Catastrophes, computing, and containment: living with our restless habitat

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Abstract It may be easy for those who have spent their lives in the tranquil English countryside to misunderstand what others who live elsewhere know only too well. Namely, that mankind lives on the thin skin of a restless planet, and that geophysical hazards are omnifarious and omnipresent. Surely, the odds for any one of us to be killed by a grapefruit-sized hailstone, a meteorite or by one of the the more common geophysical hazards (*e g* lightning strikes) are small, and are not likely to be considered catastrophic to anyone but the individual involved. But for some localities, the risk to life and property from specific geophysical hazards is extreme, and can be sufficiently well established that measures such as defensive structures or warning systems become viable as societal undertakings The computer is proving to be of great use in the establishment and operation of many real-time warning systems Further, computers are increasingly being used for the storing and massaging of maps and related large data bases which permits newer, more sophisticated and more accurate estimates of the probabilities of rare catastrophic events, and hence the wiser allocation of restricted government funds amongst a plethora of hazard reduction projects. The remainder of the paper is confined to a specific class of hazard, namely floods; and more specifically compares the classic procedures for estimating the probabilities of extreme events with some of the newer, robust procedures that have become possible since the event of powerful, cheap computers.

Introduction

Geophysical hazards are neither uniformly distributed in space (see Figure 1) nor in time, and for those who have lived all their lives in the tranquil English countryside it may be easy to forget that they are indeed inhabitants of a restless planet. geophysical catastrophes can and do occur continuously, and the aftermaths of the major events are reported on radio, television and in the daily newspapers, Sunday supplements, and magazines. Further, the Earth's burgeoning population assures that the future will not be any less catastrophic than the past. Hence, in spite of an increased understanding of the phenomena, and better monitoring of the data necessary for modelling and prediction, we can still expect that loss of life and property from geophysical catastrophes will increase inexorably.

Geophysical catastrophes are omnifarious. They vary from the bizarre and rare (meteor attack or lake degassing) to the commonplace (floods and droughts[1]): from the slow acting (rising sea levels and climatic changes) to the very rapid (the shock wave from the Mount St Helens eruption travelled at nearly the speed of sound[2]): and from the spectacular and obvious (Hawaiian lava flows.[3], volcanic explosions and earthquakes) to the invisible (Antarctica's ozone hole[4] and the rising concentrations of atmospheric CO_2.[5]). As Richard Critchfield has shown, large prolonged droughts can be catastrophic. However, like wars, they are phenomena for which the origin and containment are primarily socio-economic