

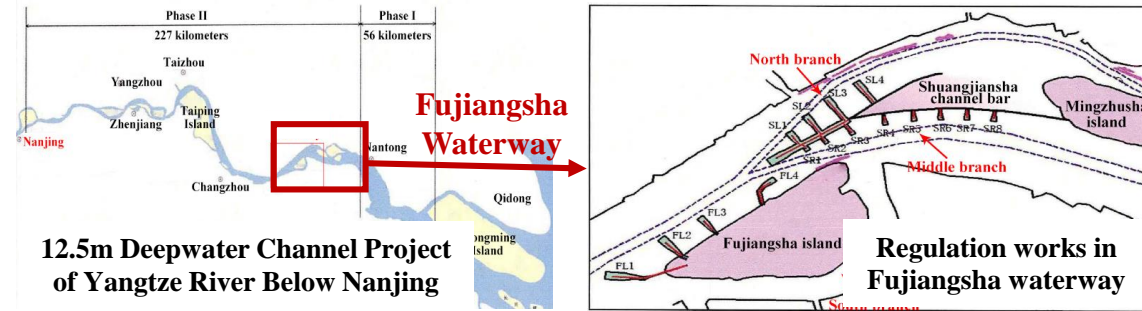
# Can Regulation Works Maintain Deepwater Channel of 12.5m in Fujiangsha Waterway: A Numerical Study

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## Background

**12.5m Deepwater Channel Project** in two phases has been carried out to enhance the navigation capacity of the Yangtze River



## Mathematical method

### Full coupled hydro-sediment-morphodynamic model

- Fully account for the feedback impacts of bed deformation on flow evolution.
- **HLLC approximate Riemann solver (Toro 2001)**
- Make model shock-capturing.

### Hybrid LTS/GMaTS (Hu et al. 2019, ADWR)

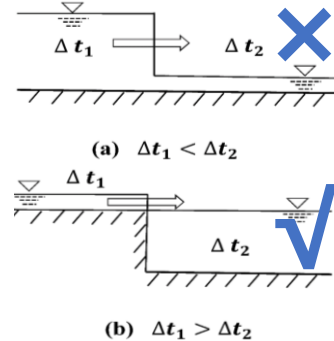
- Modify the grade exponent of cells around the (wet/dry or dynamic/static) fronts
- LTS for hydro-sediment equations

$$U_i^{**} = U_i^* - \frac{\Delta t_{L-i}}{A_i} \sum_{j=1}^3 E_{nij}^* \Delta L_{ij} + \Delta t_{L-i} (S_{si}^* + \bar{S}_{bi} + \bar{S}_{fi})$$

- GMaTS for morphodynamic equations

$$z_b^{t_0+\Delta T} = z_b^{t_0} + \Delta T \frac{1}{2^{m_{\max}^* - m_i^*}} \sum_{l_i=1}^{2^{m_{\max}^* - m_i^*}} \frac{D_T - E_T}{1 - p_o}$$

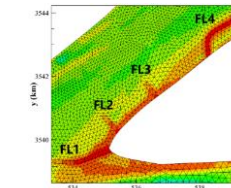
- **Significantly reduce run times** without loss of accuracy!!!



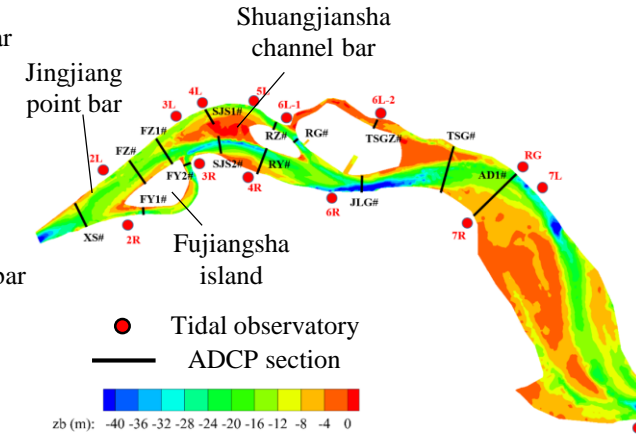
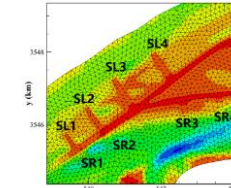
## Sediment-laden flows and morphological changes in Fujiangsha waterway

### Initial condition

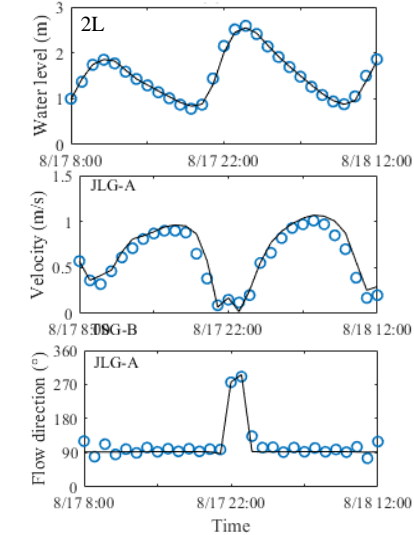
Dikes on the point bar



Dikes on the channel bar

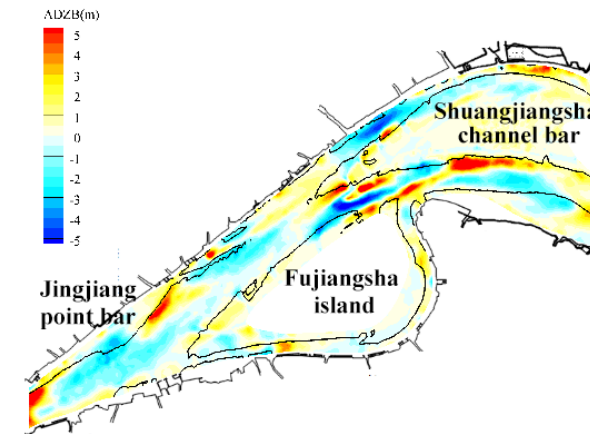


### Model verification



### Calculated results

(a) Regulation works



(b) No regulation works

