# Using Macro-Level Exposure Indicators for Future Disaster Risk Assessment in Megacities

Background & Aim

- Following the rapid urban growth in recent years, exposure could be considered as the most dynamic component in risk assessment processes.
- Estimation of spatiotemporal change of exposure is a critical and intricate task especially for megacities which are complex systems with high loss potentials.
- The conventional loss estimation approaches require a detailed inventory database of structures. Alternatively, macro-level socio-economic exposure indicators are used, relying on regularly updated data.
- This study aims to project the natural disaster loss based on the spatiotemporal variability of exposure, assuming a direct relation between losses due to physical damages and business interruption, and the economic productivity of a region.

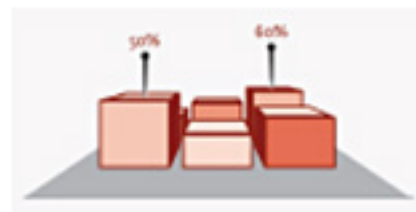**Gizem Mestav Sarica,** PhD Candidate
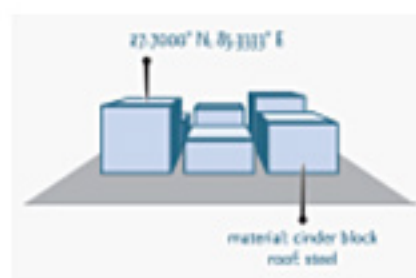**Prof. Pan Tso-Chien,** ED-ICRM
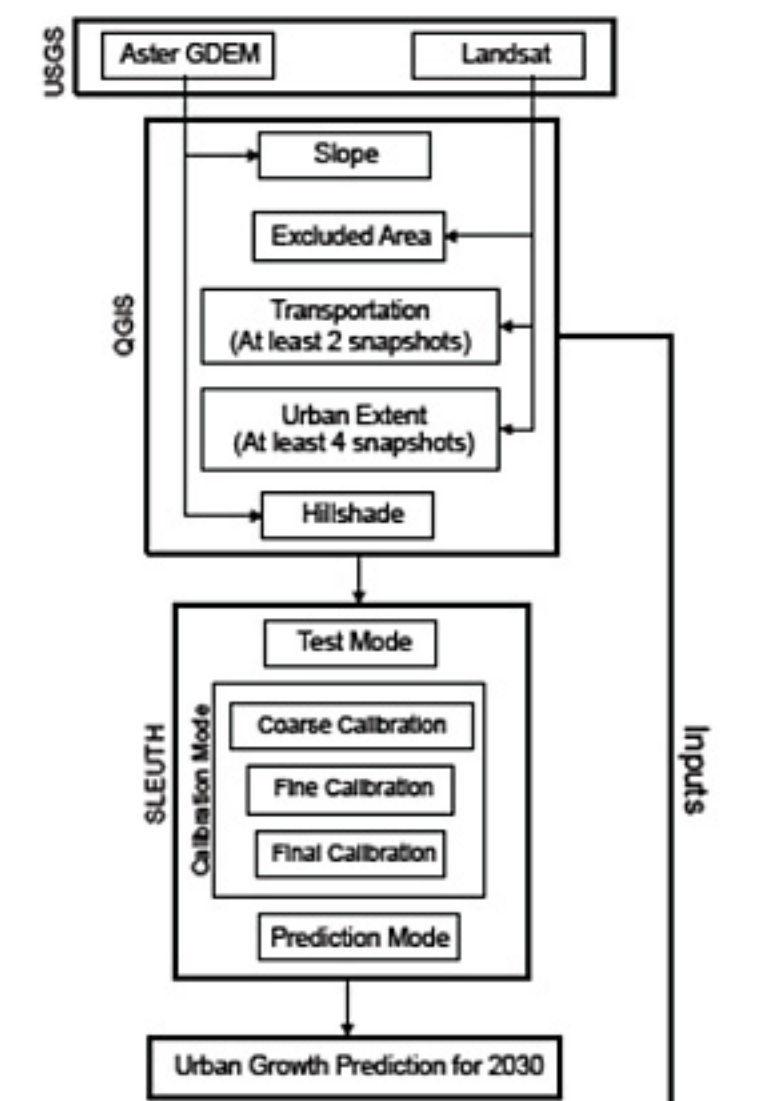
What is Risk?

HAZARD
The likelihood, probability, or chance of a potentially destructive phenomenon

VULNERABILITY
*The likelihood that assets will be damaged or destroyed when exposed to a hazard event*

EXPOSURE
*The location, attributes, and values of assets that are important to communities*

RISK = HAZARD x VULNERABILITY x EXPOSURE
The composite of the impacts of ALL potential events

Methodology

- As an initial step before the loss estimation, the change in built-up area at seismic risk and flood risk were obtained using the urban growth model projections for selected megacities, namely Istanbul, Jakarta, Metro Manila and Shenzhen.

- For this purpose, hazard maps obtained from different sources and built-up area from past, today and future are overlaid.
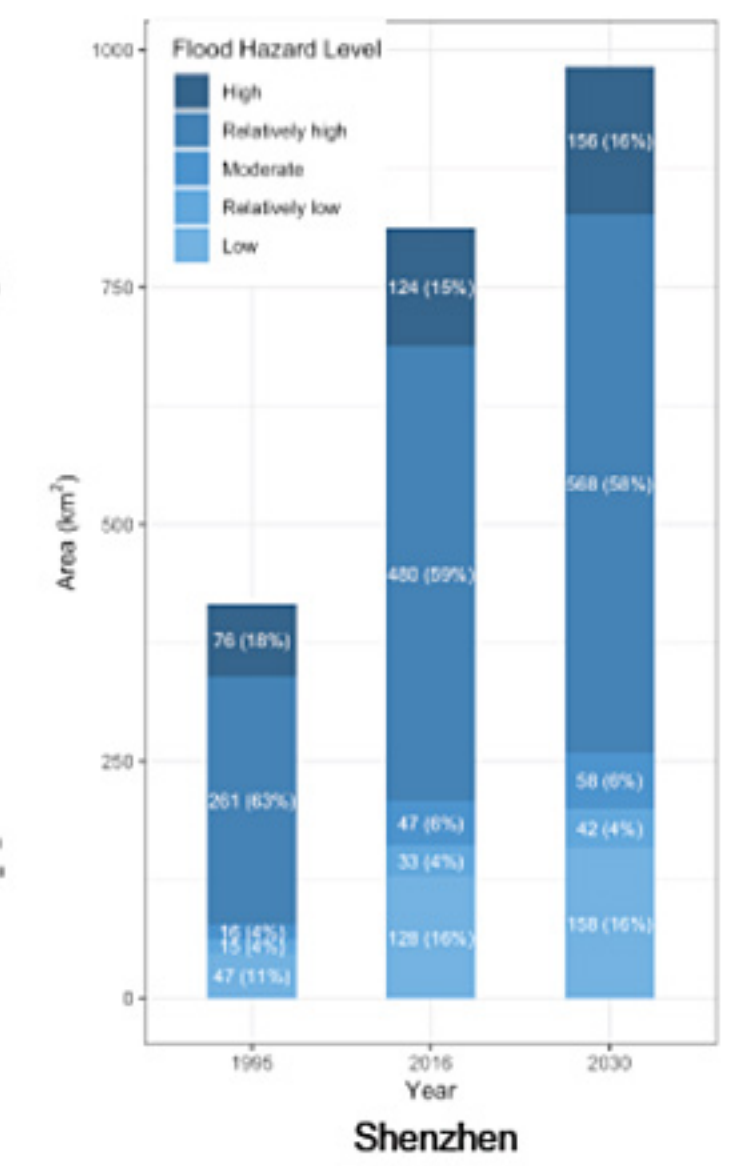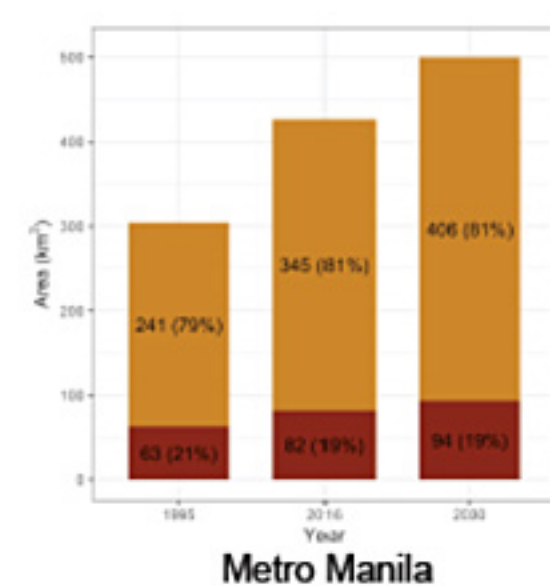

Urban Growth Modelling
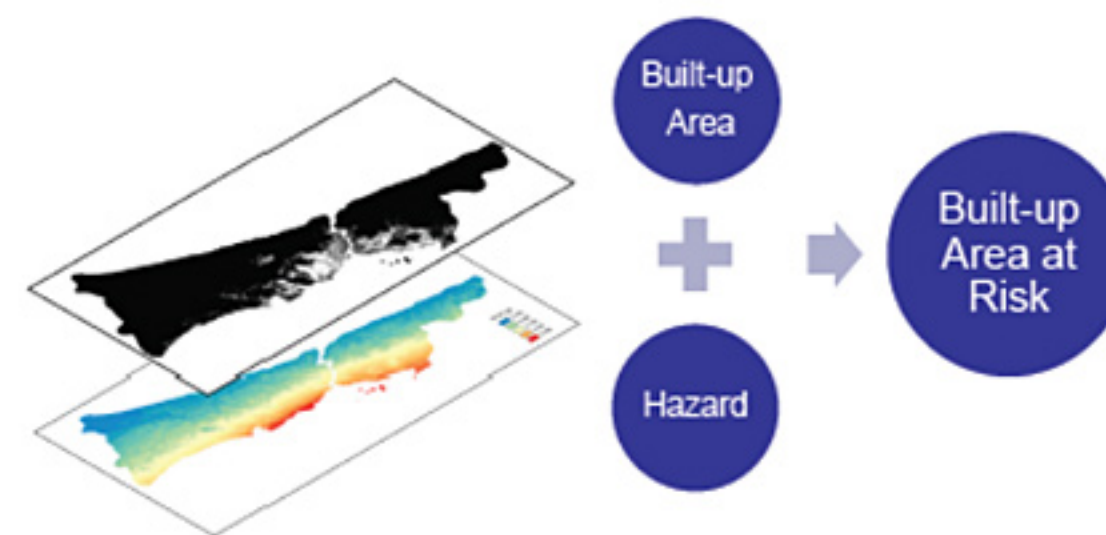
Urban Growth Prediction - 2030
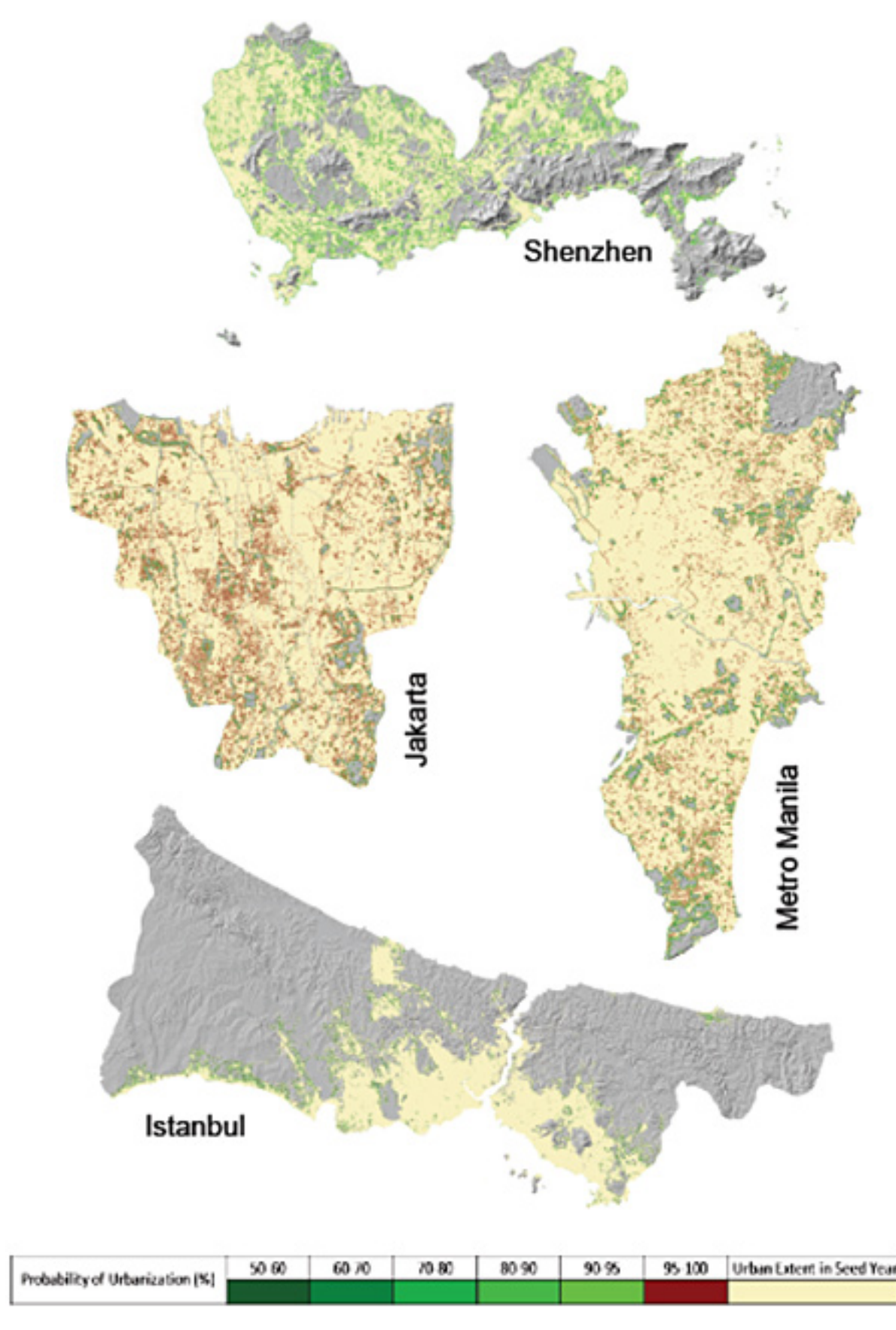
Built-up Area at Risk

- Built-up Area at Seismic Risk was obtained for 10% Probability of Exceedance in 50 years for Jakarta, Metro Manila and Istanbul.

- Built-up Area at Flood Risk was obtained for Shenzhen.

Conclusions and Future Work

- SLEUTH Urban Growth Model was used to assess the spatiotemporal change in built-up area at risk for selected megacities considering different types of natural disasters.
- It was observed that each city is unique and shows different trends from past to future. However, the increase of built-up area in hazardous regions should be assessed carefully for disaster risk reduction.
- Following the built-up area prediction for future, grid-based population and GDP are planned to be used for future loss estimation of selected megacities considering deterministic and probabilistic seismic hazard analysis approaches.

Contact Us:
Executive Director, ICRM (ExecDir-ICRM@ntu.edu.sg)
N1-B1b-07, 50 Nanyang Avenue, Singapore 639798
Tel: +65 6592 1866   Website: http://icrm.ntu.edu.sg

References:
- Open data for resilience initiative field guide, GFDRR (2014)
- Silva EA and Clarke KC 2002 Calibration of the SLEUTH urban growth model for Lisbon and Porto, Portugal Computers, Environment and Urban Systems 26 525–552
- Wald DJ, Quintoriano V, Heaton TH and Kanamori H. 1999 Relationships Between Peak Ground Acceleration, Peak Ground Velocity, and Modified Mercalli Intensity in California Earthquake Spectra 15 557-564