

GEM - GLOBAL EARTHQUAKE MODEL



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Over half a million people died in the last decade due to earthquakes and tsunamis, most of these in the developing world, where the risk is increasing due to rapid population growth and urbanization. In particular many of the world's megacities of 10 million inhabitants and more, such as Delhi, Bogota, Jakarta and Lima, are situated in highly seismic active areas. A significant proportion of the world's population is therefore at risk from earthquakes.

The 2010 Haiti and Chile earthquakes painfully reminded the world of the destructive impact of seismic events: not only in terms of human casualties, but also in terms of social disruption and economic losses. Some earthquakes have caused losses that are higher than the country's annual GDP.

It may be obvious that there is need to reduce this risk. However in many earthquake-prone regions no risk models exist, and even where models do exist, they are often inaccessible due to their proprietary nature or their complex user-interface. Risk mitigation requires accurate, consensual and uniform risk estimates; reliable earthquake risk information.

Such information should be state-of-the-art and compiled in a transparent manner by the community - everyone should be able to contribute and comment - so that it is owned by the public and hence trusted to be used. It should be accessible to all possible stakeholders, cover the entire globe and not only include

hazard and risk information, but extend towards the social and economic impact of earthquakes.

GEM, the Global Earthquake Model initiative, aims to do all that. GEM is an internationally sanctioned programme, initiated by the OECD, working at the establishment of an independent, open standard to calculate and communicate earthquake risk around the world. GEM is structured as a public-private partnership and thereby combines the strengths (and objectives) of both the public and the private sector.

The partnership includes a number of authoritative global institutions, such as the World Bank, the OECD, UNESCO and UN's International Strategy for Disaster Reduction, but also the two largest international professional associations in the field: IASPEI (International Association of Seismology and Physics of the Earth's interior) and IAEE (International Association for Earthquake Engineering). There are six private organisations contributing to GEM and currently nine

countries have adhered to GEM and discussions with another 15 are ongoing. GEM's partners have ensured over two-thirds of the 35 Million Euro needed for GEM's first five-year programme.

GEM is building a dynamic, modular, flexible and expandable model, plus accompanying software and tools. Implementation of GEM's working programme is based on a combination of global and regional elements, and integrates developments on the forefronts of scientific and engineering knowledge as well as IT processes and infrastructure. It takes five years to build the first working global earthquake model and its accompanying software and tools. The work started in 2009 and at the end of 2013 the first version of a truly global and comprehensive earthquake model will be presented.

In June 2010 the GEM initiative has been able to deliver a proof-of-concept for hazard and risk calculations on a global scale, mainly as a fruit of the collaborative GEM1 pilot project. GEM1 laid the foundations of

the model, by critically reviewing the current state-of-the-art, by collecting input data and models and building engines for global calculations. It also included a first User Needs Assessment.

International consortia, involving hundreds of professionals and institutions, are working on the creation of necessary standards, databases and methodologies on a global level. These are the global components of the model and are thus developed by the community for the community. The work on Hazard Global Components has started and will be delivered in 2012. The work on Risk Global Components will start in the fall of 2010 and will be delivered in 2012 and 2013 and the work on the Socio-Economic Global Components will take off in early 2011, with the goal to be finalized in 2013.

Programs are being set-up in many regions of the world as independently run, bottom-up projects, and links are established with ongoing regional programs. Both such programs are defined as GEM Regional Programs and involve a great number of local experts who will use GEM software, will generate local data, will validate the data and standards that were created on a global level

and will serve as a starting point for technology transfer in the region. Currently three GEM Regional Programs are operational: in the regions of Europe and the Middle East and a collaboration is ongoing in Central America. Programs are being prepared in Africa, South-Asia, South-East Asia and Oceania, Central Asia, South America, the Caribbean, North-East Asia

There are hundreds of institutions, organizations and individuals involved in GEM that contribute expertise, data or software, participate in global and regional programs, or take part in reviews and public assessments. Participation of individuals and institutions worldwide ensures that the model is owned by the global community and reflects its needs and knowledge.

GEM is going through a continual user-needs assessment effort, to ensure that the software and tools that are being developed meet the needs of users. GEM potential users are broad and have different characteristics. GEM's products will therefore be attuned to the needs of expert users and consumers with a basic knowledge of the subject. Partnerships and an active user-community are the ingredients

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that support the initial use of the tools and subsequent adoption of the information the global earthquake model produces, a necessary first step toward awareness and risk mitigating behaviour.

The main output of GEM's first five-year working programme will be the inclusive OpenGEM platform for the calculation and communication of earthquake risk. It will allow basic and expert users to run applications, access seismic risk information on local, national and regional scale, and visualize the latter in maps, curves, tables and export these in compatible formats. Basic users are likely to want to view output produced by the global earthquake model, perhaps that related to the location of their own house. Expert users will be able "plug in" their own data and run their own calculations. Because not everyone will be able to access an internet portal, or would like to run calculations through the internet, a stand-alone OpenGEM software package will be an important derivative.

GEM will however produce more than a platform for risk

assessment. Global harmonized databases within the fields of earthquake hazard, vulnerability, exposure and socio-economic impact will be made available, such as a global earthquake consequences database and a global historical seismic catalogue. GEM will also produce best practices and standards related to many aspects of seismic risk assessment, which will help the community to work together under a common framework at a global scale. A community development platform for the computational engine will allow for true open-source and object-oriented development of the GEM risk engine by the community. Programmers and other experts will be able to test, use and further improve GEM's software code. There will be technical reports for the (scientific) community to build upon. Finally technical training programmes /workshops will be held for diffusion of the knowledge on GEM software and use (including application for risk mitigation), especially in less supported and developed areas where risk information is needed most.

