

# **GEM CONFERENCE** Are we making a difference?

13th - 14th June 2023, Centro Congressi Bergamo, Bergamo, Italy

# New Frontiers of Earthquake Model Development: Aon Impact Forecasting and GEM partnership

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Being one of the world's deadliest natural hazards, earthquakes challenge experts from different fields to collaborate towards more accurate assessment of future seismic activity and guide risk management accordingly. Acknowledging this, Impact Forecasting - Aon's catastrophe model development center of excellence - and Global Earthquake Model (GEM) have been closely collaborating for several years on the development of advanced tools to analyze the financial implications of earthquakes.

A characteristic example of this powerful collaboration is the release of the new probabilistic loss models for earthquake risk assessment in Canada, EMEA and APAC. The Canada Earthquake model combines the sixthgeneration hazard model implemented by Natural Resources Canada, utilizing GEM's OpenQuake platform, with Impact Forecasting enhancements for secondary perils (liquefaction landslides, tsunami, fire). In Asia and Pacific region, the 2023 models provide most up-to-date earthquake risk view for Singapore and South Korea, considering general and detailed construction and occupancy classes, including high-value transportation (airport, seaport) and industrial facilities. The models consider local soil conditions, soil-structure interaction effects, and damage in glass facades, while the contribution of secondary perils (liquefaction, landslides) has been implicitly included in the models. Next year, the Italy and Switzerland Earthquake models will be released, providing robust insights for re/insurers based on high-resolution and most up-to-date modelling. For this, Impact Forecasting in collaboration with the University of Strathclyde, Glasgow have developed a regional correlation model to simulate the spatial distribution of ground-motion fields in this region.

The collaborative efforts to improve catastrophe models should be continuous, aiming to enhance earthquake risk understanding globally, increase the usage of earthquake models for client-based needs and solutions, and substantially reduce the catastrophe protection gap.

## Catastrophe model anatomy



### Impact Forecasting Earthquake models







## **IF-GEM Project Partnership Around The World & Enhancements by IF**





### Italy & Switzerland



#### GEM University of Strathclyde Glasgow Collaborations Sera

- Country-specific spatial correlation
- Demand surge based on socio-economic data
- Liquefaction and Landslides
- Probabilistic & Historical model
- **Regional Seismicity** 400,000 events (covering 160,000 years)



# **South Korea**



Collaboration with GEM for initial hazard and vulnerability data; based on Korea Institute of Geoscience and Mineral Resources (2012) GEM and International Seismological Centre global catalogue



Landslides susceptibility

- Catalogue of 91,421 events for 100,000 years
- Complex fault modelling
- Multi-fault rupture hypothesis up to 3 segments can rupture simultaneously
- Background seismicity for small-magnitude; large-magnitude events attributed to fault
- Secondary perils (liquefaction, landslides)



- 6th gen SHMC Lessons and advances form past 10 years
- New data sources included
- Based on NBCC 2020
- 1.3 million events (200,000 years) and 11 historical events
- Vulnerability in collaboration with GEM, NRCan and UBC
- Contents and BI based on occupancy following Hazus
- Vehicle damage by IF based on ATC-13 data
- Vulnerability for wooden buildings (façade and roof type)
- Unknown curves selection based on exposure data
- Secondary perils: Liquefaction, Landslides, Fire, Tsunami





# Conclusions

- Lessons learnt from past earthquakes highlight the critical role insurance plays in managing imposed damage and losses.
- Catastrophe models are crucial tools to assess earthquake risk, suited to quantify expected financial losses, for which economy • and insurance industry need to be prepared, so that the recovery from such catastrophic events is financially manageable.
- Secondary perils can increase recognizably the total earthquake losses, with trend to dominate at particular locations. For this, catastrophe managements tools should consider additional load due to potential liquefaction, landslides, fire, and tsunami depending on the location and past observations.
- Impact Forecasting (IF), Aon's catastrophe model development centre of excellence, is developing loss models globally.
- Collaboration with Global Earthquake Model (GEM) and other research institutes helps to obtain up-to-date view of the hazard





- Irsyam et al. (2020) and extra sources near Singapore O) GEM from GEM with modified assumptions from IF
- Probabilistic model: catalogue for 200,000 years 87,093 events



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