BASEMENT Users' Meeting online 2021

Investigation of landslide tsunami using BASEMENT (version 2.8)

Jiang Yujie, Li Jian

China University of Geosciences (Wuhan)

2021-01-28

BASEMENT Anwendertreffen 2021
BASEMENT Users' Meeting online 2021

Outlines

- **Why I choose BASEMENT to study my project (Landslide tsunami)?**
- **Modelling an experimental landslide tsunami (Sue's experiment)**
- **Investigate an physical experiment of landslide tsunami (Monai Experiment)**
- **Future work**

BASEMENT Users' Meeting online 2021

➢Why I choose BASEMENT to study my project (Landslide tsunami)?

I. Friendly interface , powerful function

II. OpenMP multi-threads parallelisation

III. Built-in visualization(BASEvis)

IV. Output files within multiple formats

BASEMENT Users' Meeting online 2021

➢Modelling an experimental landslide tsunami (Sue's experiment)

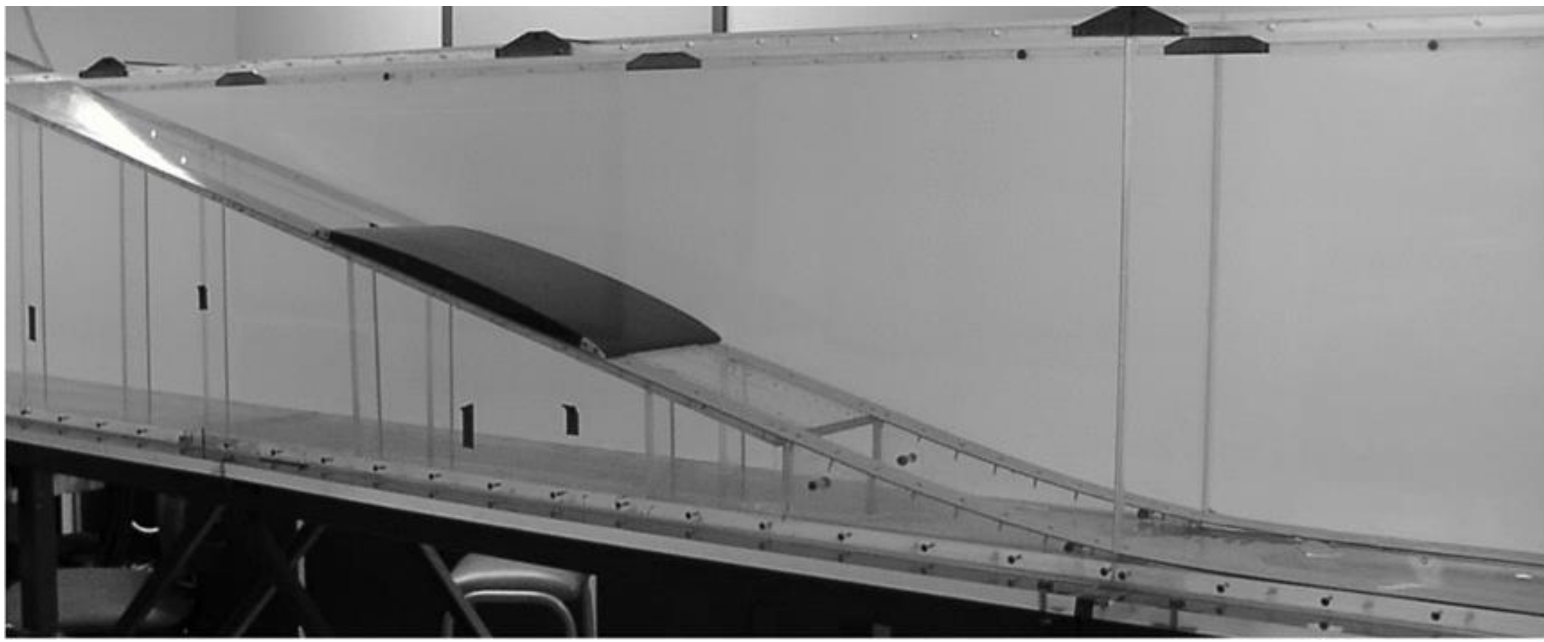


Figure 1 Experimental set-up for submarine landslide-induced tsunami(Sue,2006)

BASEMENT Users' Meeting online 2021

➢Modelling an experimental landslide tsunami (Sue's experiment)

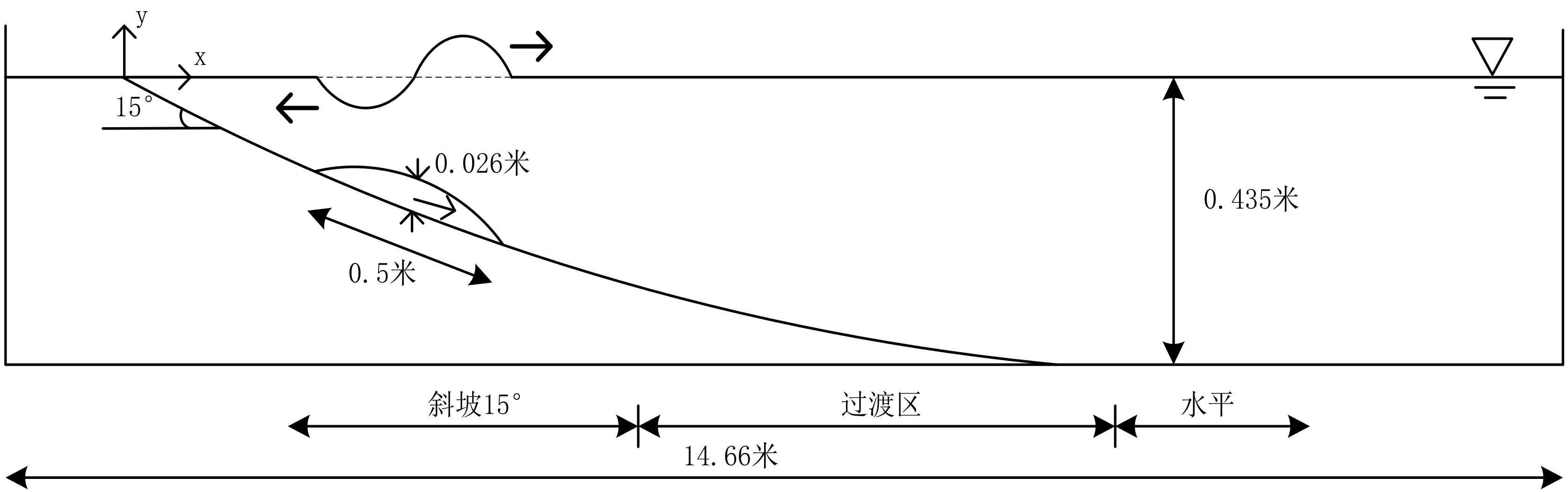
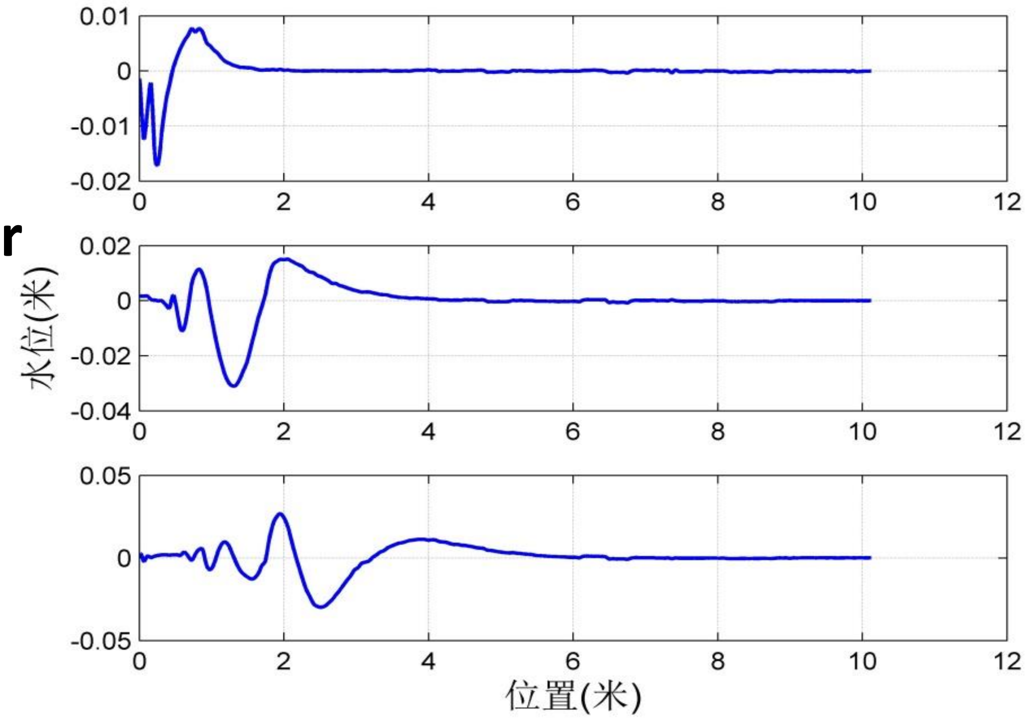


Figure 2 Slide view of the experiment (Sue, 2006)

BASEMENT Users' Meeting online 2021

➢Modelling an experimental landslide tsunami (Sue's experiment)

Water Level (m)



Position (m)

Figure 3 Experimental results of water levels at t=0.6,1.6,2.6s(Sue, 2006)

BASEMENT Users' Meeting online 2021

➢Modelling an experimental landslide tsunami (Sue's experiment)

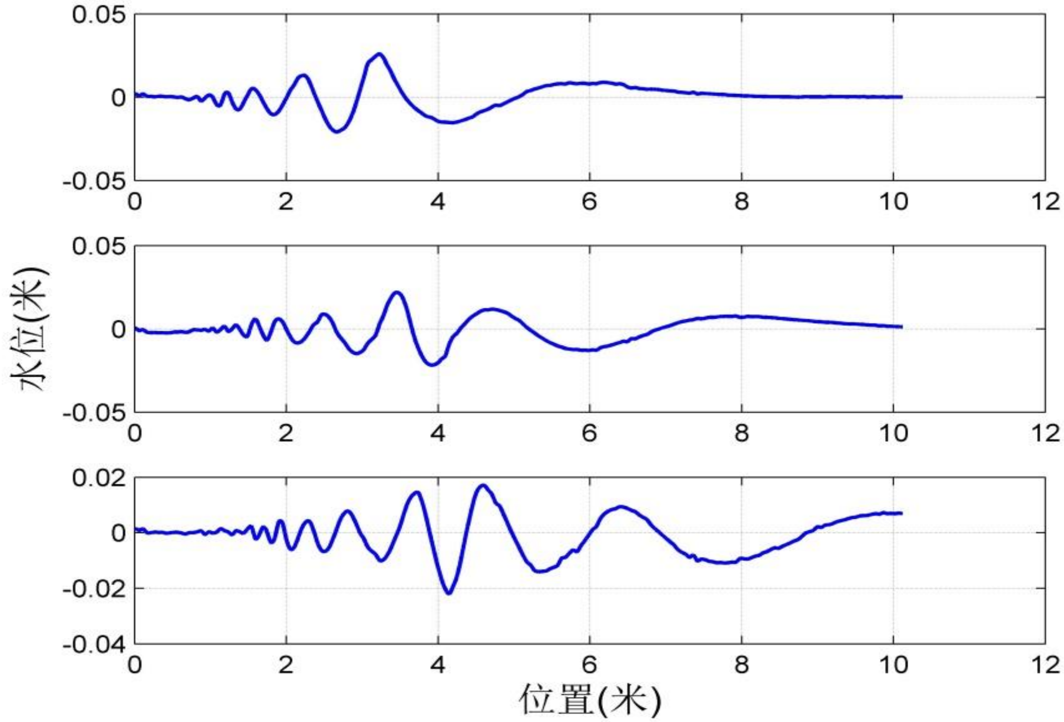


Figure 4 experimental result of water levels at t=3.6,4.6,5.6s(Sue,2006)

BASEMENT Users' Meeting online 2021

- **Modelling an experimental landslide tsunami (Sue's experiment)**

Tsunami wave propagation process reproduced by BASEMENT:

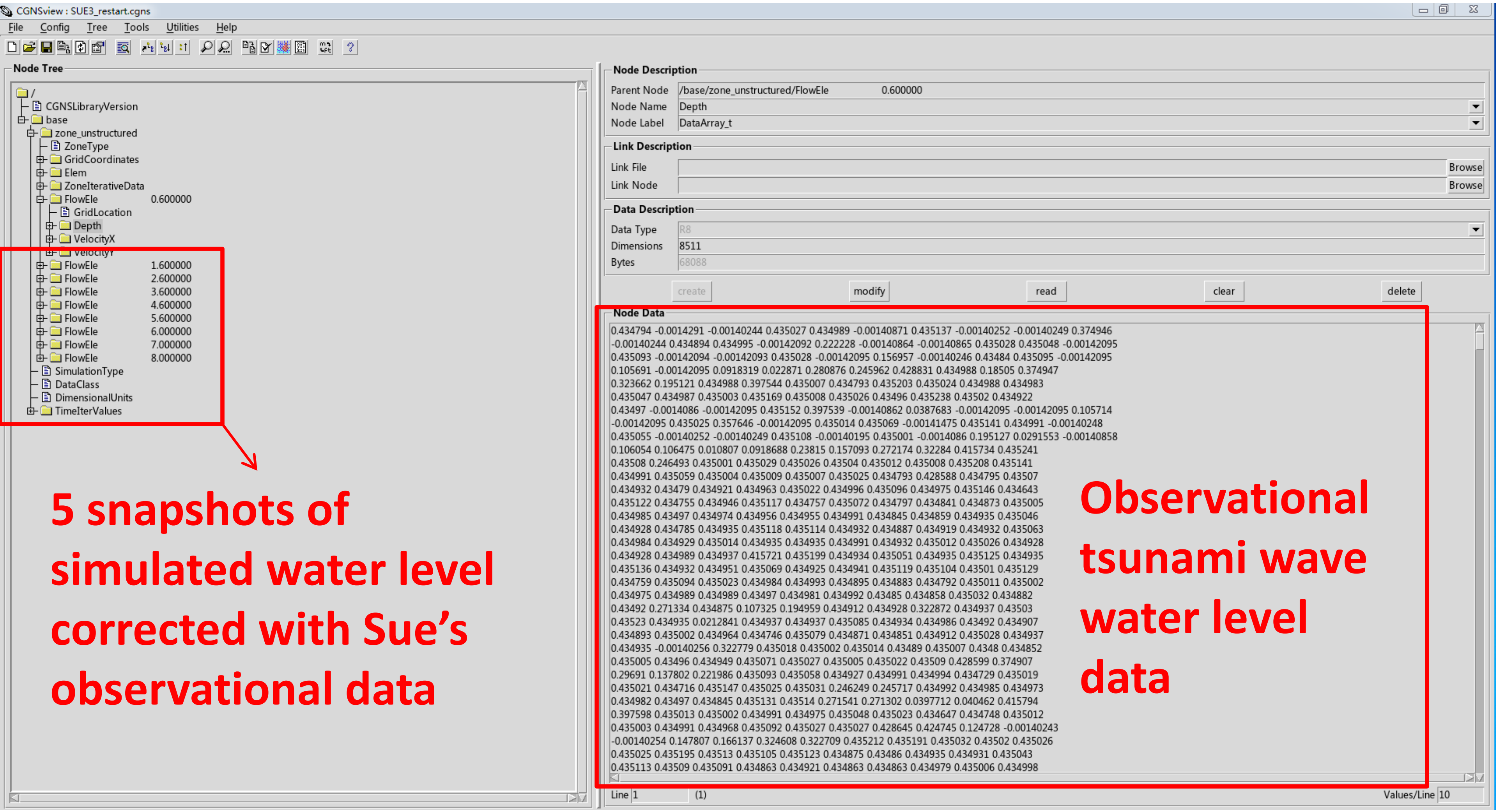
I. Domain discretized by BASEmesh

II. Initial simulation with input waves by BASEMENT

III. Event-driven water levels were created by CGNSview tool

IV. Compare the simulated results with measured results

BASEMENT Users' Meeting online 2021



CGNSview window

BASEMENT Users' Meeting online 2021

➢Modelling an experimental landslide tsunami (Sue's experiment)

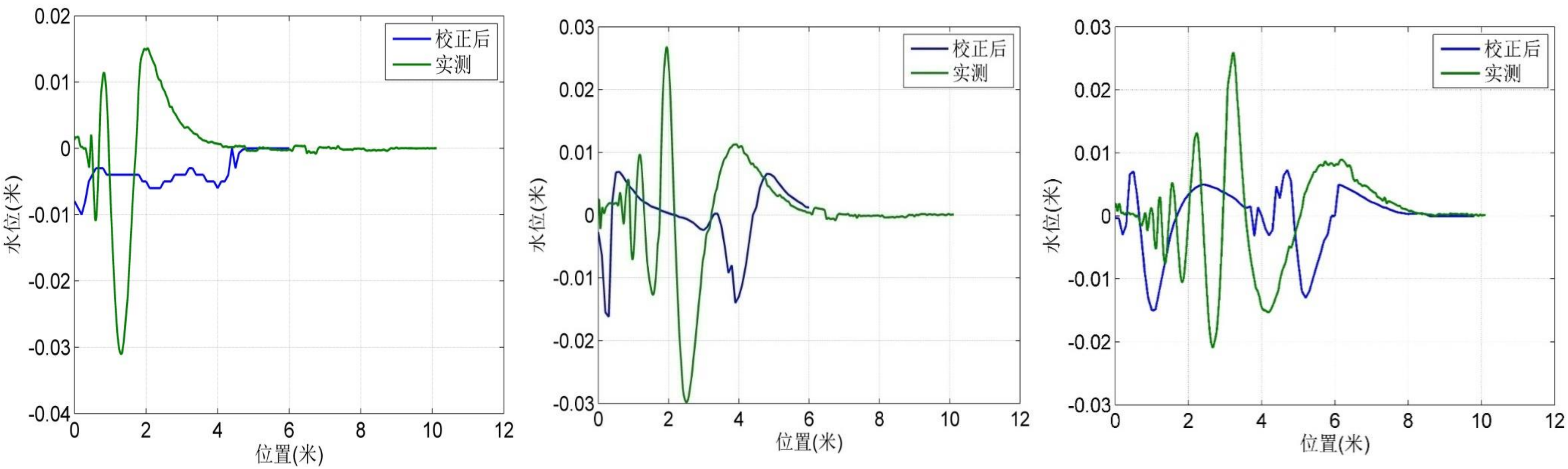


Figure 5 The comparison between measured and corrected results at t=1.6s,2.6s,3.6s

BASEMENT Users' Meeting online 2021

➢Modelling an experimental landslide tsunami (Sue's experiment)

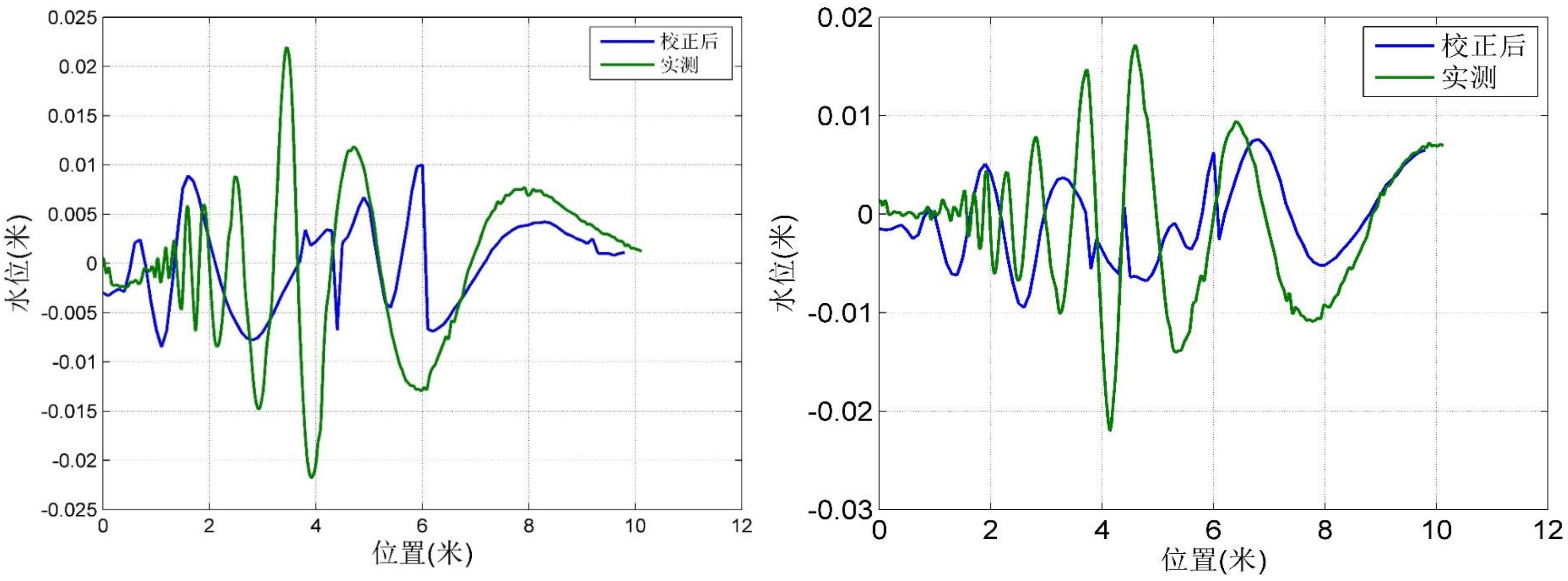


Figure 6 The comparison between measured and corrected simulated results at t=4.6s, 5.6s.

BASEMENT Users' Meeting online 2021

➢Modelling an experimental landslide tsunami (Sue’s experiment)

Preliminary results:

I. The landslide process plays an significant role in the whole landslide tsunami waves.

II. It’s hard to simulate the real wave propagation process by the pure hydrodynamic code for landslip events.

III. Coupled simulation between geomechanic and hydrodynamic models could be more suitable to reproduce the real process especially at the starting stages

BASEMENT Users' Meeting online 2021

➢Investigate an physical experiment of landslide tsunami (Monai Experiment)

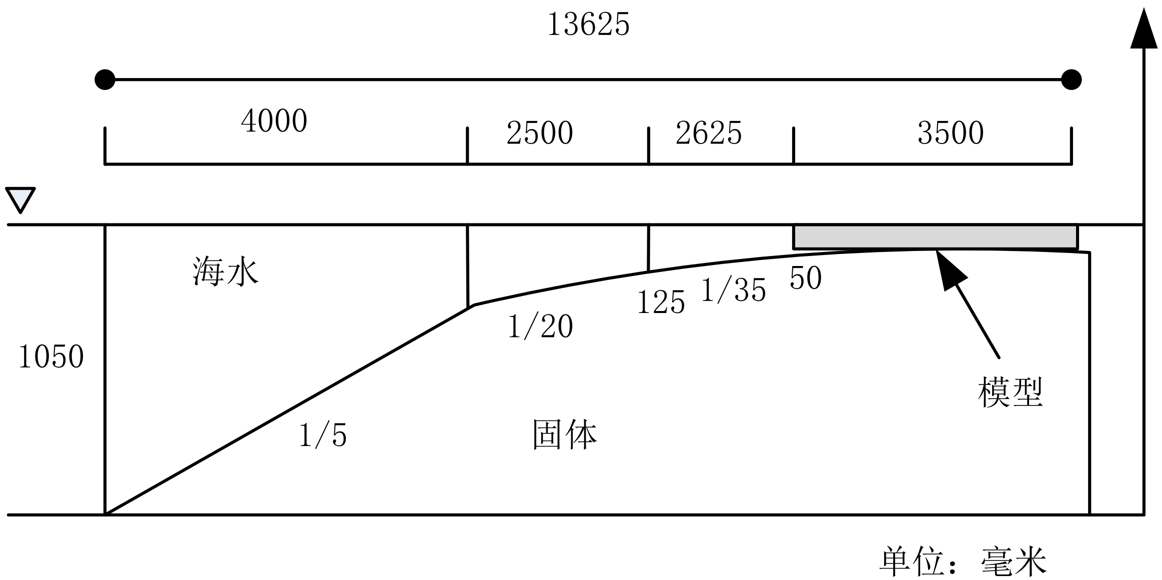
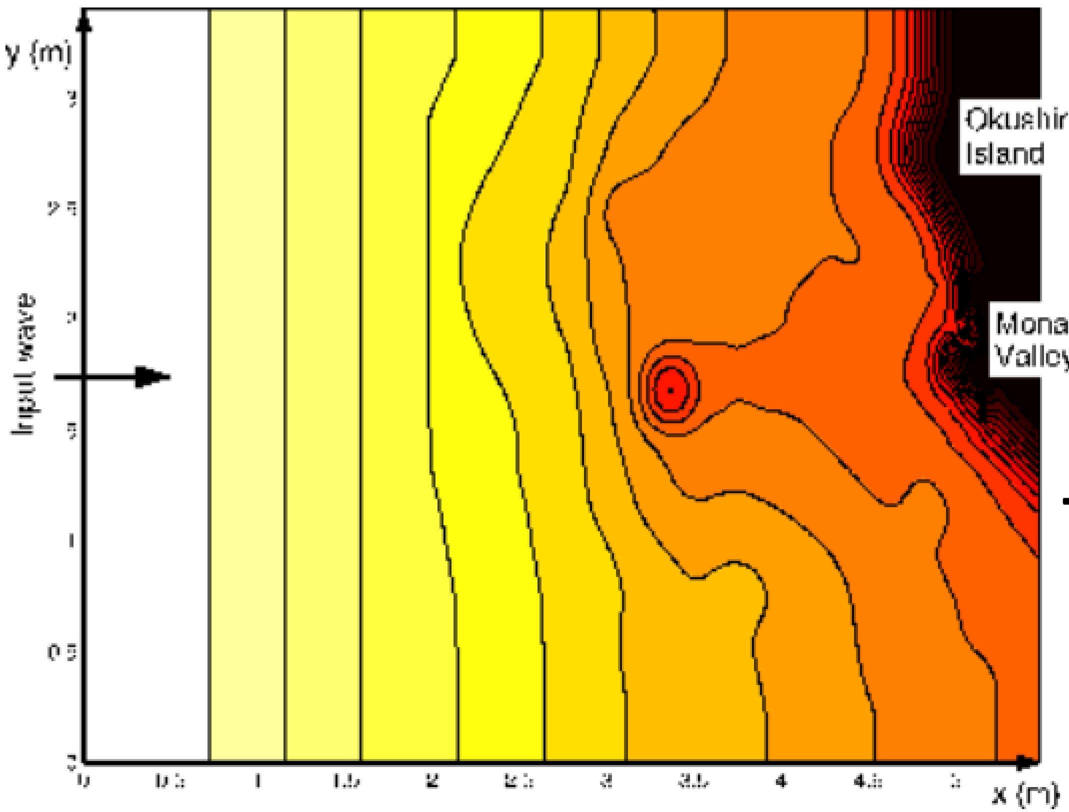


Figure 7 The physical setup of Monai experiment(NOAA)

BASEMENT Users' Meeting online 2021

- **Investigate Monai experiment on landslide tsunami**

Input wave



Topography map

Figure 8 Configuration of Monai simulation(NOAA)

BASEMENT Users' Meeting online 2021

➢Investigate Monai experiment on landslide tsunami

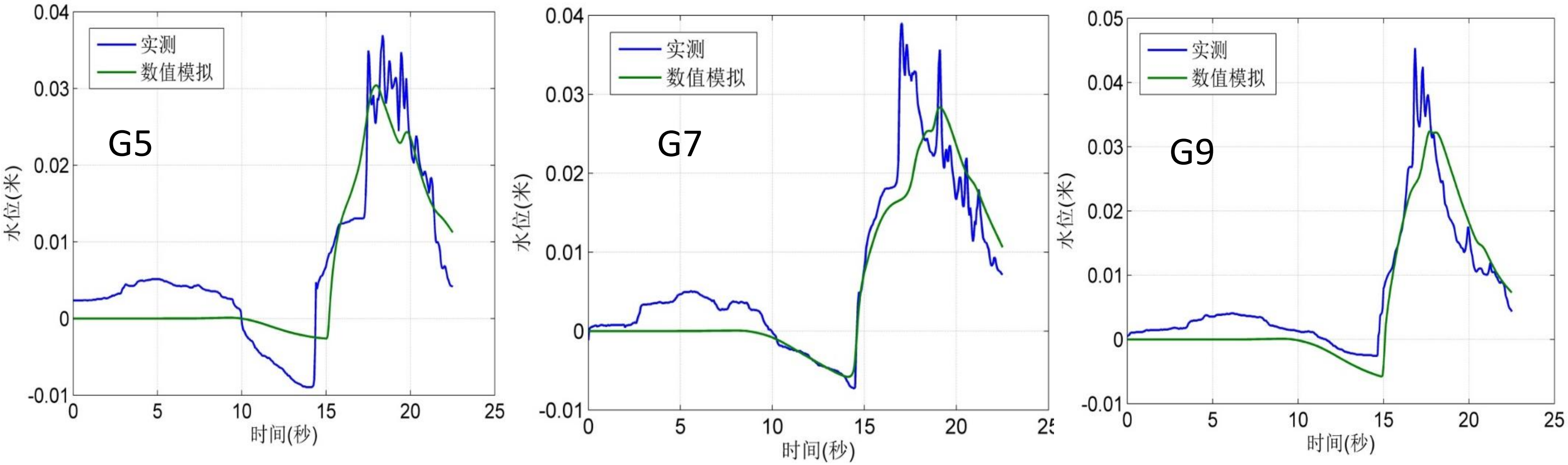


Figure 9 Comparison between measured and simulated water levels at 3 positions for model validation

BASEMENT Users' Meeting online 2021

➢**Investigate Monai experiment on landslide tsunami**

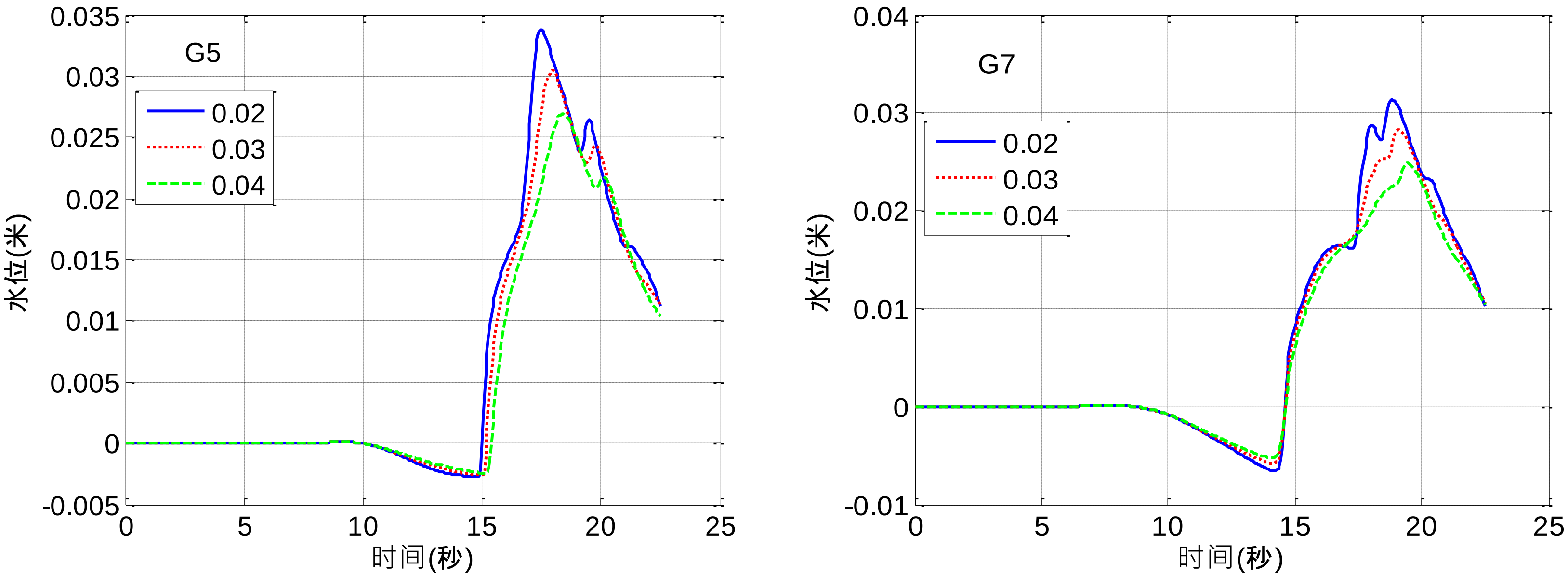


Figure 10 Influence of different friction coefficients on water levels

BASEMENT Users' Meeting online 2021

➢ Investigate Monai experiment on landslide tsunami

Based on the initial simulation , Sediment transport is introduced to discuss the effect of topography change and water level

Added type	Porosity	Grain size	Inlet Suspended sediment concentration
Bed load	40%	0.5/1/1.5mm	0
	40%/45%50	0.5	0
	40%	0.5	1e-5/5e-5/1e-4 m^3/s
Suspended load	40%	0.5	5e-5 m^3/s

BASEMENT Users' Meeting online 2021

➢Investigate Monai experiment on landslide tsunami

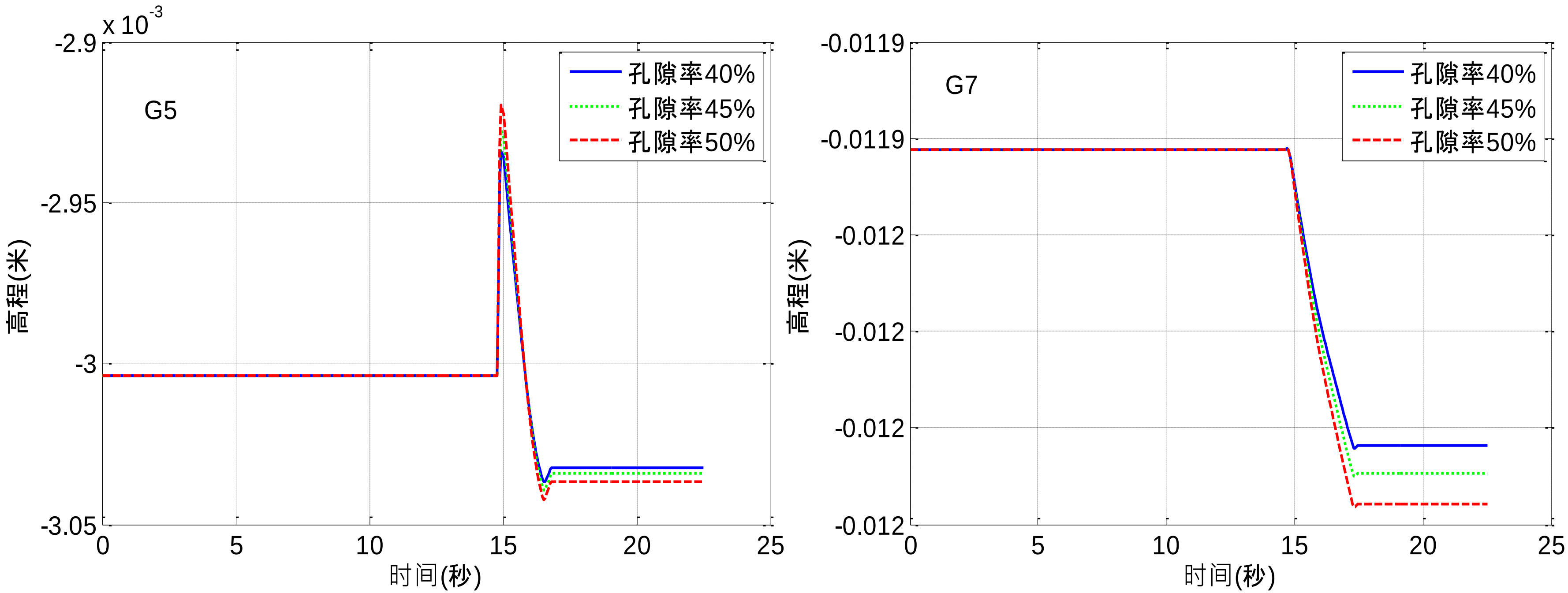


Figure 10 Effect of sediment porosity on the topography evolution at 2 exact positions

BASEMENT Users' Meeting online 2021

➢Investigate Monai experiment on landslide tsunami

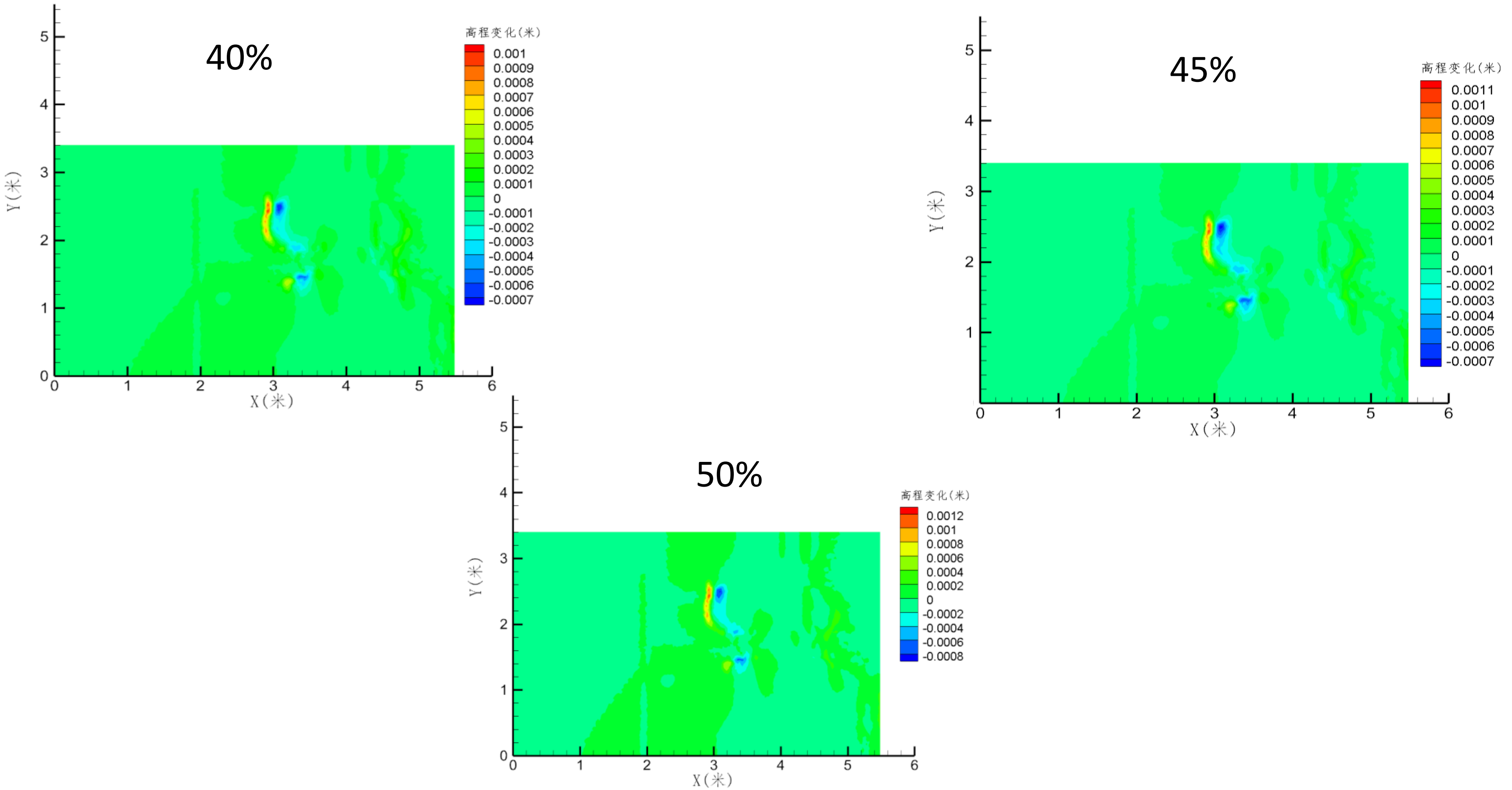
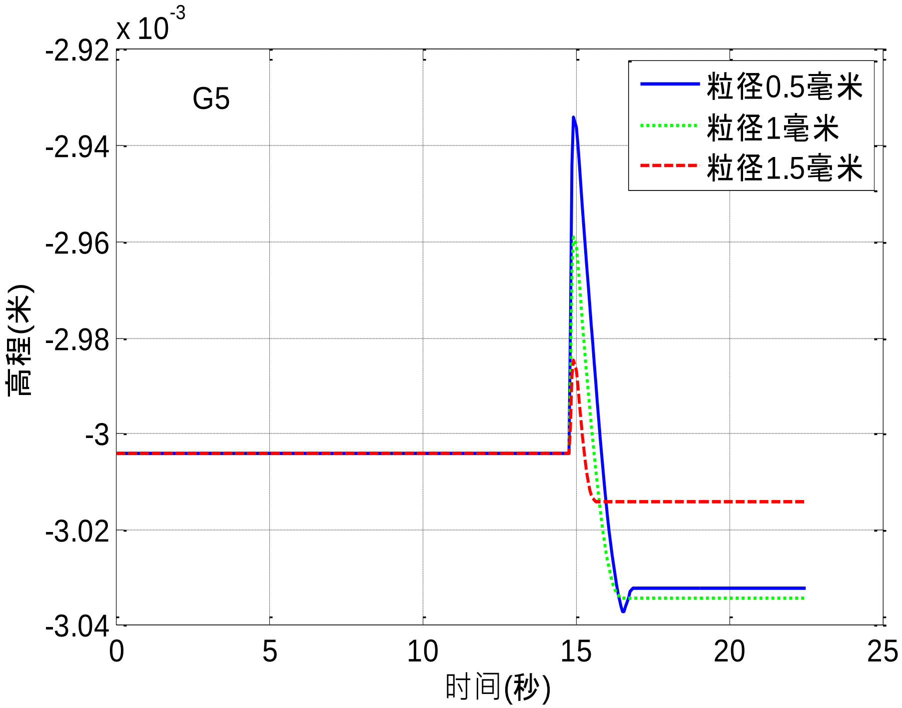


Figure 11 The different porosity on seafloor topography changes

BASEMENT Users' Meeting online 2021

➢Investigate Monai experiment on landslide tsunami



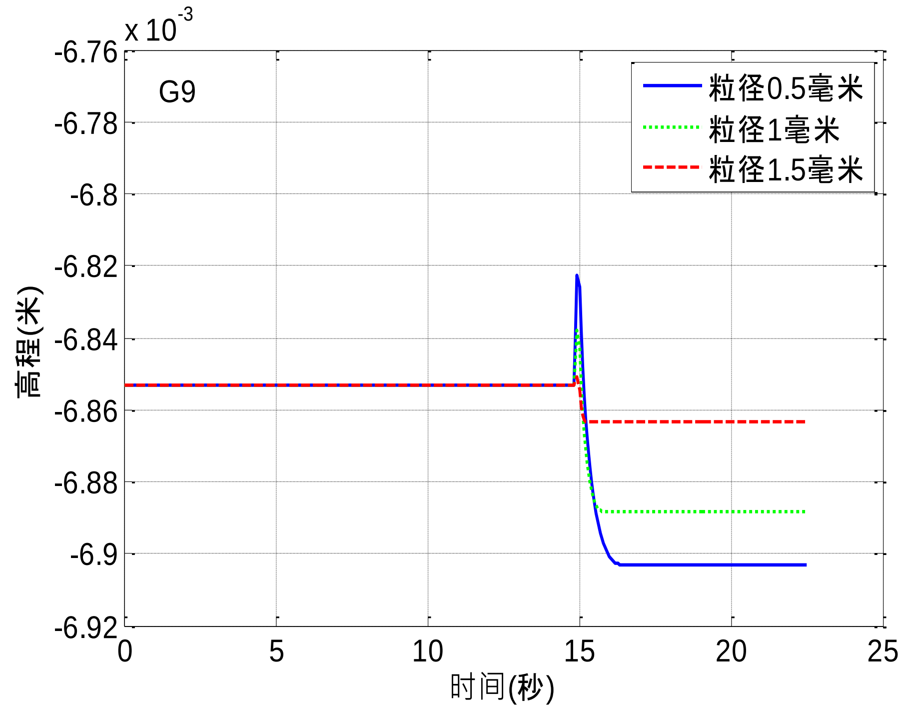


Figure 11 Influence of different grain size on water levels at 2 exact positions

BASEMENT Users' Meeting online 2021

➢Investigate Monai experiment on landslide tsunami

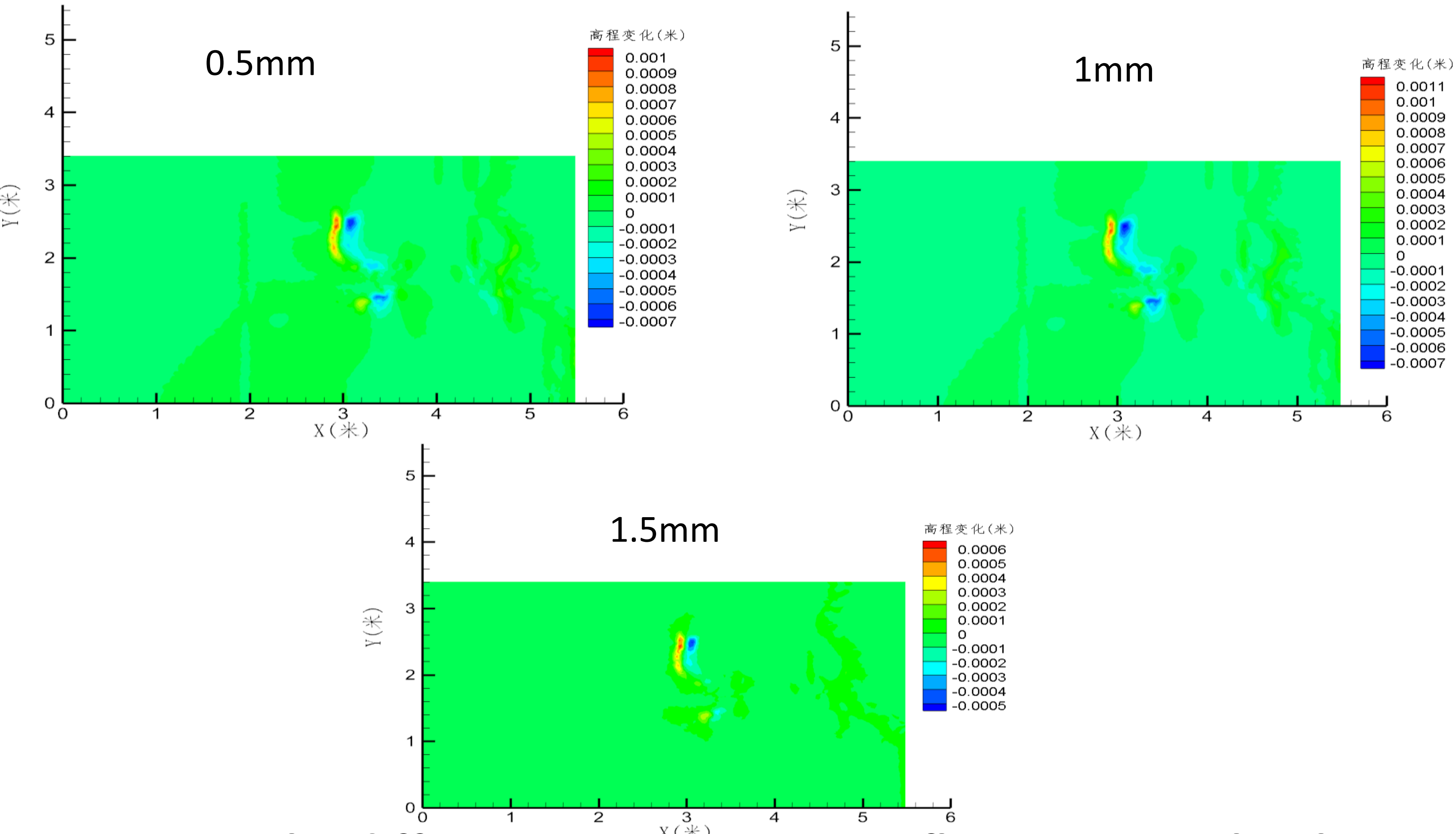


Figure 12 The different grain size on searfloor topography changes

BASEMENT Users' Meeting online 2021

- **Investigate Monai experiment on landslide tsunami**

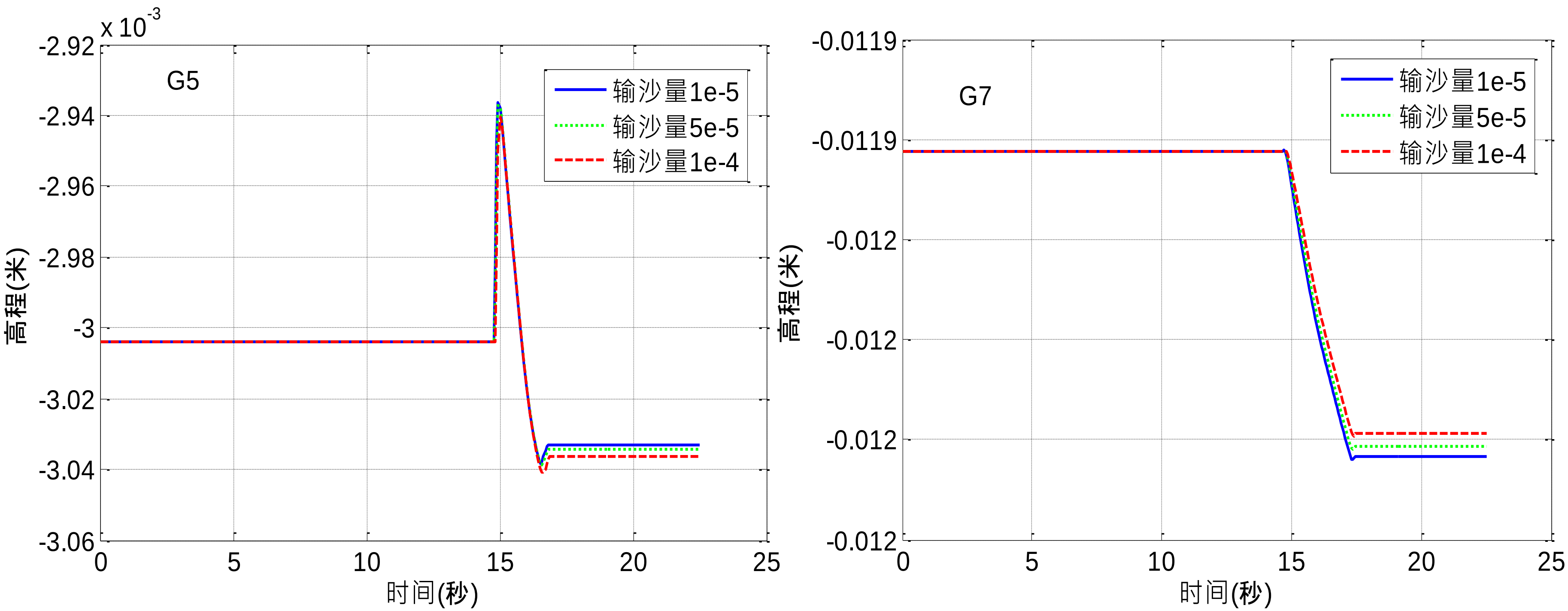


Figure 13 Influence of different sediment discharge on water levels at 2 exact positions

BASEMENT Users' Meeting online 2021

➢Investigate Monai experiment on landslide tsunami

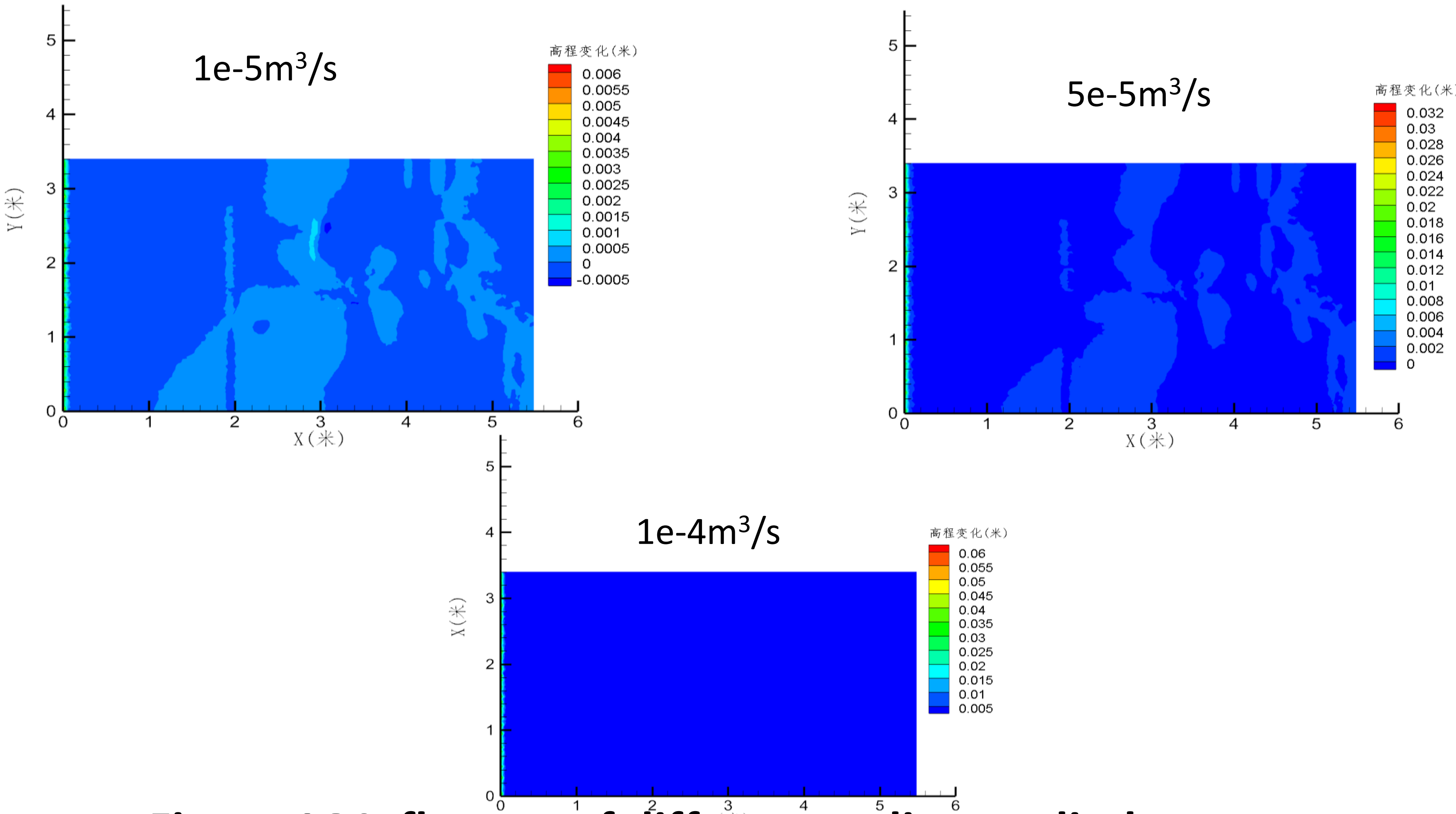


Figure 14 Influence of different sediment discharge on seafloor topography changes

BASEMENT Users' Meeting online 2021

➢ **Investigate Monai experiment on landslide tsunami**

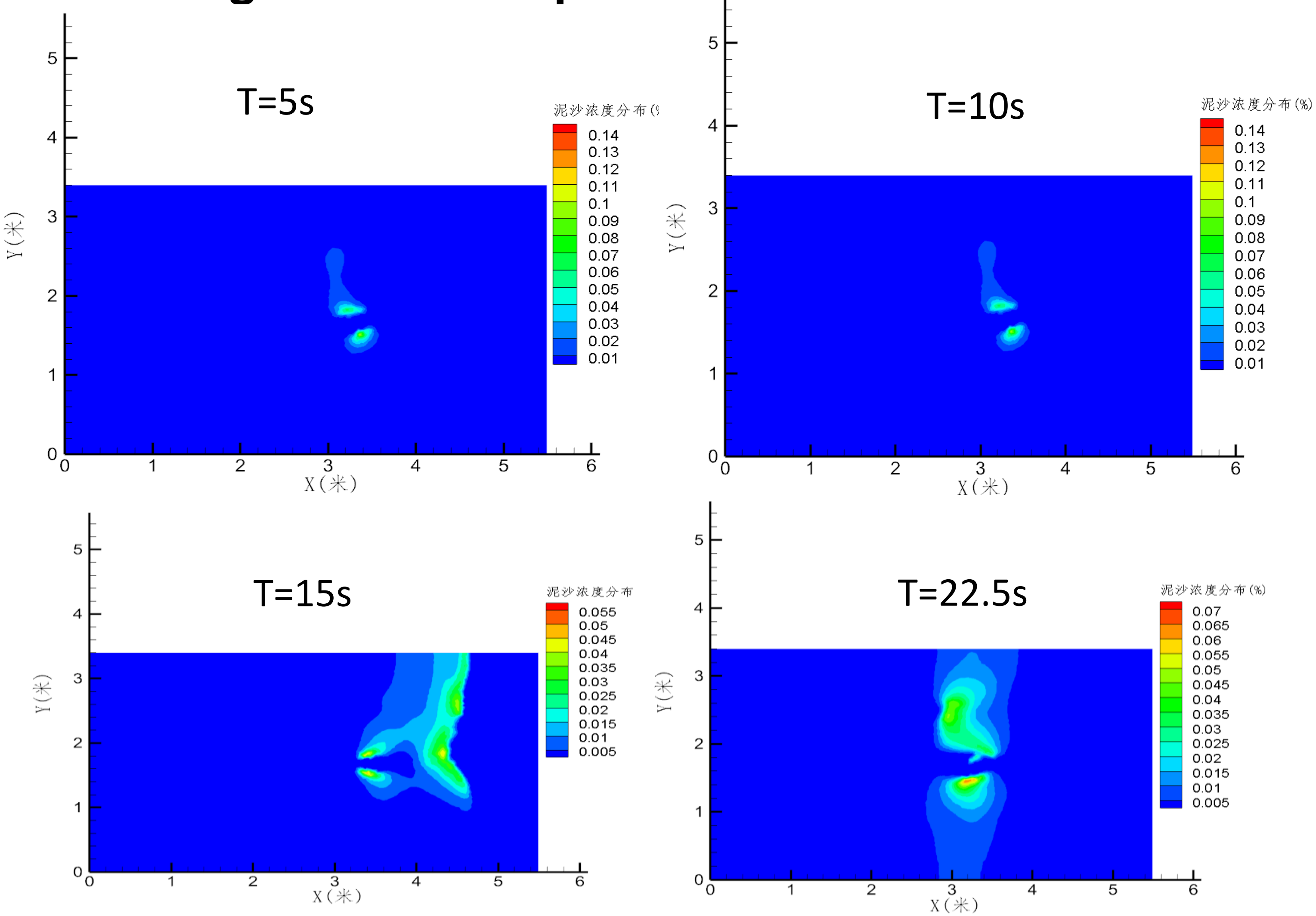


Figure 15 The snap shot of concentration distribution

BASEMENT Users' Meeting online 2021

➢Investigate Monai experiment on landslide tsunami

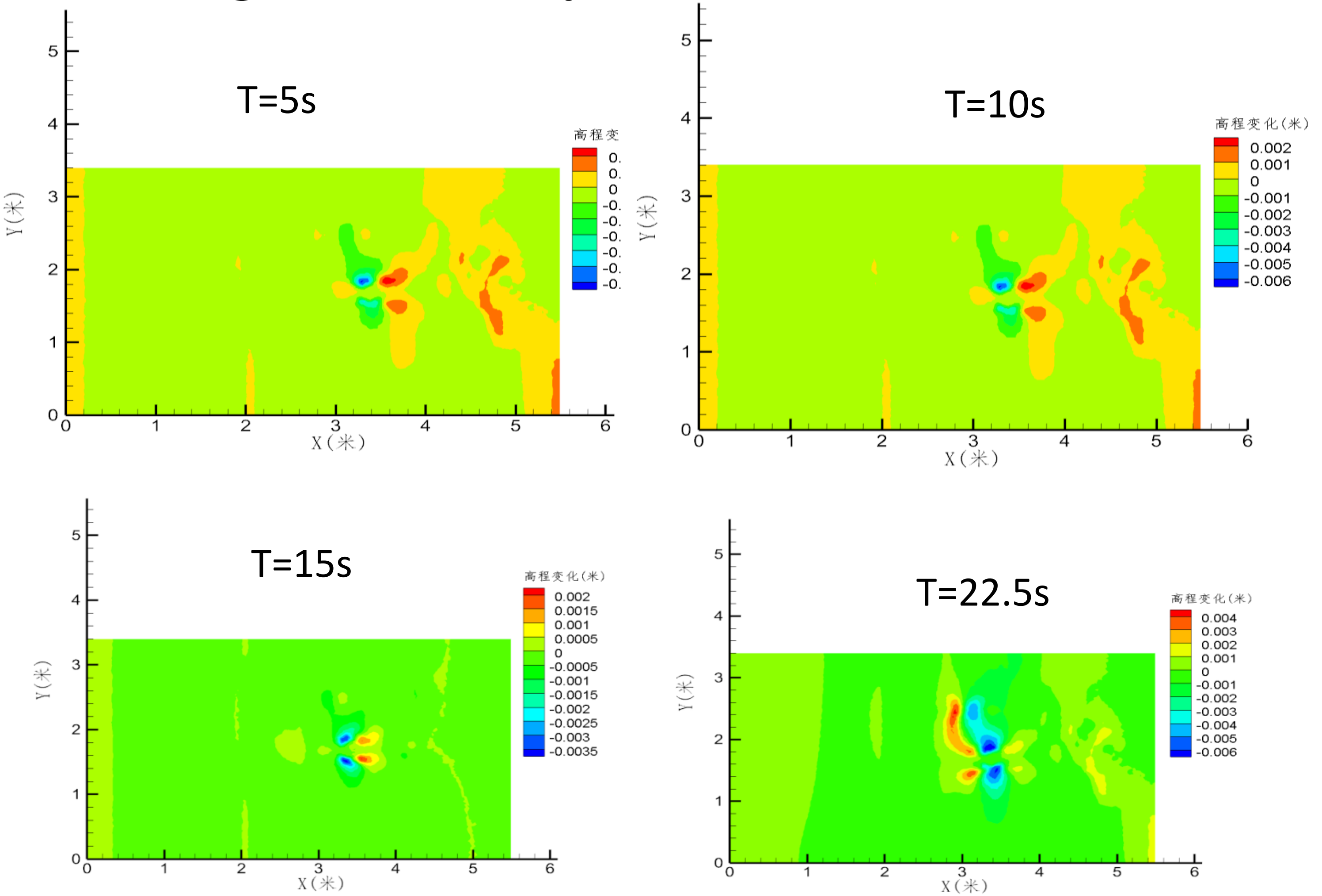


Figure 2 The snap shot of searfloor topography changes

BASEMENT Users' Meeting online 2021

- **Investigate Monai experiment on landslide tsunami**

Preliminary results:

I. **The parameters such as porosity, grain size and sediment concentration play an significant role both in water level and seafloor topography.**

II. **Tsunami-induced sediment transport results in sea floor topography changes that’s the archive of geological event.**

BASEMENT Users' Meeting online 2021

➢Future work

I. Multi-grain components for sediment transport simulation will be considered, especially for the in-situ situation.

II. More accurate event-driven simulations will be adopted for landslide induced tsunami.

III. GPU parallelized computation (BASEMENT version 3.x) should be conducted.

Thank you for listening !