GuyCarpenter

Cat Resource Center

REVOLUTIONIZING SEISMIC DATA: THE INTERNATIONAL MACROSEISMIC SCALE AND ITS (RE)INSURANCE IMPLICATIONS

The International Macroseismic Scale (IMS) provides a common language for describing earthquake shaking intensities across the globe, facilitating effective communication among scientists, engineers, emergency managers, insurers and the public. Read on to learn about the evolution of ground-shaking intensity scales, the need for a unified international scale, and the role of the (re)insurance industry's collaboration in supporting this effort.

Macroseismic Intensity Scales: Past, Present and Future

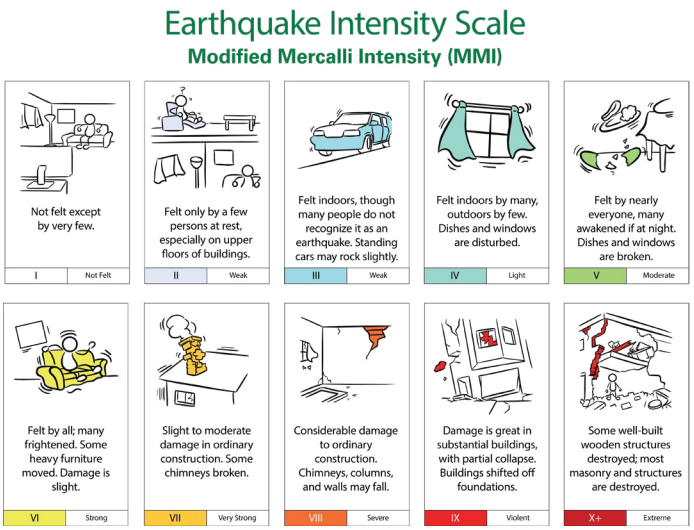
Introduction to shaking intensities

A macroseismic or seismic intensity scale is a qualitative measure of shaking from earthquakes, based on the resulting damage to structures and eyewitness observations. The nature of these scales allows scientists to leverage historical sources to extend the record of observed ground motions further back in time, before the advent of seismometers, which instrumentally record ground motions. Even today, people vastly outnumber seismometers, hence crowd-sourced shaking information illuminates the distribution of ground motions in more detail than the seismic network can alone. Intensity scales typically range from 1 (shaking not felt) to 10 (total destruction).

Past

Previously, independent macroseismic intensity scales were used around the world, such as Modified Mercalli Intensity Scale (MMI), European Macroseismic Scale (EMS), Mercalli Cancani Seiberg scale (MCS), and Japan Meteorological Agency (JMA) Seismic Intensity Scale. These scales assigned intensity values per structure or observation (Figure 1).

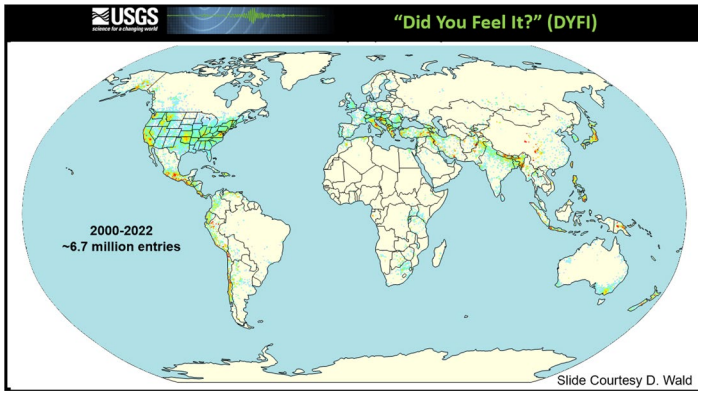
Figure 1: A sample illustration of MMI indicators. Source: US Geological Survey, public domain image



Present

With the advent of internet crowd-sourced and aggregated data, shaking measures have become more representative. Platforms like the US Geological Survey's "Did You Feel It?" allow for the rapid collection of data from citizen scientists, leading to improved intensity assessments (Figure 2).

Figure 2: Overview of USGS' "Did You Feel It?" Platform. Courtesy of D. Wald at the US Geological Survey



The online questionnaires correspond to the same shaking indicators in past scales, most closely following MMI, but have more precision due to the increased number of reports gathered.

International Macroseismic Scale

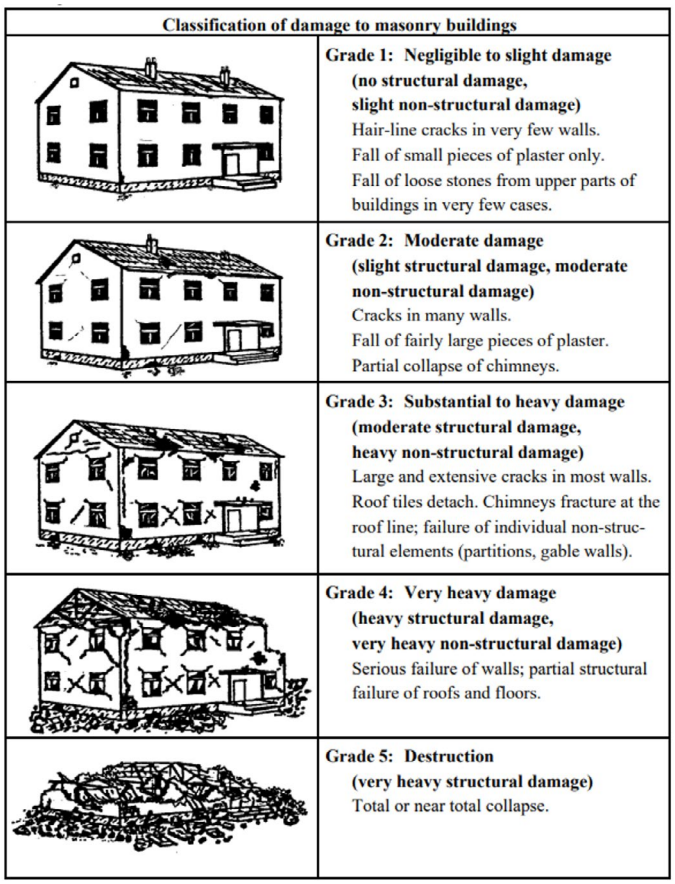
Future

The development of a unified international scale is crucial, especially for high intensities (7+) that contribute most to seismic risk. This unified scale would eliminate the need for conversion between different macroseismic scales, making risk assessments more efficient and accurate.

Countries would contribute appendices based on their typical building stock, describing their vulnerabilities and damage grades, thus creating a globally comprehensive and standardized measure (Figure 3).

- **Improved Communication:** The IMS provides a common language for describing earthquake intensities, facilitating effective communication among scientists, engineers, emergency managers and the general public. This standardized scale ensures that information about earthquake impacts is consistent and easily understood across different regions and countries.
- **Enhanced Risk Assessment:** The IMS can support more accurate and reliable assessment of earthquake risks. A standardized measure of intensity can enable better estimation of potential damage to buildings, infrastructure and communities immediately following an earthquake. This timely information is crucial for (re)insurers, policymakers and urban planners.
- **Global Comparison:** The IMS enables global comparison of earthquake events, allowing for enhanced understanding of seismic activity patterns and trends. It facilitates sharing of best practices and lessons learned from regions with different levels of seismic risk, potentially leading to more effective risk reduction strategies worldwide.

Figure 3: Overview of USGS' "Did You Feel It?" Platform. Courtesy of D. Wald at the US Geological Survey



Current Challenges and Opportunities for Industry Support

- **Data Availability and Quality:** Successful implementation of the IMS relies on the availability and quality of data. Thus, data collection systems should be robust, standardized and accessible. Collaboration between national and international agencies, academic

How Can the (Re)Insurance Industry Contribute and Collaborate?

Industry-Level: As the (re)insurance industry has a long track record of managing diverse global portfolios exposed to seismic risk, it has invested in research and development on large scales due to the global and infrequent nature of the peril. The (re)insurance industry has been a major sponsor of global earthquake hazard and risk estimation efforts over decades. Collaborative initiatives like the Global Earthquake Model (GEM) demonstrate the industry's commitment to coordination and cooperation. Collaboration and supporting IMS initiatives would be a natural extension of on-going work and can build up the global earthquake hazard risk estimation.

Company-Level: Contributing to the development, adoption and application of the IMS would be a natural next step in the ongoing collaboration between science and the (re)insurance industry. By actively participating in this effort and building capabilities that bring the IMS to the industry, there is potential for enhancing risk management activities. From a catastrophe modeling lens, globally consistent frameworks and metrics help with evaluation and management of a complex and infrequent peril.

Small Group to Individual Level: Information from post-event reconnaissance and damage assessments are crucial for implementing the IMS. This information can be integrated into the claims adjustment process, which could then be aggregated for portfolio risk management; there are similar practices in emergency management. Opportunities for (re)insurers to aggregate and share exposure characteristics and performance data, including the data collected from building or equipment sensors, would contribute to IMS development. As explained earlier, crowd-sourcing intensity data is tremendously valuable, but does require participation from the public. This can be the first step in contributing to the larger effort.

institutions, and industry stakeholders is essential to address data gaps and improve data quality.

- **Regional Variations:** Different regions may have unique characteristics that need to be considered and require flexibility in the framework when implementing the IMS. Supplements specific to each region can provide additional information on local building practices, geological conditions, and societal factors that influence earthquake impacts.
- **Public Awareness and Education:** The successful adoption of the IMS requires public awareness and education initiatives. Efforts should be made to educate the general public about the scale, its meaning, and its implications for personal safety and preparedness. This can be achieved through public outreach campaigns, educational programs in schools, collaboration with media outlets, and by insurance carriers facilitating policyholder education.

The IMS represents a significant advancement in earthquake hazard and risk assessment. By transitioning from independent scales to a unified international scale, the IMS can improve the accuracy and efficiency of risk assessments. Industry collaboration, particularly from the (re)insurance sector, is vital in supporting the development and implementation of the IMS. By actively participating in this effort, (re)insurers can contribute to the improvement of catastrophe risk assessment and ensure the relevance of the IMS for the industry as a whole.

Contacts

Questions? Connect with our earthquake experts Leah Salditch Leah.Salditch@guycarp.com or Taronne Tabucchi Taronne.Tabucchi@guycarp.com

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