Center for Weather Climate and Disaster Research



Hazard Map Induced by Tsunami - Case Study in Gongliao District

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1 Background

2 Method

3 Hazard Assessment

4 Results

5 Conclusion

NTU

WCDR

Background

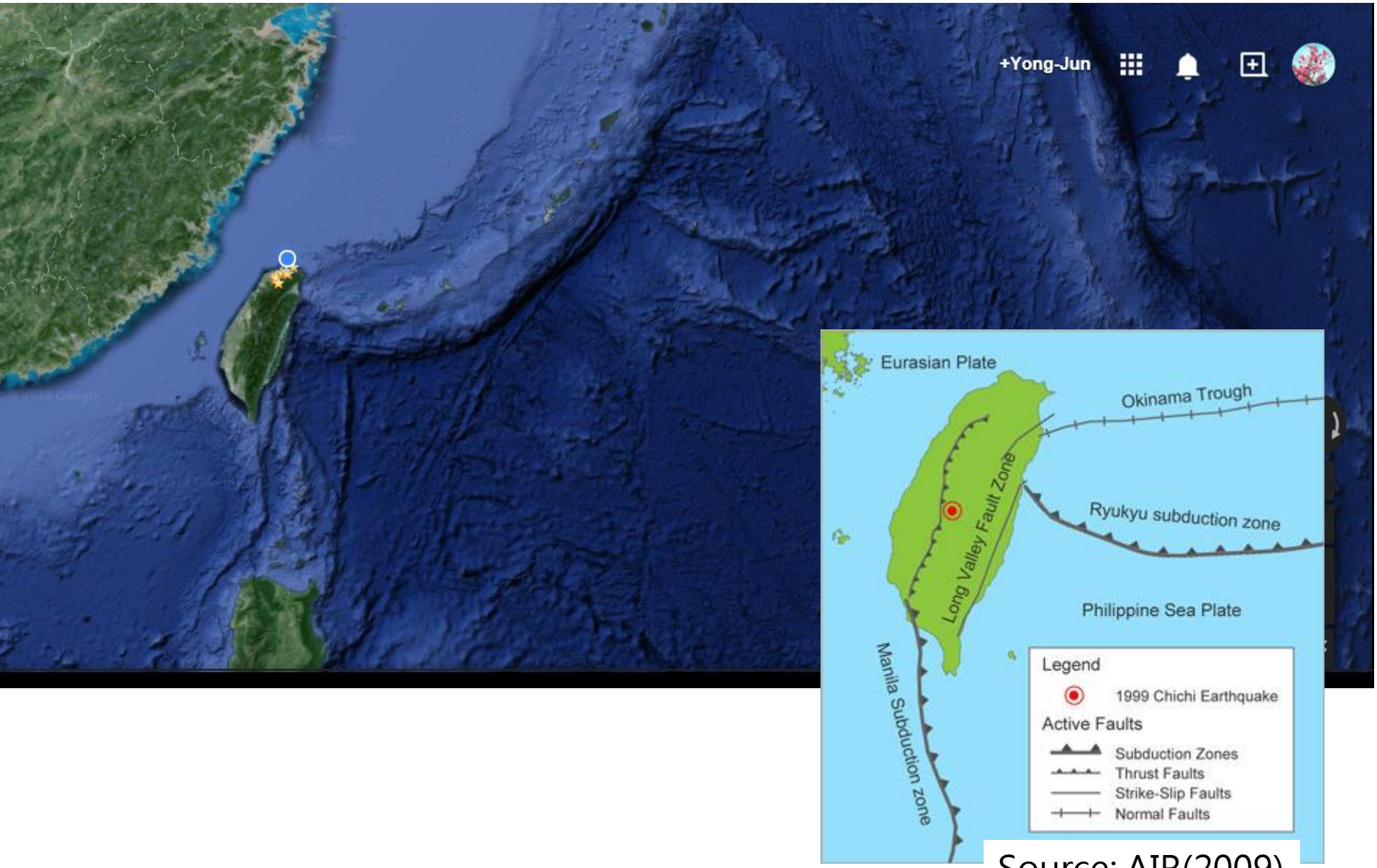
1 Background

- The tsunami induced by east Japan Earthquake has inundated to elevation of 40 m and brought huge damages to buildings.
- Taiwan is located at the junction of the Eurasian plate, the Philippine plate and the Pacific plate. The faults of east of the Ryukyu Subduction and Manila Subduction may lead to large-scale undersea earthquake and induce Tsunami.
- There were several tsunami events in Taiwan.

Building toppled by 311 tsunami

School damaged by 311tsunami

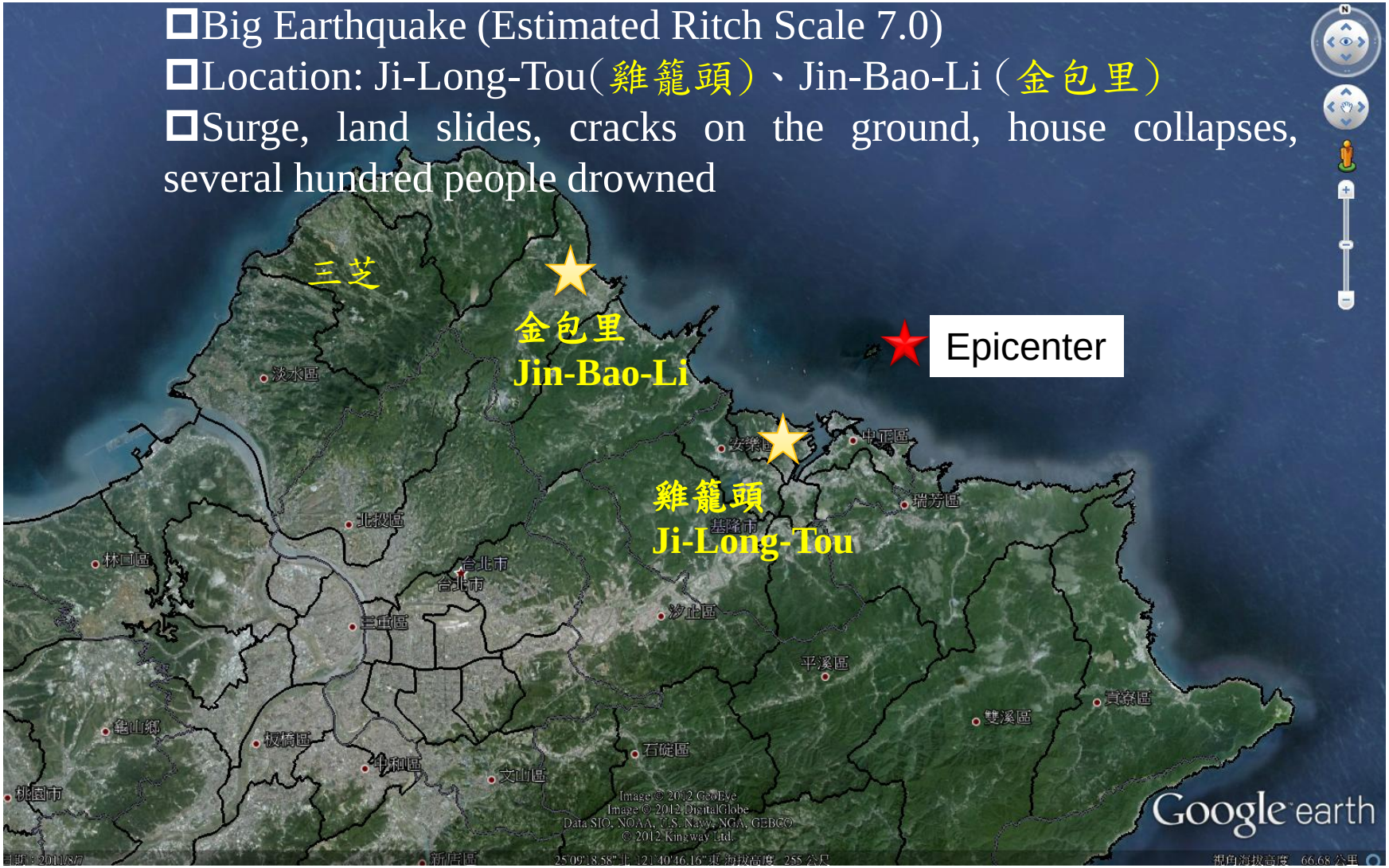
Location of Taiwan



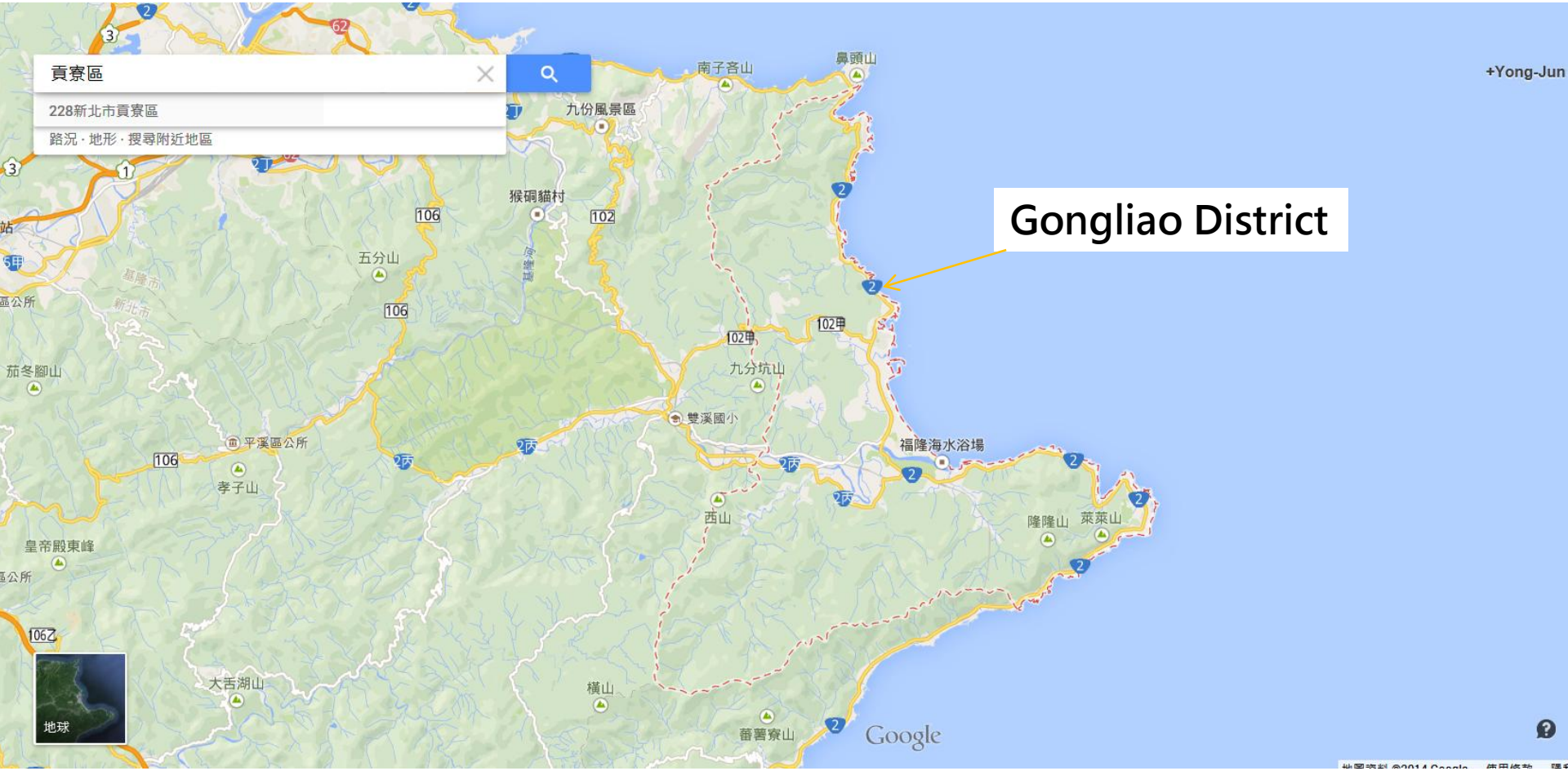
Source: AIR(2009)

1 Historical Tsunami (1867)

- Big Earthquake (Estimated Ritch Scale 7.0)
- Location: Ji-Long-Tou（雞籠頭）、Jin-Bao-Li（金包里）
- Surge, land slides, cracks on the ground, house collapses, several hundred people drowned

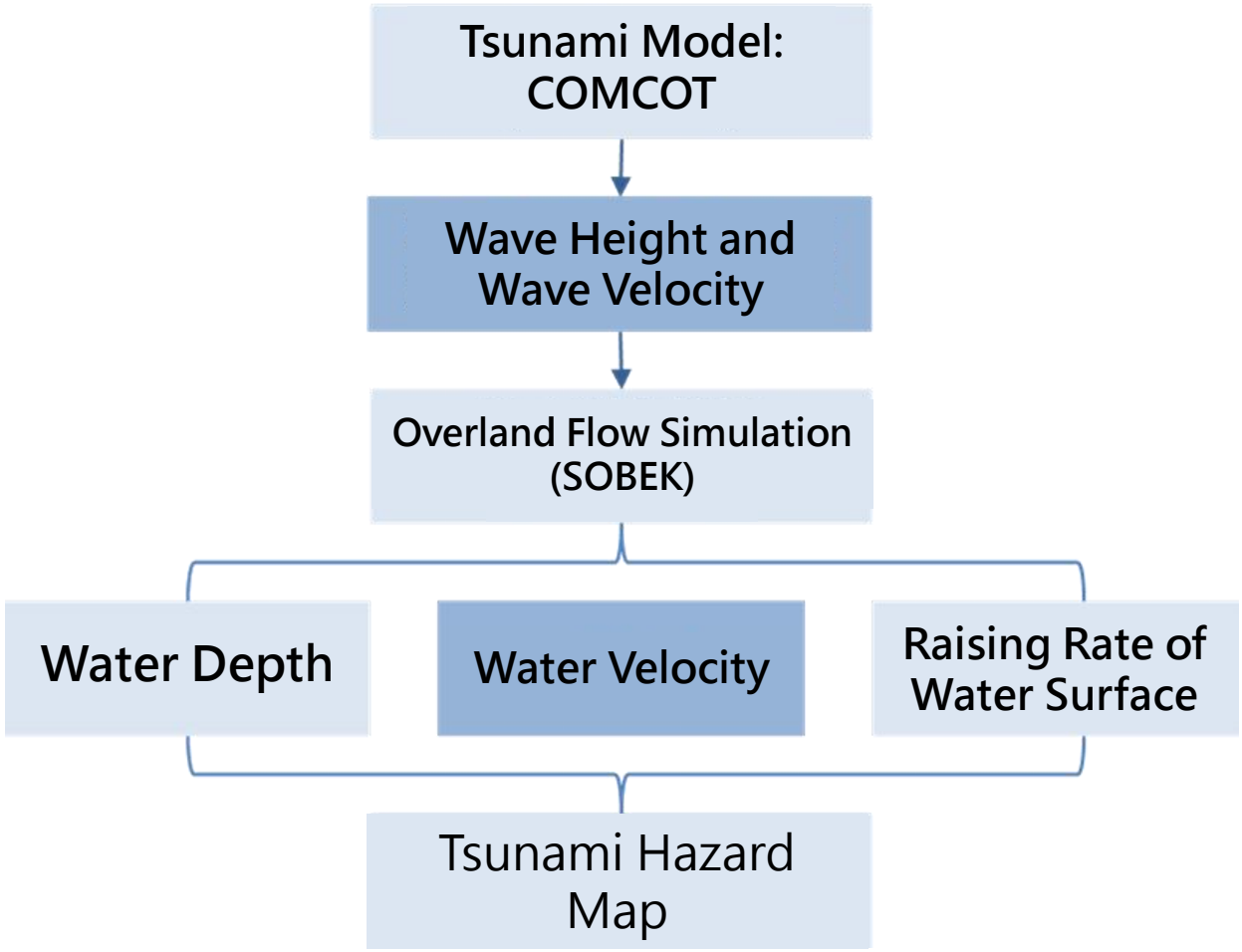


1 Study area-Northern Taiwan- Gongliao District



Method

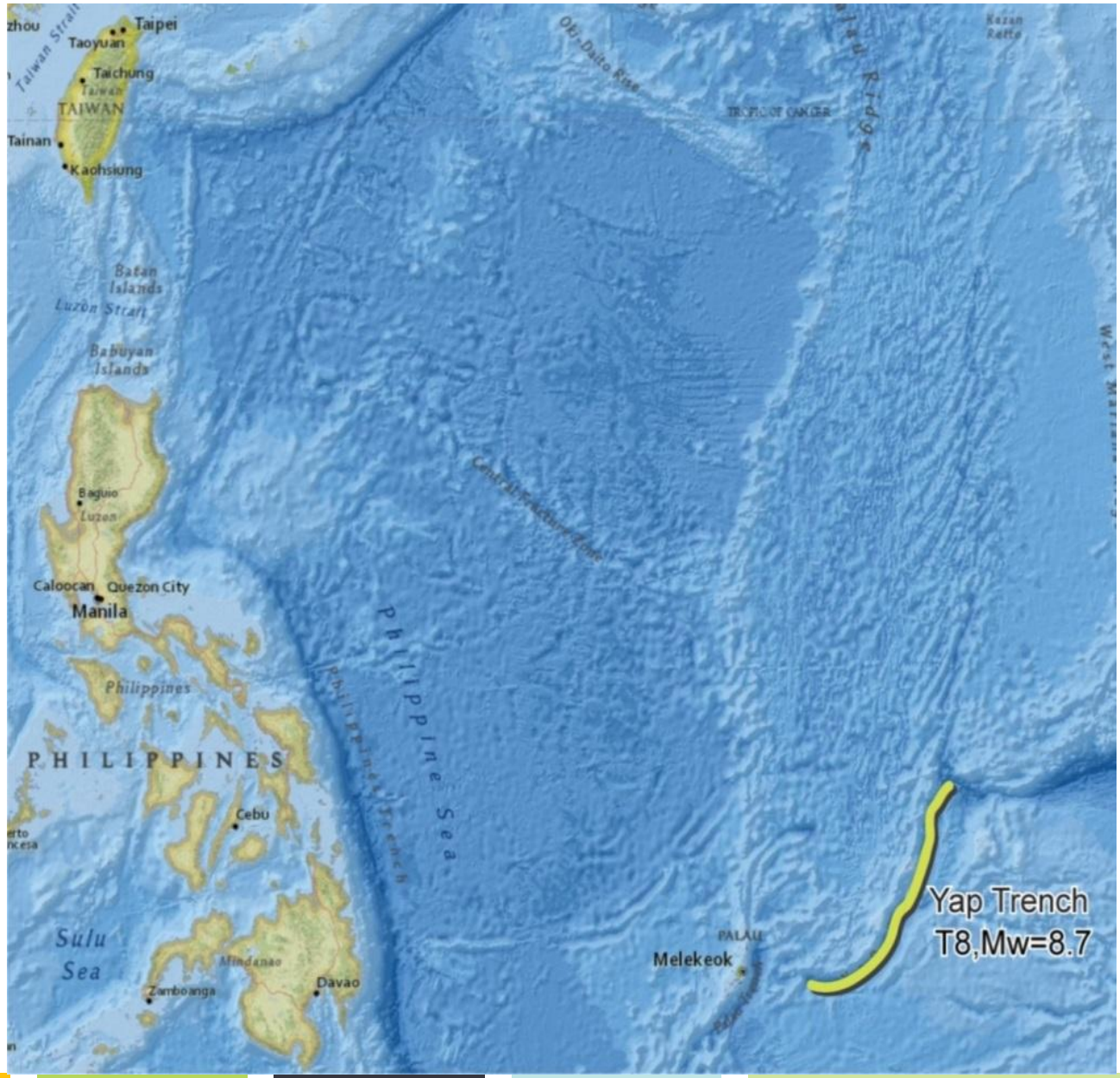
2 Flow Chart


Tsunami Model: COMCOT
Wave Height and Wave Velocity
Overland Flow Simulation (SOBEK)
Water Depth
Water Velocity
Raising Rate of Water Surface
Tsunami Hazard Map

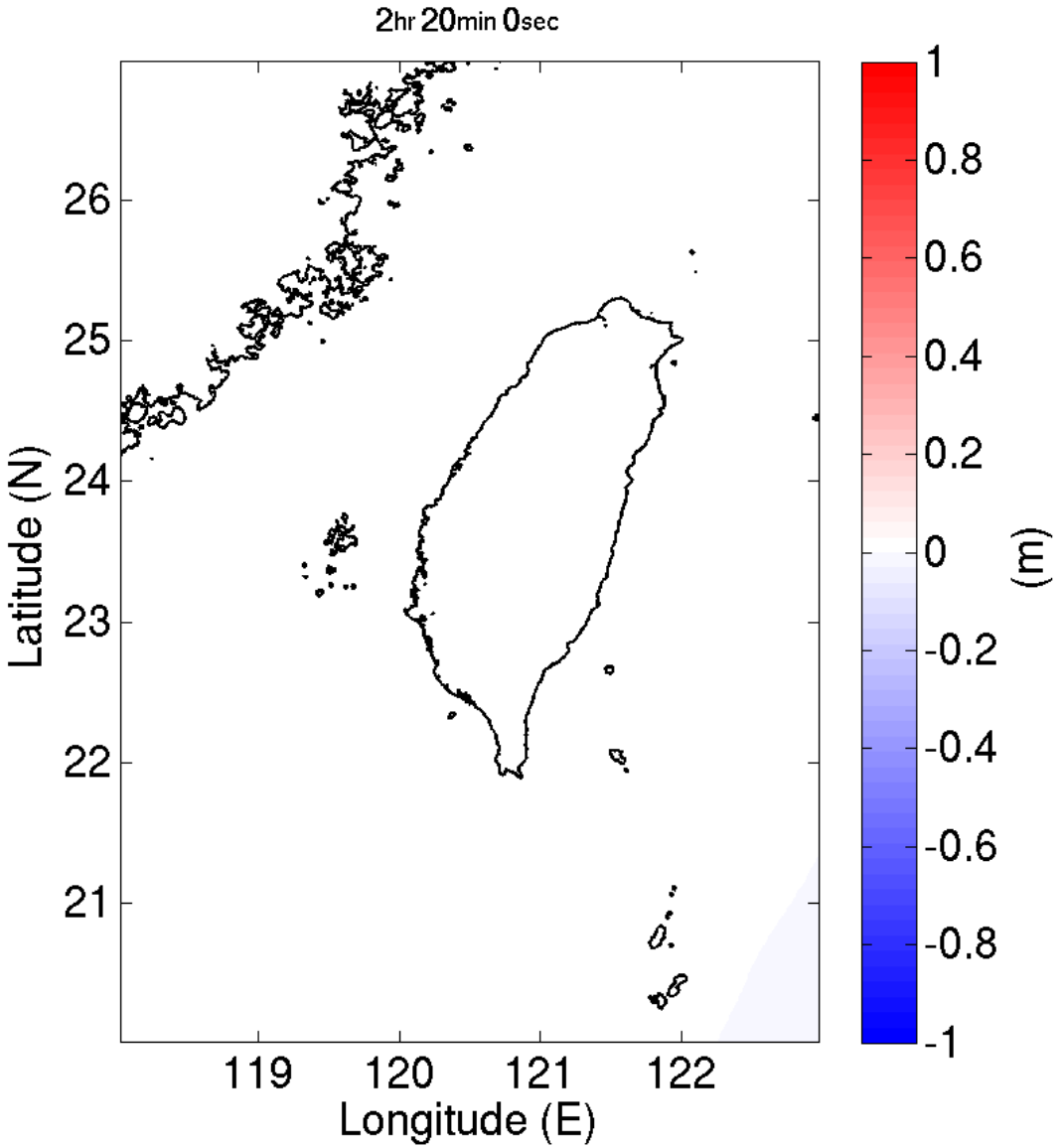
2 Method-Tsunami Model-COMCOT(1/2)

- Tsunami model: COMCOT (COrnell Multigrid Coupled Tsunami model)
- Scenario: Yap Trench(T8), the worst case for Gongliao District (Wu, 2011)
- Parameters:
  - Mw（地震規模）： 8.72。
  - Length（地震破裂長度）： 626.89 km。
  - Width（破裂寬度）：50 km。
  - Height（破裂深度）：35 km
  - Area（破裂面積）：31,344.51 km^2。
  - D（滑移量）：10.15 m。
  - Mo（地震矩）：1.35E+22 Nm

2 Location of Yap Trench



2 Method-T8 Trench Yap



2 Method-SOBEK-Inland Overland Flow

Hydrology

- Rainfall-Runoff

Hydraulic

- Channel FLOW 1D
- Overland flow 2D

Morphology

- 1D

Water Quality

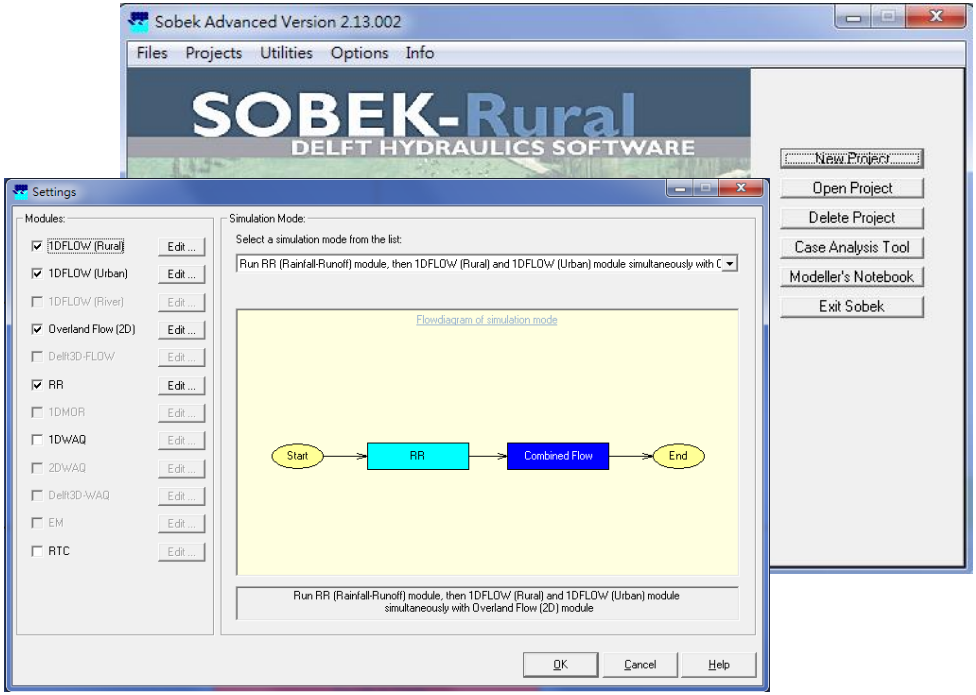
- 1D

Real Time Control

- RTC(real time control)

◆Full Saint Verant Equation

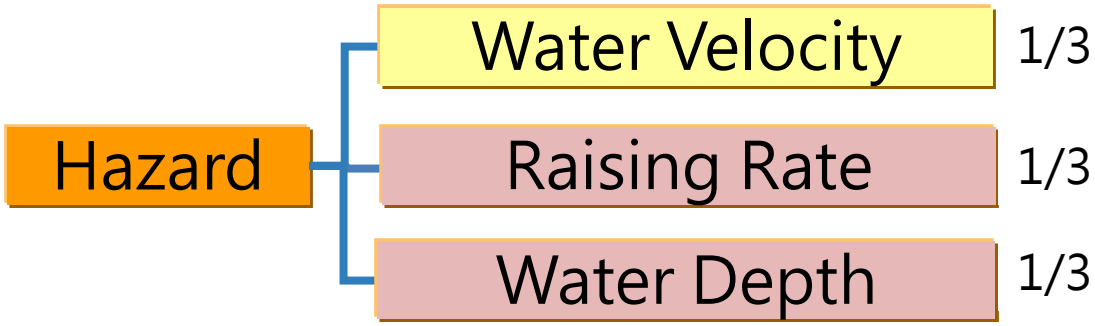
◆2D overland flow is used in this study



Hazard Assessment

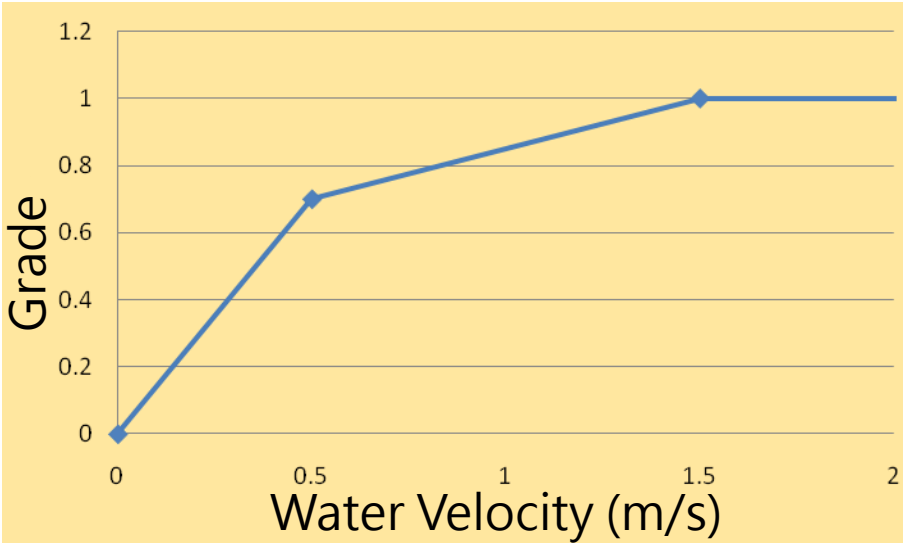
3 Hazard-aimed on Human Life

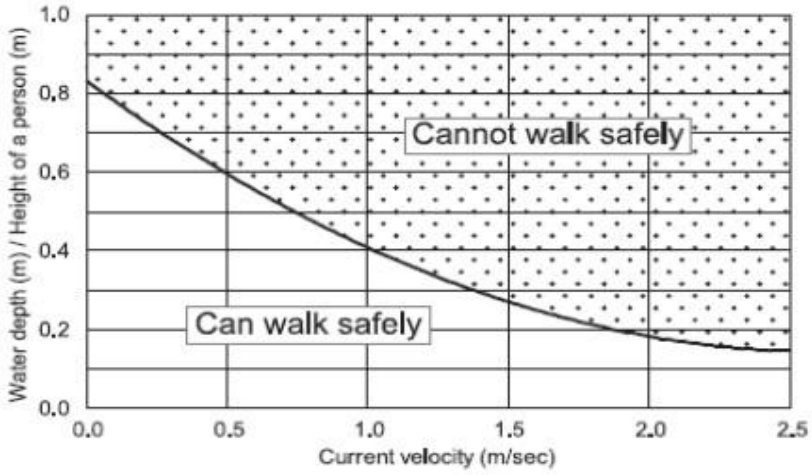
Hazard-Equal Weightings



Water Velocity

Water velocity (m/s)	Grade
0 ~ 0.5	0 ~ 0.7
0.5 ~ 1.5	0.7 ~ 1
> 1.5	1

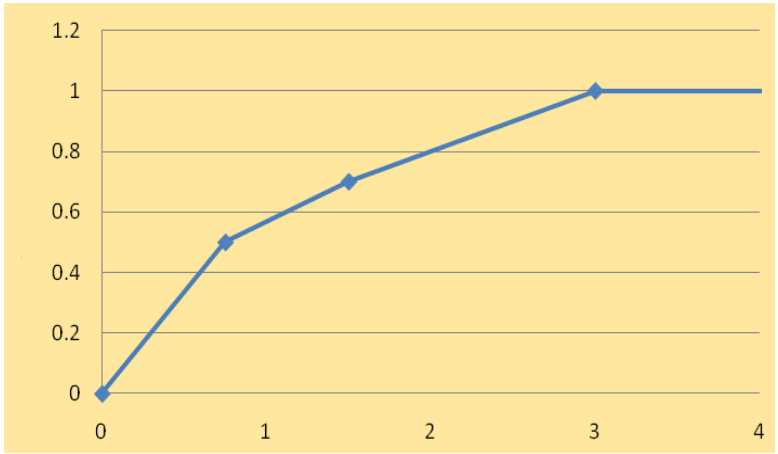




3 Hazard-Raising Rate of Water Surface

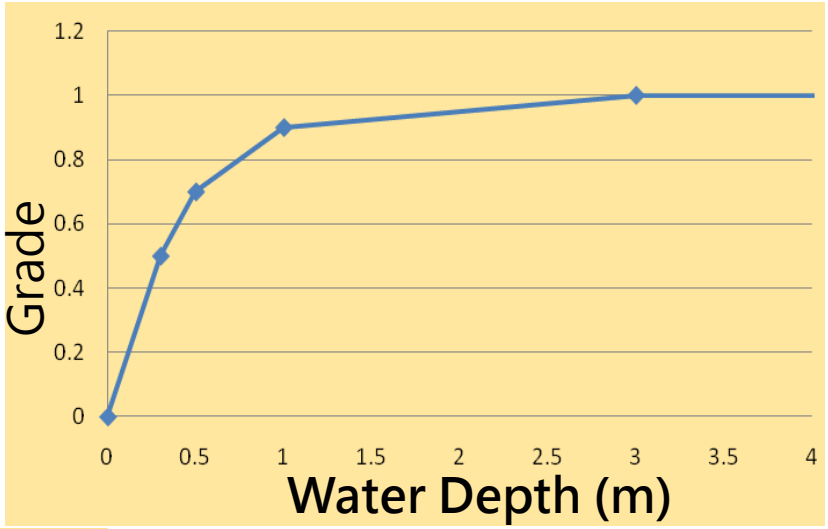
- Hazard
  - Water Velocity
  - Raising Rate
  - Water Depth

Raising Rate of Water Surface (m/hr)	Grade
0 ~ 0.75	0 ~ 0.5
0.75 ~ 1.5	0.5 ~ 0.7
1.5 ~ 3	0.7 ~ 1
> 3	1

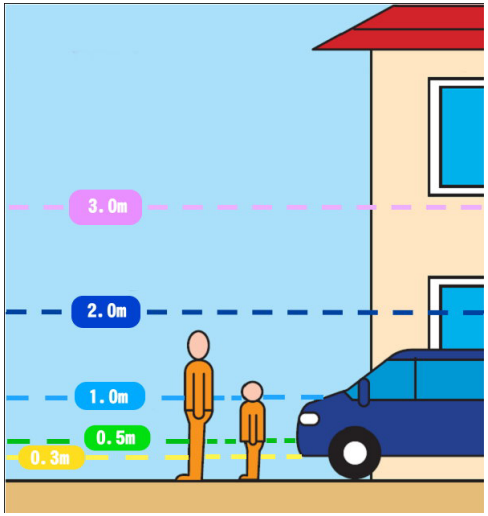


3 Hazard-Water Depth

- Hazard
  - Water Velocity
  - Raising Rate
  - Water Depth

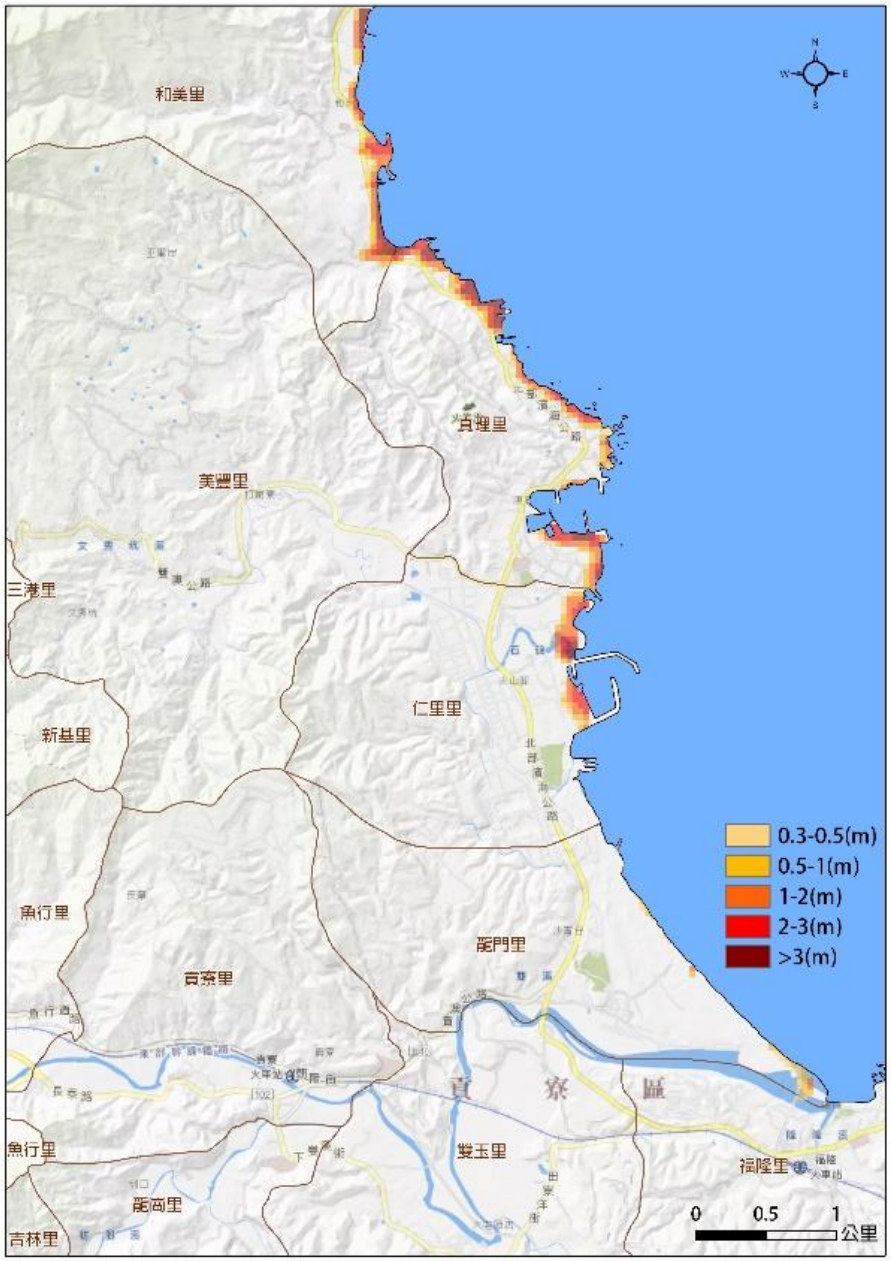


High Water Depth is main reason of drowning



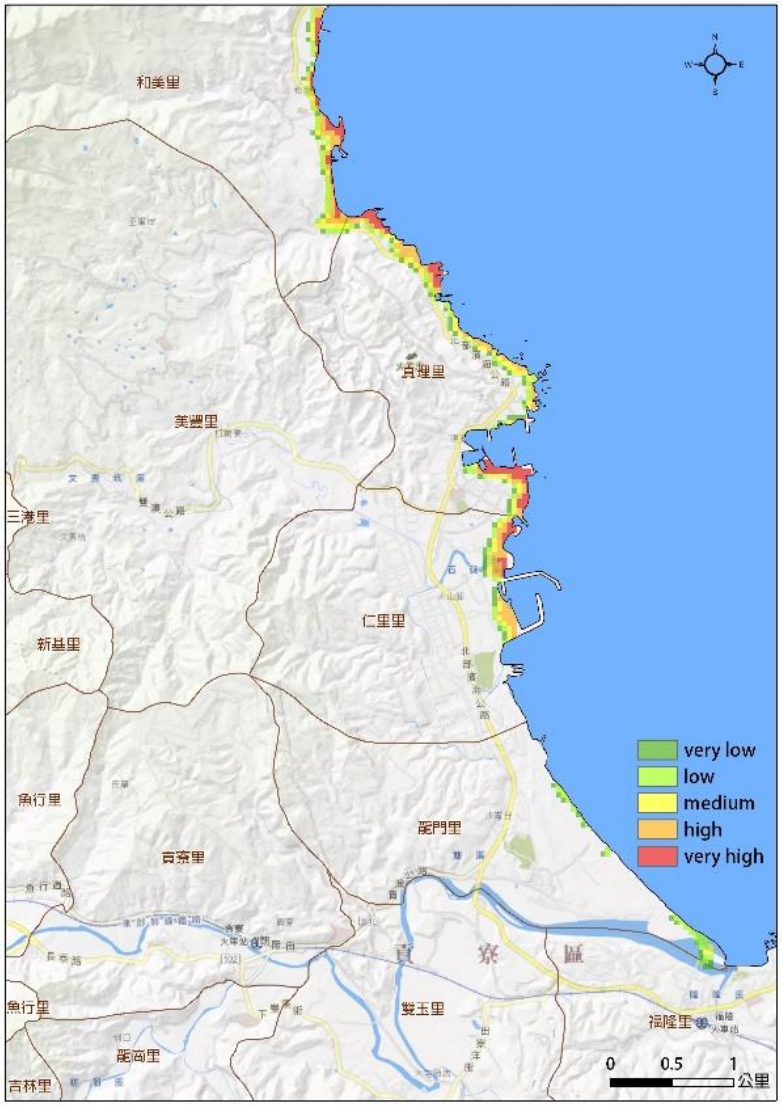
Water Depth	Grade
0 ~ 0.3m	0 ~ 0.5
0.3 ~ 0.5m	0.5 ~ 0.7
0.5 ~ 1.0m	0.7 ~ 0.9
1.0 ~ 3.0m	0.9 ~ 1
>3.0m	1

4 Inundation Depth



Inundation Depth (m)	Area (ha.)
0.3 ~ 0.5	8.57
0.5 ~ 1.0	12.98
1.0 ~ 2.0	19.35
2.0 ~ 3.0	11.41
>3.0	10.61

4 Hazard Map



Hazard	Area (ha.)
very high	13.53
high	18.56
medium	13.90
low	16.63
Very low	12.38

Conclusions

5 Conclusions and Suggestions

- The methodology can be used in other area for making tsunami hazard map.
- Two models are used for better representative of impacts of tsunami.
- Weighting of different factors can be gotten by Analytic Hierarchy Process (AHP) in the future.
- Combining factors of vulnerability (such as populations, etc.), the risk map of tsunami can be delineated.

Thanks for your attention!