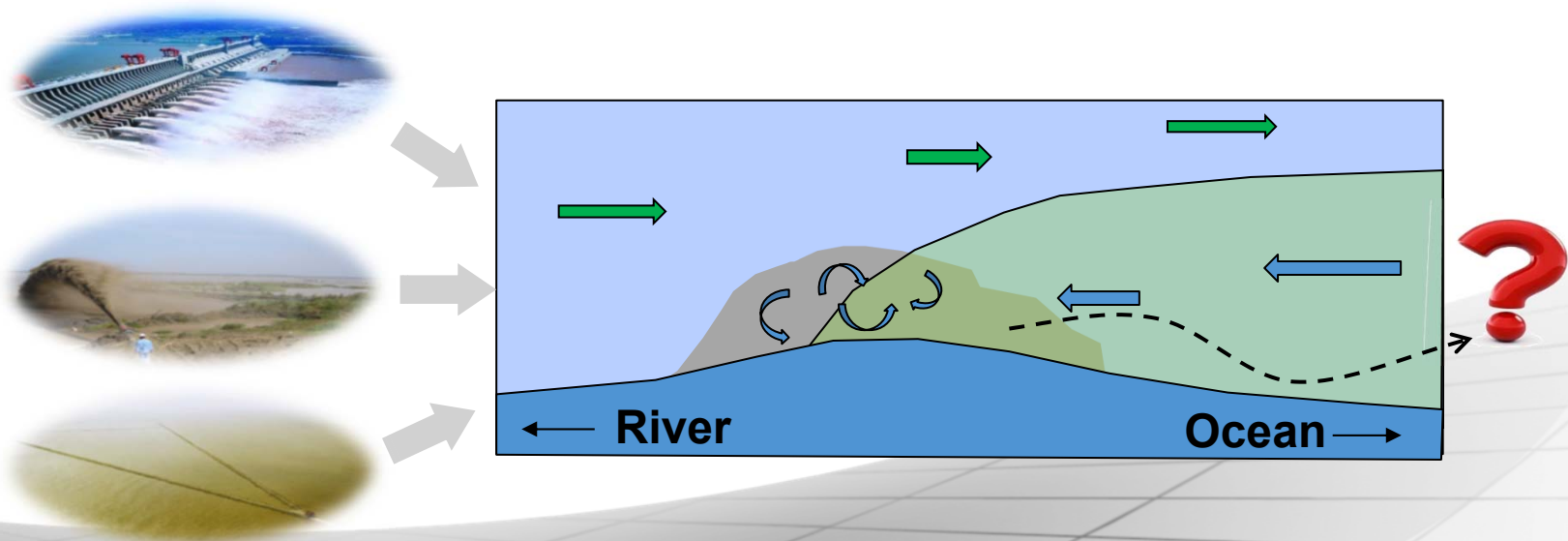


Dredging volume distribution in the North Passage

Conclusion

❖ Influence of human activities:

- TMZ already steadily exists in the lower reach of the Yangtze Estuary.
- Location of the TMZ migrated downwards in SP.
- Mouth bars which used to associated with TMZ have completely disappeared in the NP and the upper section of the SP.



Thank you !

