

## Development of Earthquake and Typhoon Loss Models for Japan, Specifically Designed for Underwriting and Enterprise Risk Management Cycles

**Authors :** Nozar Kishi, Babak Kamrani, Filmon Habte

**Abstract :** Natural hazards such as earthquakes and tropical storms, are very frequent and highly destructive in Japan. Japan experiences, every year on average, more than 10 tropical cyclones that come within damaging reach, and earthquakes of moment magnitude 6 or greater. We have developed stochastic catastrophe models to address the risk associated with the entire suite of damaging events in Japan, for use by insurance, reinsurance, NGOs and governmental institutions. KCC's (Karen Clark and Company) catastrophe models are procedures constituted of four modular segments: 1) stochastic events sets that would represent the statistics of the past events, hazard attenuation functions that could model the local intensity, vulnerability functions that would address the repair need for local buildings exposed to the hazard, and financial module addressing policy conditions that could estimate the losses incurring as result of. The events module is comprised of events (faults or tracks) with different intensities with corresponding probabilities. They are based on the same statistics as observed through the historical catalog. The hazard module delivers the hazard intensity (ground motion or wind speed) at location of each building. The vulnerability module provides library of damage functions that would relate the hazard intensity to repair need as percentage of the replacement value. The financial module reports the expected loss, given the payoff policies and regulations. We have divided Japan into regions with similar typhoon climatology, and earthquake micro-zones, within each the characteristics of events are similar enough for stochastic modeling. For each region, then, a set of stochastic events is developed that results in events with intensities corresponding to annual occurrence probabilities that are of interest to financial communities; such as 0.01, 0.004, etc. The intensities, corresponding to these probabilities (called CE, Characteristics Events) are selected through a superstratified sampling approach that is based on the primary uncertainty. Region specific hazard intensity attenuation functions followed by vulnerability models leads to estimation of repair costs. Extensive economic exposure model addresses all local construction and occupancy types, such as post-linter Shinand Okabe wood, as well as concrete confined in steel, SRC (Steel-Reinforced Concrete), high-rise.

**Keywords :** typhoon, earthquake, Japan, catastrophe modelling, stochastic modeling, stratified sampling, loss model, ERM

**Conference Title :** ICRAM 2017 : International Conference on Risk Assessment and Management

**Conference Location :** Amsterdam, Netherlands

**Conference Dates :** August 07-08, 2017