Institute of Catastrophe Risk Management

Prof Pan Tso-Chien
A/P Lo Yat-Man Edmond
Dr Qian Qiyu
Dr Ning Chaolie

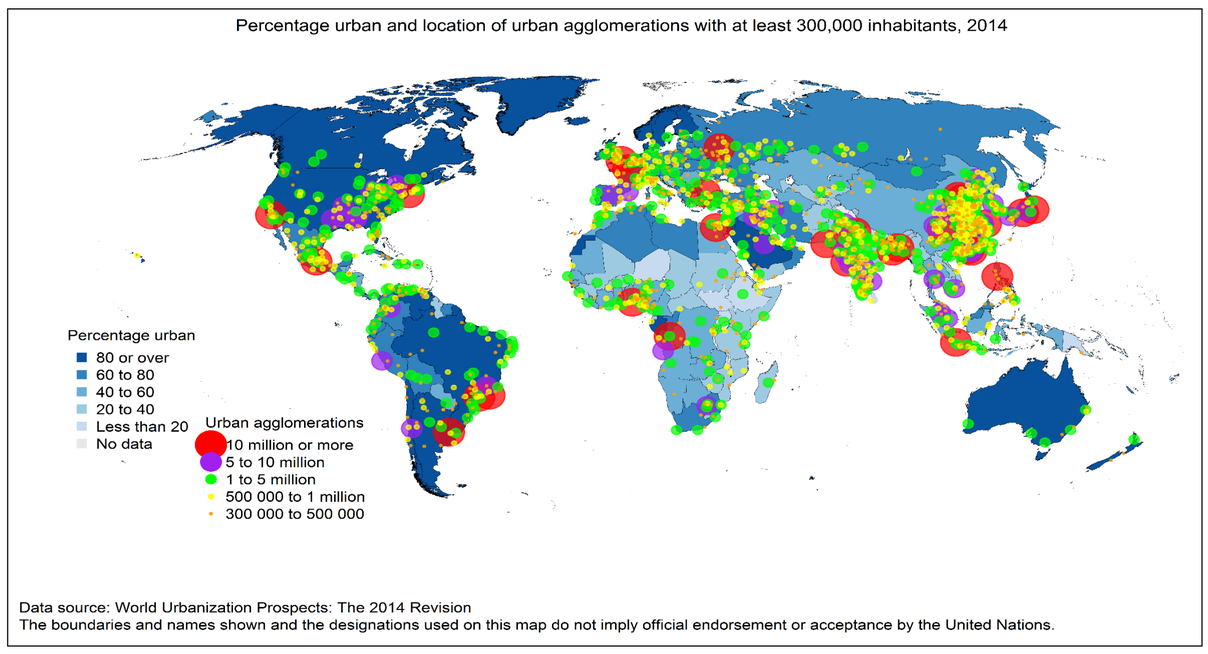
Macro-level Seismic Loss Estimate of Megacities

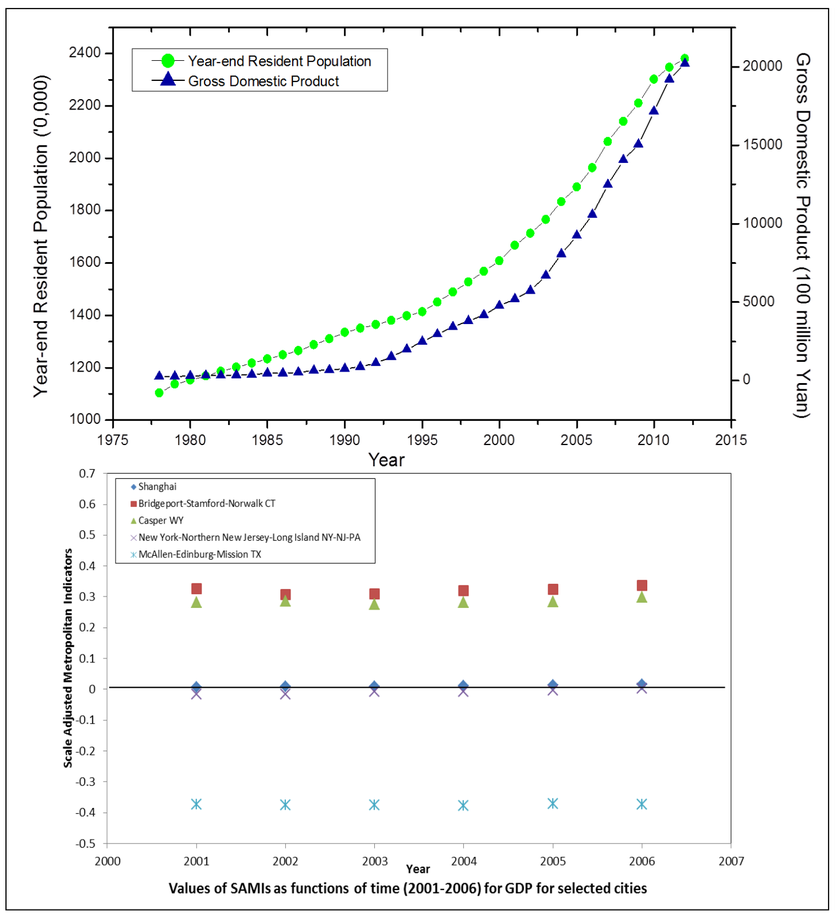
There is increasing trend of urbanization around the world. The complexity of understanding and then managing megacity risks is immense. Nowadays more and more megacities are located in or close to natural hazard-prone regions. A macro-level seismic assessment model for megacity is proposed to estimate the potential seismic loss in current year and in the future. Initial application is to Shanghai city, and in future to other major cities/regions of interest in Asia.

- **City Growth Model**
  - Sante Fe Institute believes that many diverse properties of cities are shown to be power law functions of population size with scaling exponents β:

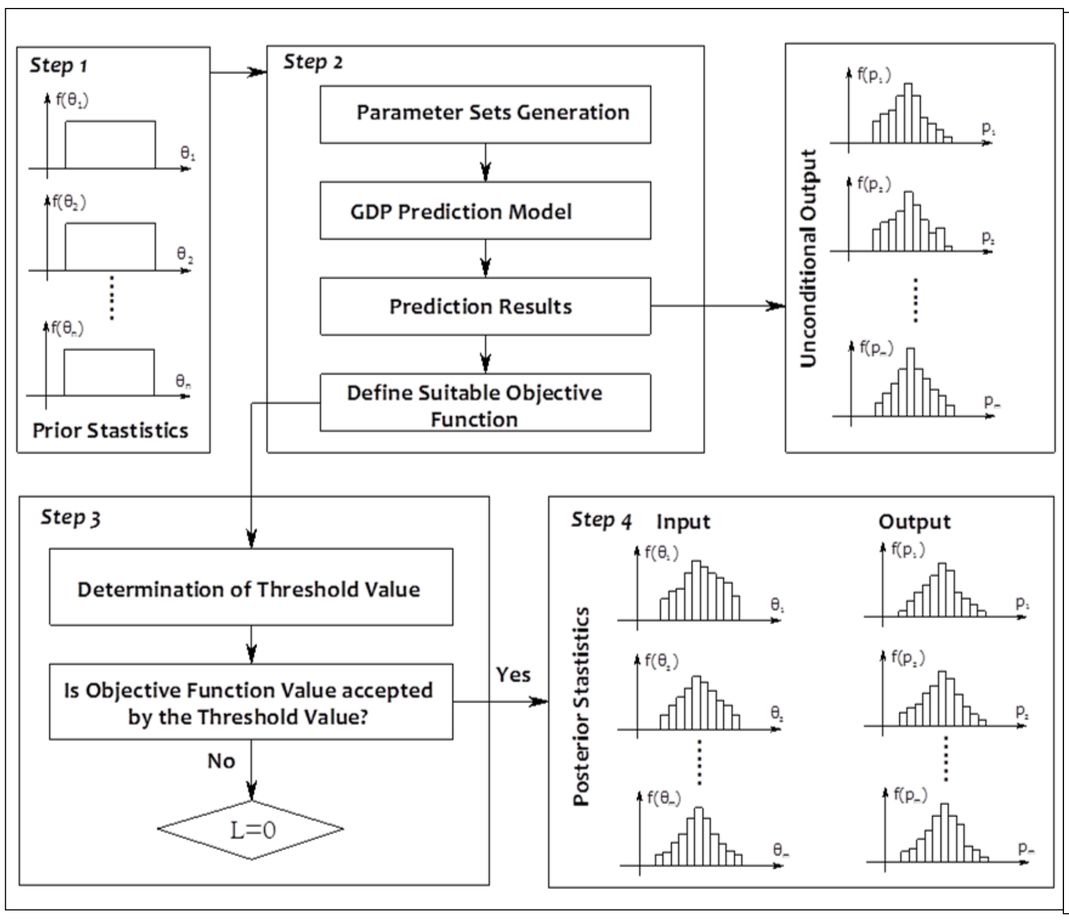
$$Y(t) = Y_0 N(t)^{\beta}$$

- **Macro-level Seismic Loss Estimate**
  - Exceedance Curve
  - Seismic Ability Index of Structures
  - Damage Functions derived from Historical Observed Events (Source: Zhang Fenghua,et al

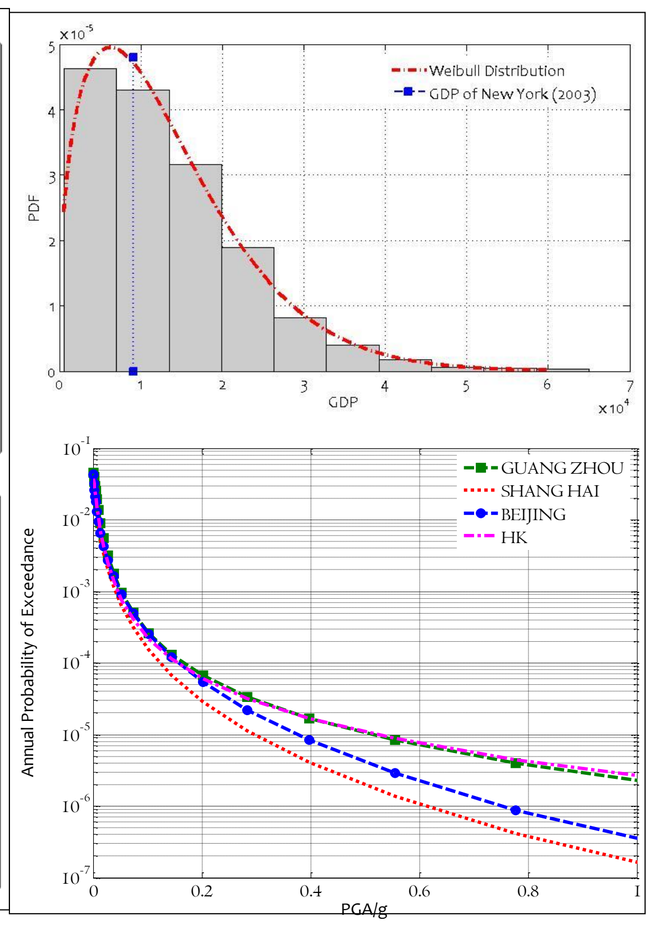




(a) Shanghai population & economic growth
(b) Shanghai economy comparison with selected US cities



The generalized likelihood uncertainty estimate (GLUE) method is used to evaluate the uncertainty of city growth model parameters



(a) GDP distribution for China cities
(b) Exceedance curve for selected China cities

Results and Observations for Shanghai:

- Population and GDP growth for current year and for 2030
- Shanghai's economy development is similar to the average US cities in terms of GDP
- GDP distribution of US cities is shown to fit Weibull distribution well while Shanghai GDP has a different distribution
- Seismic loss estimate for current year and for 2030

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