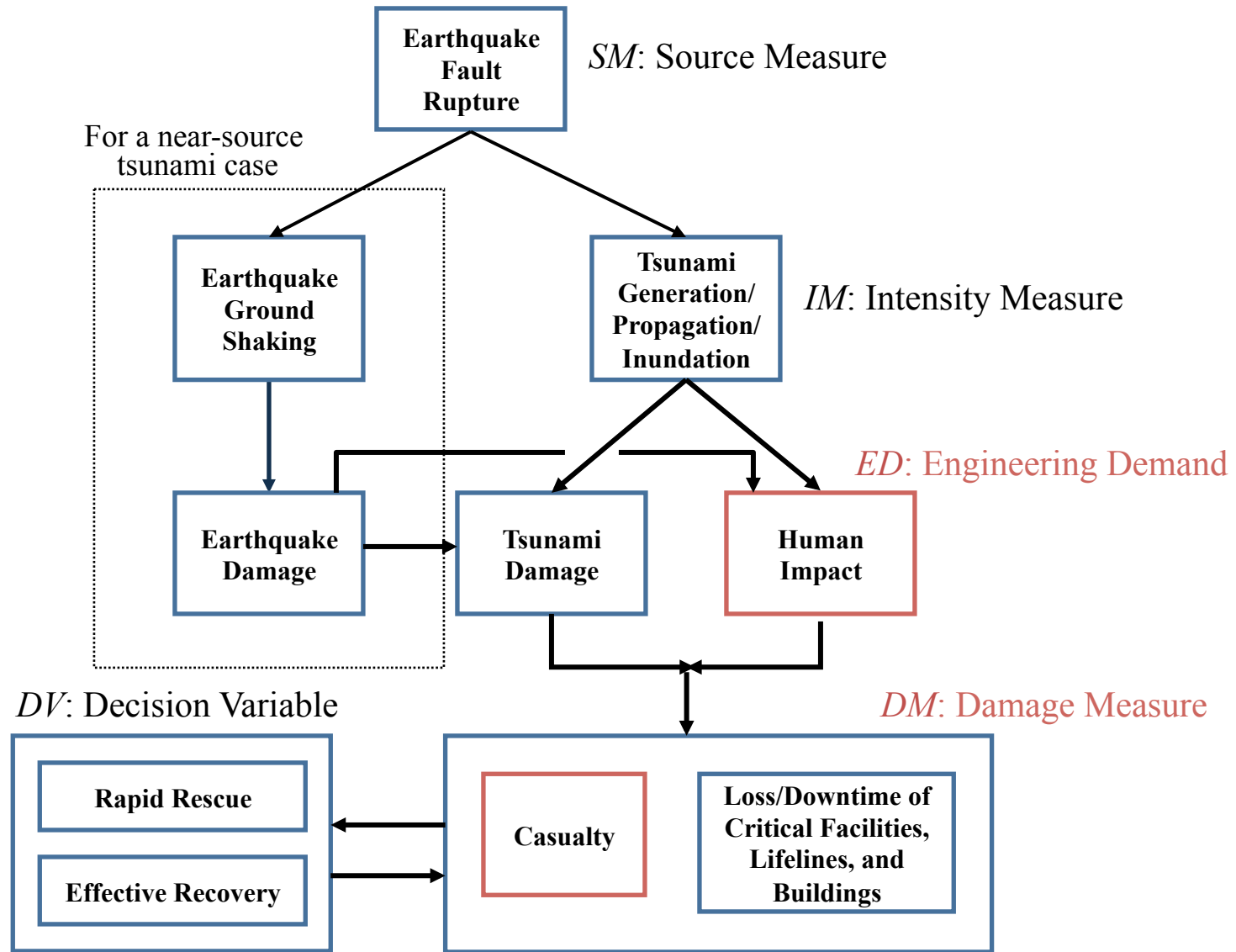
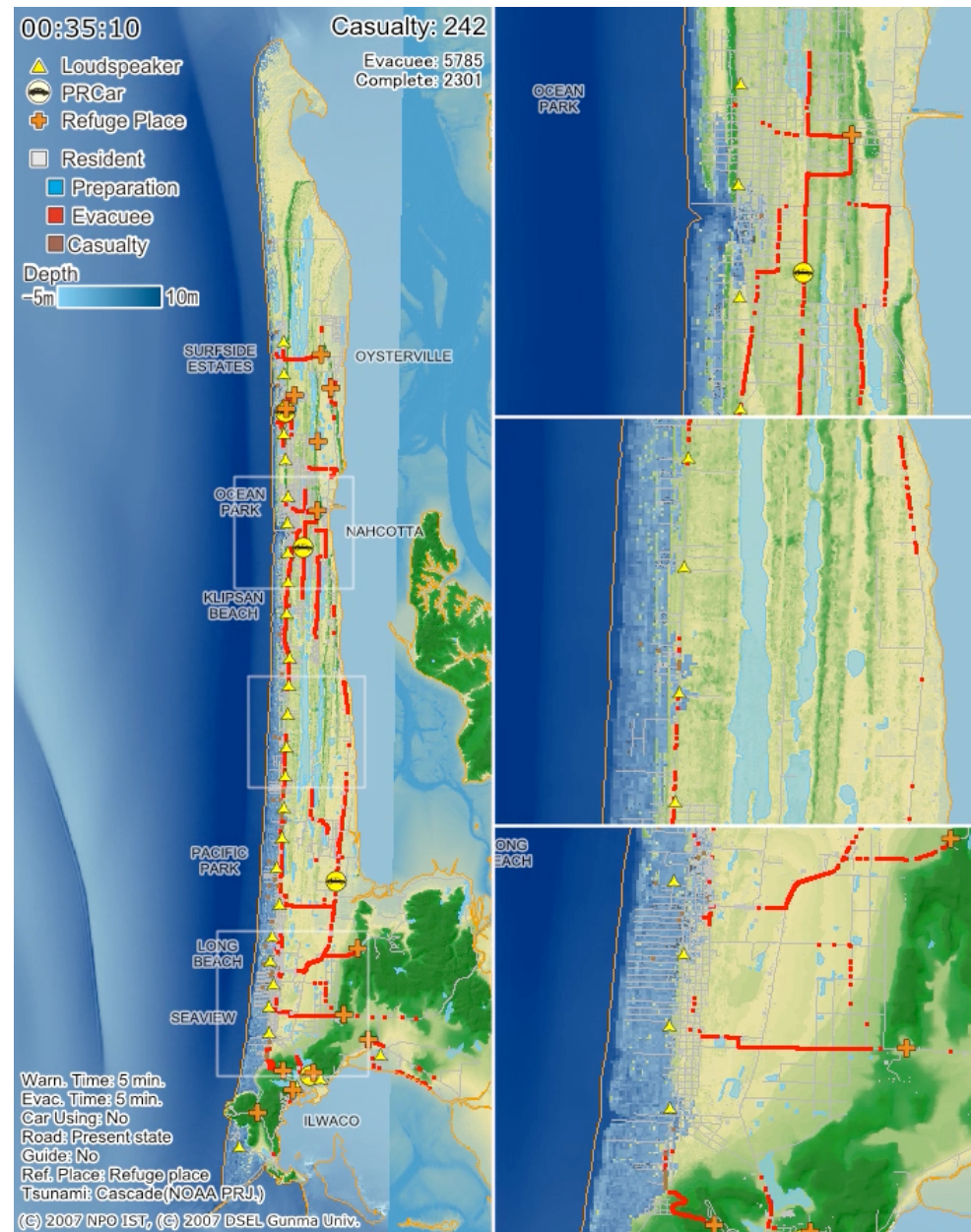


# TSUNAMI HAZARD AND CASUALTY



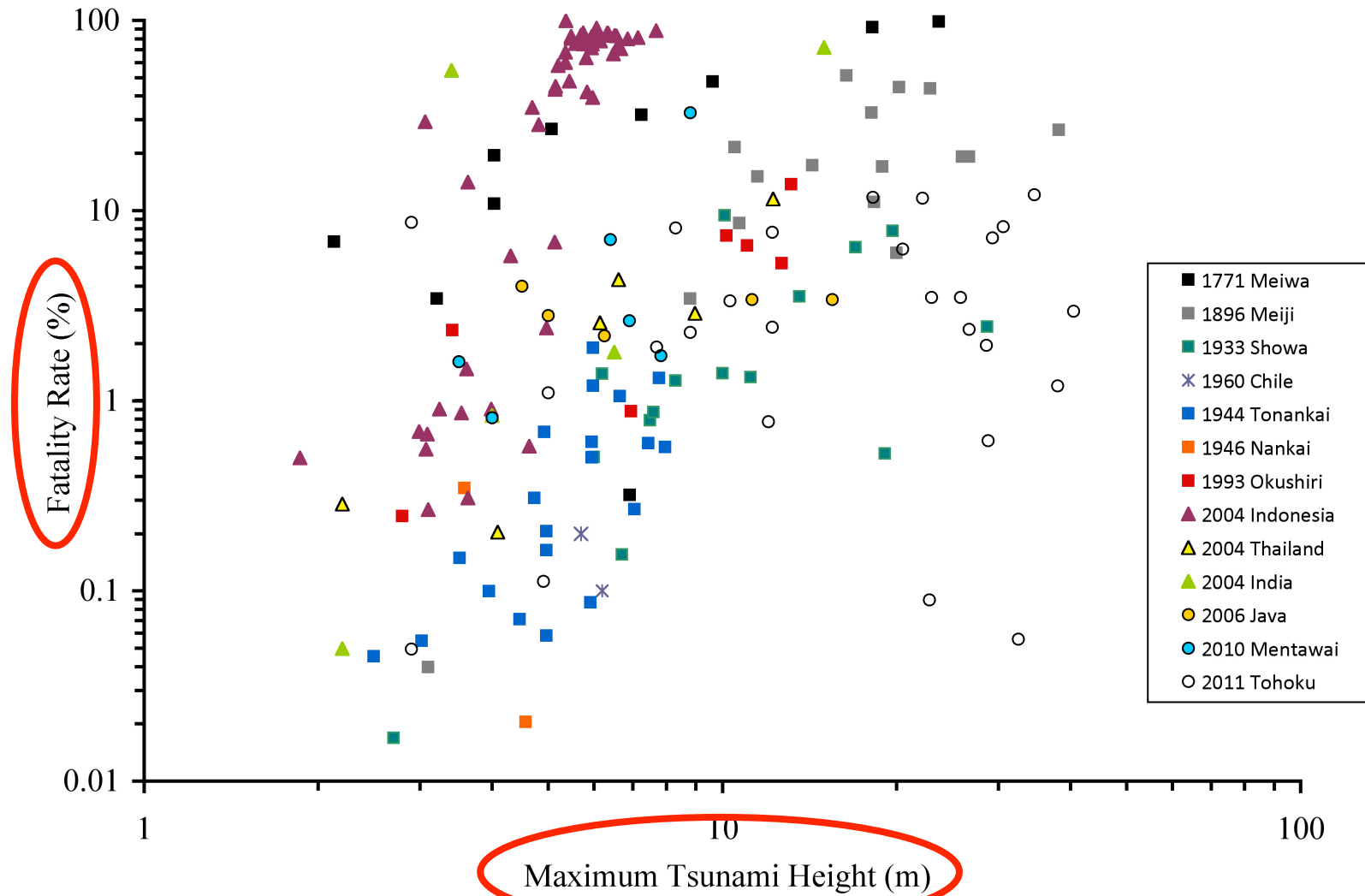
# Agent-Based Modeling

- Collection of autonomous decision-making agents.
- An individual agent evaluates the situation and makes decisions based on a set of rules.
- Complete time-series data for tsunami inundation.
- Agent-based-simulations involve significant uncertainty in human behavior.



# Indication from the Statistics

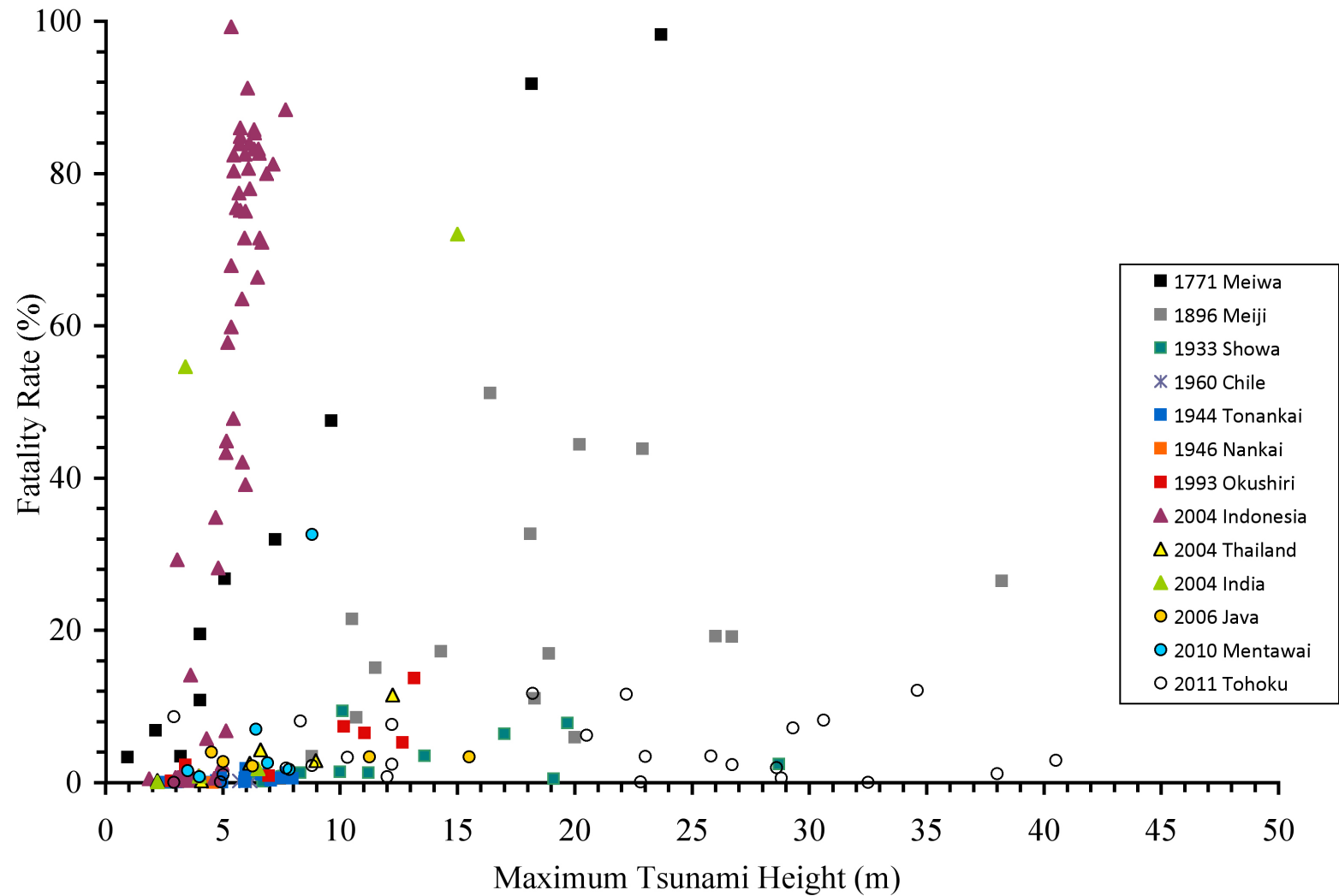
## Plot in lob-log scale



Data from Koshimura

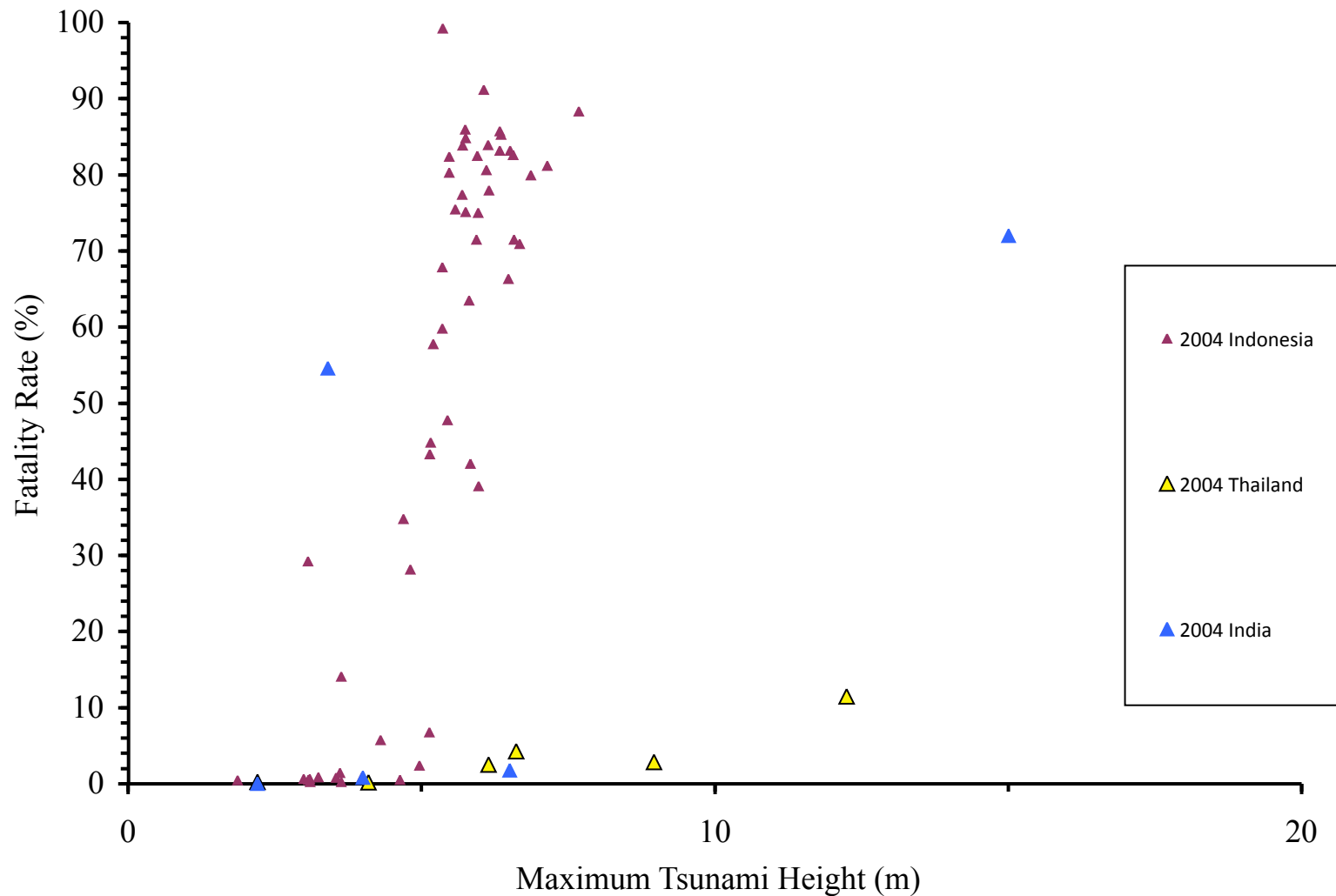
# Indication from the Statistics

## Plot in **linear scale**



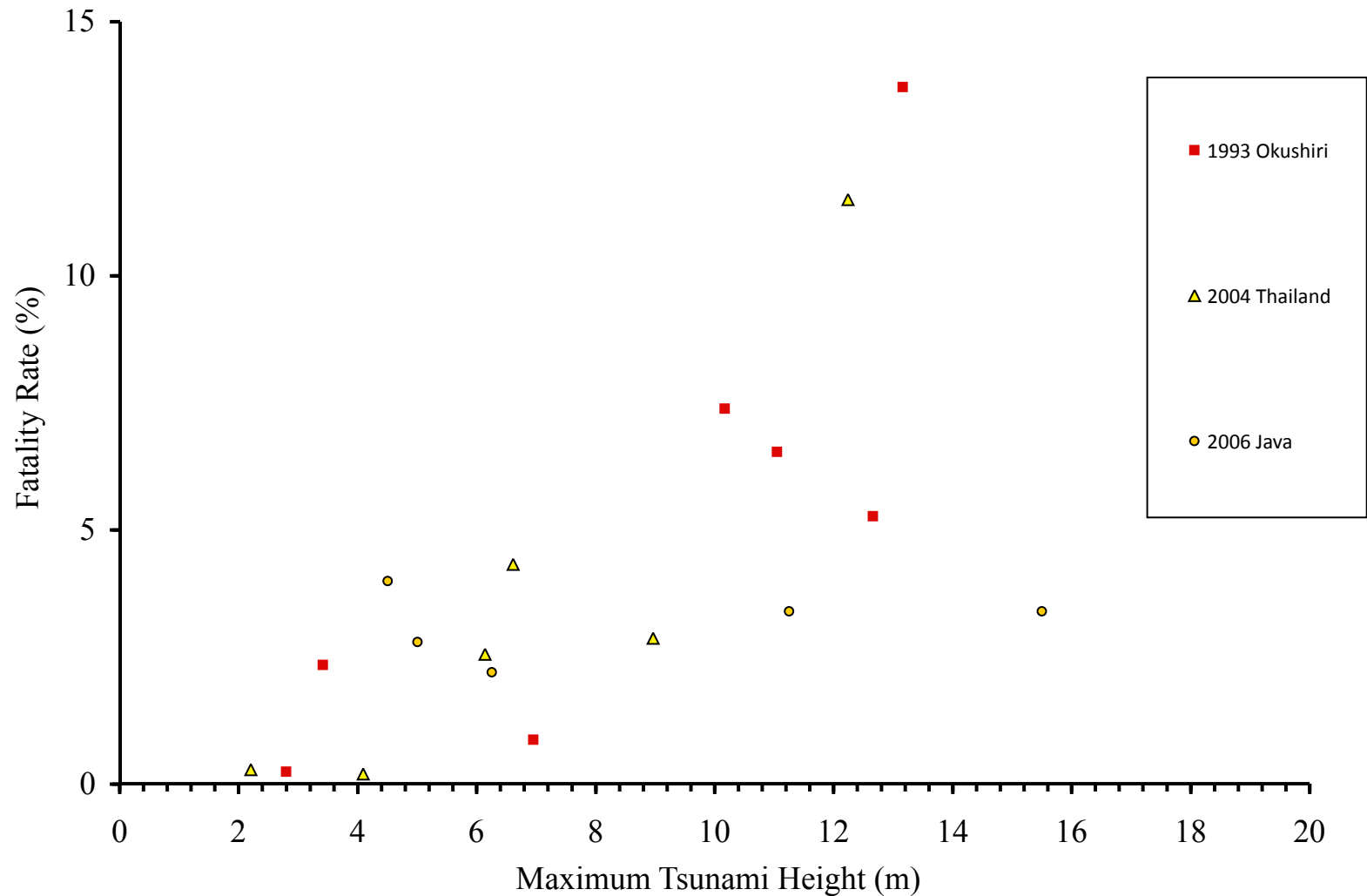
# Indication from the Statistics

See some trend for each country impacted by the 2004 event.



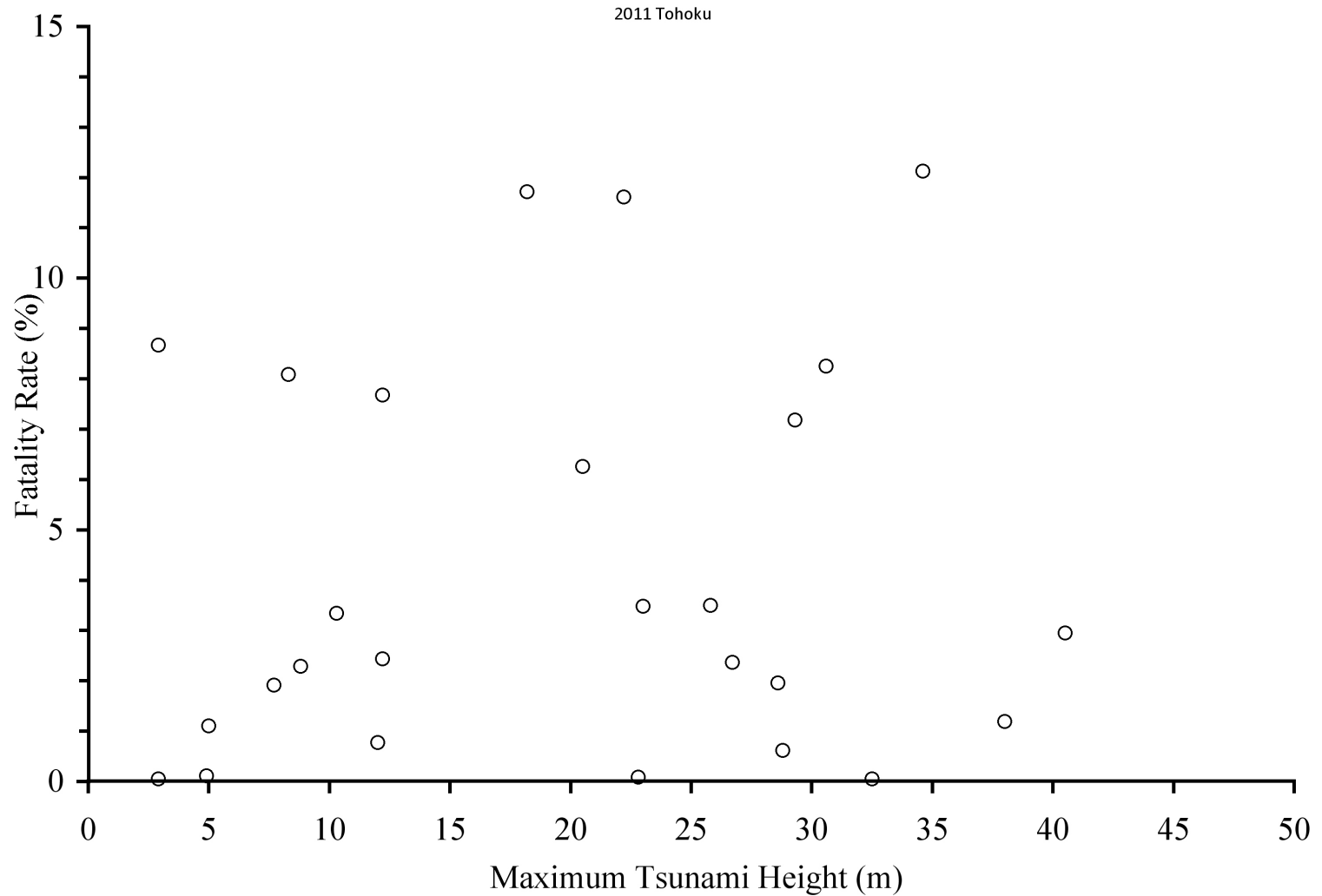
# Indication from the Statistics

See some trend for each individual event:  
1993 Okushiri, 2004 Thailand, 2006 Java

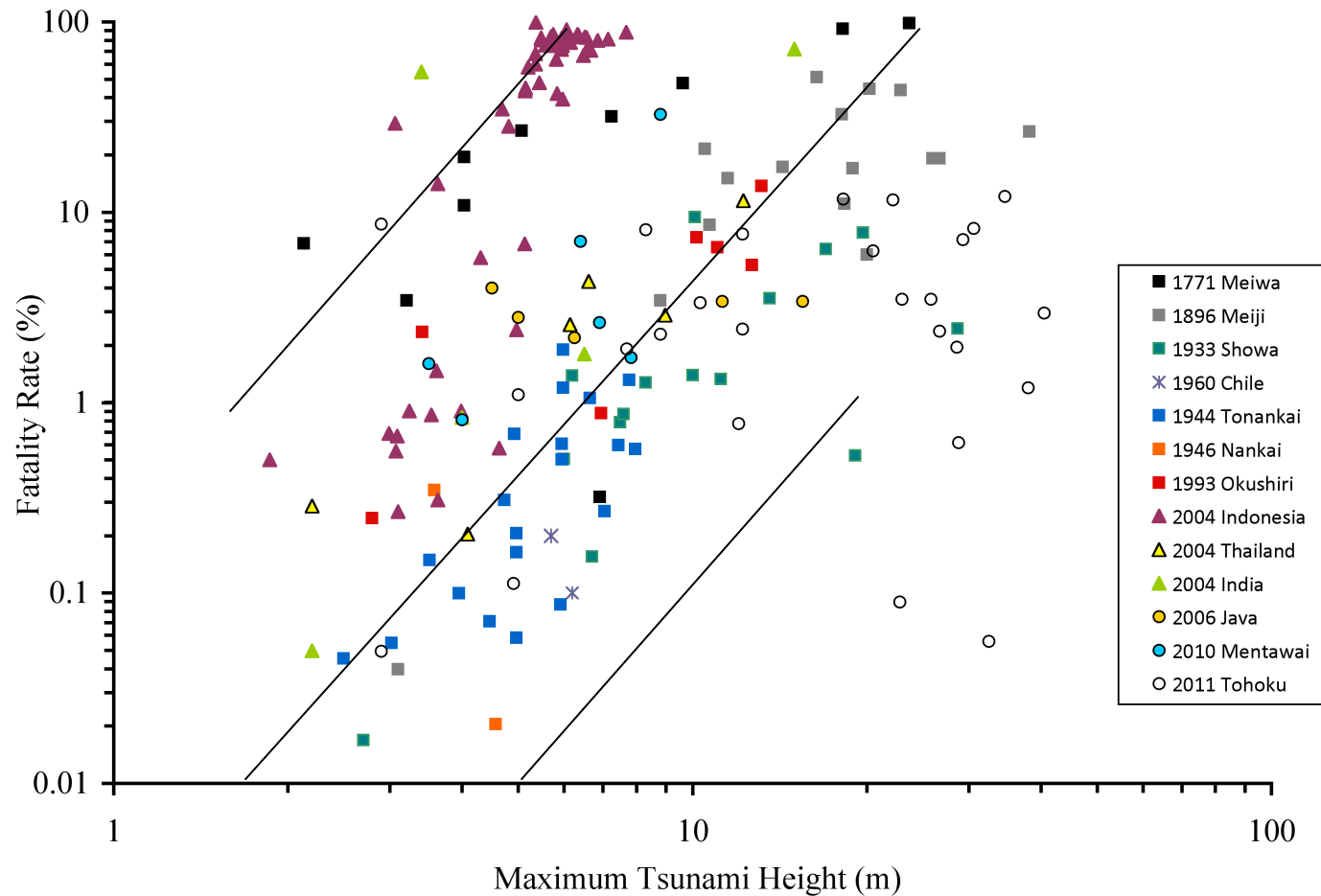


# Indication from the Statistics

No trend for the 2011 Heisei (Tohoku) Tsunami.



## Indication from the Statistics



Only trend that we can detect from the figure is that tsunami fatality rate diminishes when maximum tsunami “height” is less than 1.5 m.

- There is a very weak trend that fatality rate increases with tsunami height for a given event and a given locality, but cannot expect the similar trend for a different event for a different area.
- More likely, people's prior knowledge to tsunami hazard (i.e. education), notification of tsunami warning, and their response made the significant difference.

# Important Factors for Casualty Estimation

- To estimate tsunami casualties, the “time-related” information is crucial.
  - With no warning (including a natural cue), nobody would start to evacuate until one detects the tsunami near the shore.
  - Coastal communities who are adequately prepared for tsunamis would respond to the warning quicker than those who are not prepared.
  - Tsunami runup processes are also important: how fast the tsunami advances inland.

What's Next?

## Phase 2 Project

Follow through and Complete the PBTE Methodology Development.

- Incorporate additional hazard scenarios – approximately 25 probabilistic datasets– into the PBTE Data Explorer for the test site (Port Hueneme).
- A sufficient number of hazard scenarios is crucial for the development of a mathematic-based algorithm (e.g. Bayesian Data Assimilation methods) for quantification of uncertainties.
- The developed algorithm for uncertainty quantification will be incorporated into the GIS-based platform (the extended PBTE Data Explorer) with considerations given to its usability.
- The uncertainties will be represented specifically for the purpose of assisting with decision-making processes.