Challenges in estimating real-time earthquake shaking and impact

D.J. Wald

USGS, Golden, CO, USA

2014 NZSEE Conference

ABSTRACT: The U.S. Geological Survey (USGS) has developed several near-real time earthquake information systems that provide rapid and automated alerting of estimated economic and human impacts following earthquakes. In this talk I describe the four components that rapidly assess an earthquake's impact. First, earthquakes trigger rapid source characterization; second, these source parameters help inform our estimates of shaking-distribution (ShakeMap). Third, losses are modeled by computing populations exposed per shaking intensity level, and country-specific loss functions are used to provide estimates of economic impact and potential casualties (PAGER). Finally, these uncertain loss estimates are communicated in an appropriate form for actionable decision-making among a variety of users.

Several aspects of our problem cannot yet be adequately solved with purely empirical or solely mechanistic approaches. The "physics-based" model components are essential for informing empirical loss models where they are data-limited, and for providing a framework for better understanding the causative pathways that dominate earthquake losses. In the course of explaining the end-to-end strategies and science/engineering we employ, I describe the pragmatic choices made in balancing the uncertainties in and benefits provided by our empirical and physical models. Recognizing and reconciling the complimentary benefits of data-driven verses theoretical problem solving is at the core of our end-to-end earthquake hazard and loss estimates, as it is for a wide variety of other challenges within the earth and engineering sciences.