

# ENCYCLOPEDIA *of* NATURAL HAZARDS

# Encyclopedia of Earth Sciences Series

## ENCYCLOPEDIA OF NATURAL HAZARDS

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ENCYCLOPEDIA OF EARTH SCIENCES SERIES

# ENCYCLOPEDIA *of* NATURAL HAZARDS

*edited by*

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## Preface

Few subjects have caught the attention of the entire world as much as those dealing with natural hazards. The first decade of this new millennium provides a litany of tragic examples of various hazards that turned into disasters affecting millions of individuals around the globe. The human losses (some 225,000 people) associated with the 2004 Indian Ocean earthquake and tsunami, the economic costs (approximately 200 billion USD) of the 2011 Tohoku Japan earthquake, tsunami, and reactor event, and the collective social impacts of human tragedies experienced during Hurricane Katrina in 2005 all provide repetitive reminders that we humans are temporary guests occupying a very active, angry, and ancient planet. Any examples here to stress the point that natural events on Earth may, and often do, lead to disasters and catastrophes when humans place themselves into situations of high risk.

Few subjects share the true interdisciplinary dependency that characterizes the field of natural hazards. From geology and geophysics to engineering and emergency response to social psychology and economics, the study of natural hazards draws input from an impressive suite of unique and previously independent specializations. Natural hazards provide a common platform to reduce disciplinary barriers or boundaries and facilitate a beneficial synergy in the provision of timely and useful information and action on the critical subject matter.

As social norms change regarding the concept of acceptable risk and human migration leads to an explosion in the number of megacities, coastal overcrowding and unmanaged habitation in precarious environments such as mountainous slopes, the vulnerability of people and their susceptibility to natural hazards increase dramatically. Coupled with the concerns of changing climates, escalating recovery costs, and a growing divergence between more developed and less developed countries, the subject of natural hazards remains on the forefront of issues that affect all people, nations, and environments all the time.

At the start of a new decade, in the first few months of 2010 alone, a magnitude 7 earthquake near Port-au-Prince, Haiti, killed an estimated 230,000 people, exposed the inadequacies of their infrastructure and emergency response capacity, and virtually crippled an entire nation. In contrast, a month later, a significantly larger magnitude 8.8 earthquake off the coast of Chile provided a sober lesson that those areas with a long history of exposure to natural hazards are indeed much more capable to cope with the consequences of unexpected events. Shortly thereafter, the eruptive events from Eyjafjallajökull volcano in Iceland virtually paralyzed air traffic in the United Kingdom and Western Europe for days. Travelers from around the world were impacted and inconvenienced. The economic repercussions were significant and all nations quickly realized how unprepared they are to natural hazards occurring outside of their borders.

This treatise provides a compendium of critical, timely, and very detailed information and essential facts regarding the basic attributes of natural hazards and concomitant disasters. For instance, swelling soils cost some \$2.3 billion in damage annually in the United States alone, some 3 billion people were affected and about 7 million people died from flooding in the twentieth century, there are over 45,000 dams around the world and 80% of the useful storage capacity for hydropower in Asia will be lost by 2035, wildfires release an estimated 3,431 million tons of CO<sub>2</sub> into the atmosphere annually, lightning strikes cost the insurance industry more than \$5 billion annually, an individual's social perception of the environment has radically changed in recent decades with the advent of near-real-time media reporting (CNN effect), in 1800 only 3% of the global population was urbanized as compared to over 50% by 2008, and resilience is frequently the most common outcome among survivors exposed to natural disasters. This volume clarifies and defines many fundamental concepts and terms, for instance, P waves vs. S waves, comets vs. asteroids, debris flow vs. debris

avalanche, dispersive soil vs. expansive soil, or shield volcano vs. stratovolcano. Under a single cover, a diverse suite of topics ranging from solar flares, droughts, and blizzards to tiltmeters, seismographs, and GIS to cryological engineering and structural mitigation to post-traumatic stress disorder, coping capacity and religion, and hazards are addressed.

The *Encyclopedia of Natural Hazards* effectively captures and integrates contributions from an international portfolio of almost 300 specialists whose range of expertise addresses over 330 topics pertinent to the field of natural hazards. Disciplinary barriers are overcome in this comprehensive treatment of the subject matter.

Clear illustrations and numerous color images enhance the primary aim to communicate and educate. The inclusion of a series of “classic case study” events interspersed throughout this volume provides tangible examples linking concepts, issues, outcomes, and solutions. These case studies illustrate different but notable recent, historic, and prehistoric events that have shaped the world as we now know it. They provide excellent focal points linking the remaining terms to the primary field of study. This *Encyclopedia of Natural Hazards* will remain a standard reference of choice for many years.

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Peter Bobrowsky



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