Natural hazards

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Earthquakes and Volcanic Eruptions: A Handbook on Risk Assessment. By Herbert Tiedemann. *Swiss Reinsurance Company, CH-8022 Zürich, Switzerland: 1992. Pp. 951. $180.*

SCIENTISTS tend to be slow to communicate the results of their research in practically useful ways. Their desire for additional knowledge competes with the time, money and effort needed to develop applications for the benefit of society, and organizational and cultural barriers come between researchers and their potential customers. The considerable progress made during the past 50 years in our understanding of natural disasters is only gradually being exploited by governments in land-use regulation, by industry in investment decisions and by the general public in assessing personal risk. Recent catastrophes, such as the 1980 eruption of Mount St Helens, and the earthquakes in 1985 in Mexico City and in 1989 in Loma Prieta, California, the 1992 tropical storms in Florida and Hawaii and the 1993 floods in the Midwest of the United States, have heightened public awareness of natural hazards and vividly illustrated the fragility of a complex industrial society. One particular weakness is the limited capability of insurance systems to deal with such disasters, much less with the larger ones predicted on the basis of geological and meteorological data.

In this extraordinary volume on earthquakes and volcanoes — the most severe geological hazards that threaten human life and property — Herbert Tiedemann provides a major contribution towards bridging the information gap between the Earth-science community and those who need more economically effective risk assessments. Working with the Swiss Reinsurance Company, Tiedemann has generated a broad summary of knowledge about earthquakes and volcanic eruptions, principles that influence the resulting damage to society, and guidelines for assessing risks, intended for use by the insurance industry but broadly applicable to government and industrial policies and individual lifestyle decisions.

At 3.6 kg and measuring 22 × 27 cm, this tome is hardly a mere handbook. Rather, it is an impressive summary and synthesis that is handsomely produced, combining coated paper, attractive founts and many excellent illustrations (674 figures, most in colour). The index alone consists of 91 pages. Detailed data for risk assessment are compiled in 27 appendices, two of which are separate, colour global maps of historical earthquakes and volcanic eruptions (scale 1:23,000,000) and a paperback catalogue summarizing 697 individual events. One complaint: the binding is inadequate for a book of this size; the cover on my copy began to come away before this review was completed.

Tiedemann has read voraciously and on the whole thoughtfully; most of his summaries are thorough and up to date without being too technical. In places, however, basic principles are inadequately defined for the lay reader, who may be overwhelmed by the rambling discussion of details (on, for example, earthquake magnitude and intensity). Quite a few factual errors, even in figure captions, suggest that the volume was inadequately checked for technical accuracy. The lack of source citations, while in keeping with nontechnicality, is frustrating when the discussion involves alternative interpretations of primary data. At times, Tiedemann's enthusiasm for a topic leads to over-speculative conclusions. For example, in discussing large explosive eruptions of ash flows that lead to caldera collapse — probably the most catastrophic events to affect the Earth other than rare extraterrestrial impacts — Tiedemann confusingly combines size data for individual well-documented calderas, composite dimensions of multiple caldera collapses associated with recurrent eruptions (in, for instance, the Toba complex in Sumatra) and novel inference of even larger volcanic collapse structures based entirely on topographical features in Madagascar (where young ash-flow deposits are unknown). A resulting graph (Fig. 223; not based solely on data from Table 32 as claimed in the caption) is used to draw the dubious conclusion that "eruptions are possible which generate larger calderas (diameters in excess of 200 km) than the largest known today".

More convincingly, Tiedemann compiles historical data on large earthquakes (magnitudes greater than five) during the past century to conclude that the past 25 years have been seismically comparatively inactive. These data, in conjunction with the growth in global population, capital investment and use of high-risk land, suggest to Tiedemann that the cumulative exposure to insurance losses from earthquakes "is much larger than anticipated because of the gross underestimation of the vulnerability of elements at risk". Indeed, the excellent photographs of structural damage from earthquakes, accompanied by captions discussing the diverse causes of failure, should be sobering to any building owner, insurance carrier or policy-maker.

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Street incredibility — landslide in Anchorage caused by the Alaskan earthquake of 1964.

I am ill-qualified to judge the sections on insurance applications, but such detailed use of Earth-science data for commercial risk assessment is to my knowledge novel and constitutes impressive progress beyond the arbitrary and socially damaging 'red-lining' approach taken by some insurers following recent natural disasters in North America. I know of no other comparable volume that so comprehensively combines a thorough summary of fundamental scientific results with direct applications to large-scale issues of public concern. Certainly, this volume should prove to be useful and interesting not only to insurers but also to planners, architects, engineers and those interested in risk management and optimization — in short, to anyone who wants a broad survey of current ideas about earthquakes and volcanoes. □

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