Preliminary analysis on the 03 April 2024 M7.4 Earthquake tsunami

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M7.4 Earthquake occur nearshore Hualien



- A M7.4 earthquake occur at the boundary between land and sea region in Hualien County, Taiwan.
- Following the strong shock, tsunami was generated and triggered the warning alarm.

Sea level Observation





- Sea level data were de-tided by removing low frequency (> 120 min)components.
- Tsunami signal were instrumentally recorded at tide gauges.

Preliminary Fault models for Simulation



Strike

222°

26°

Nodal Planes

Plane

NP1

NP2

hase Moment Tensor (Mww)

loment		1.444e+20 N-n	n	
lagnitude		7.37 Mww		
epth		23.5 km		
ercent <u>DC</u>		90%		
alf Duration		12.50 s		
atalog		US		
ata Source		US. ⁴		
Contributor		<u>US</u> ⁴		
	Dip		Rake	
	33°		103°	

81°

$$M_0 = \mu SD$$

(Hank and Kanamori, 1979)

 M_0 = Moment μ = righty (30 GPa) S = Fault area D = slip value

Fault parameters				
Fault area	64 (km) × 32 (km)			
Fault slip	2.35 (m)			
Fault depth (km)	23.5 (km)			

https://earthquake.usgs.gov/earthquakes/eventpage/us7000m9g4/moment-tensor

58°

Co-seismic crustal deformation for Simulation



- Co-seismic crustal deformation of the two preliminary fault models are calculated by using Okada's theory (Okada, 1985).
- The sea-surface deformation is assumed to be the same as crustal deformation, and therefore inputted for wave propagation model.

Numerical condition for Simulation



Simulated distribution of maximum tsunami



- Both modeling showed Maximum tsunami energy focusing on Yilan basin and Ishigaki islands.
- The tsunami energy significantly radiated offshore compared to NP2 (affected by strike angle).

Simulated and Observed tsunami waveforms



- Fault plane of NP1 gives slightly higher wave height than NP2.
- Both model well simulate the first and maximum wave spatially and temporally.
- Amplified and persistent later phases are visible in both stations.

Concluding remarks

- We collected and proceeded the sea level records at Ishigaki and Naha stations in Okinawa Prefecture, Japan. We noticed the tsunami signal approximately 30 min (at Ishigaki) following the earthquake occurrence.
- We developed fault models based on Empirical scaling relations and Moment Tensor solution of USGS for tsunami simulation.
- We validated the fault models by comparing simulated and observed waveforms. We noticed that both single fault models can reproduce the observation reasonably well.
- We noticed that the tsunami energy mainly focus along East Taiwan, Yilan basin and Ishigaki islands. We also measured that the energy transportation path from the two fault models is significantly different.

