Disaster prevention and control in the earth sciences

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Among the critically useful applications of our basic knowledge of the sciences, especially physics, and our ability to exploit mathematics to the advantage of man wherever he lives on the planet, is that of disaster prediction. Here are described what we are currently capable of doing to mitigate seismic and volcanic cataclysms and how we should be able to improve our capacity to predict these natural catastrophes.

Introduction

A disaster can be defined as a situation involving the loss of life, injury to life, or destruction of property on a scale with which normal emergency services cannot cope. It therefore implies the occurrence of an unusual event which was not adequately predicted in time or place to allow measures to be taken for the protection of the threatened people or property. The two main types of event which belong to the earth sciences and which are capable of causing major disasters are earthquakes and volcanic eruptions. The purpose of the discussion which follows is to describe and critically review the present level of exposure of mankind to these hazards, and the means of protecting it from them.

The two different types of hazard pose considerably different problems with regard to both the geographical extent and the nature of the damage, as well as the premonitory signs and the duration of the phenomenon. It is simpler, therefore, to consider each type of hazard separately.

The scale of earthquake disasters

Since earthquakes are capable of causing destruction over much larger areas of the world's surface, and are more difficult to predict both in time and in place than volcanic eruptions, they result in larger losses. Details given by Montandon [1][1] show that the mean annual death rate from earthquakes between 1926–50 was about 14,000. According to Latter [2], this rate diminished for the period 1951–68 to about 3,750. When data through July 1976 are added, however, the annual average since 1951 increases to at least 10,000, whilst for the last 7.6 years, and assuming the loss of 100,000 lives in the Tangshan earthquake of 27 July 1976 (for which estimates of between 100,000 and 1 million have been quoted), the mean annual loss of life has been about 29,000.

The only general conclusion which can be drawn from these numbers is that the mean annual loss of lives through earthquakes remained reasonably static during the present century. But with the progressive concentration of world population in urban areas, and with the spectacular recent increase (in many cities) in the proportion of masonry and other earthquake-susceptible structures—especially high-rise

1. Numbers in brackets correspond to the references at the end of the article.