In this issue

Earthquakes

Earthquakes are among the most deadly and expensive natural disasters affecting mankind. The 1995 Kobe, Japan earthquake that killed nearly 6000 people and caused a direct loss of $ 100 billion is perhaps the most shocking example of disaster due to earthquake in a modern urban environment. Subsequent to this earthquake, Science and Technology Agency of Japan installed a network of 1000 digital strong motion instruments for continued assessment of seismic hazard. This initiative was born out of the need to expand the database on ground shaking, attenuation and site characteristics. Having such elaborate data improves the earthquake preparedness and risk assessment.

In most advanced societies, the need to understand seismic hazard of a region has expanded from professional seismic engineering community to the local administration and to the public, at large. However, these concepts have not been well integrated with our earthquake disaster-mitigation programmes. Obviously this must happen gradually, placing a larger demand for more information that can be used for a better appreciation of seismic vulnerability. In a large country like India where disaster management is an expensive and elaborate task, such information will be very useful in prioritizing strategies. It is time that we recognize this need.

It has been noted in many large earthquakes that the damages tend to be concentrated on discrete zones, which may be separated by relatively unscathed regions. Site characteristics, particularly the soil conditions, are important in controlling the damages due to earthquakes. Microzonation, the mapping of seismic hazard as applicable on a block-by-block scale based on local conditions, is an effective way of representing the damage potential. This has been recognized as an important input to seismic hazard mitigation.

What is the seismic status of our capital city? Although it has not been rocked by any large earthquakes in the recent past, this ancient city has been affected by many earthquakes in the historic past. Damages could also be caused by distant earthquakes as evident from the effects of the recent Chamoli, Garhwal Himalaya earthquake. The residential buildings located on Yamuna alluvium suffered more damages, suggest the localized effect and the influence of site conditions on damage patterns. Yet, how much do we know about the site conditions of our seismogenic zones? Perhaps very little. The paper 'On the seismic status of Delhi megacity' by R. N. Iyengar (**page 568**) is a useful beginning.

Kusala Rajendran

Monsoon rainfall

The understanding of the variability of the all India summer monsoon rainfall from year to year (i.e. interannual variations) is of great relevance since these variations have a direct impact on the agricultural production and the Indian economy. Moreover, fluctuations in Indian summer monsoon rainfall have strong influence on the pattern of winds in the tropics. Hence the study of the variation of Indian summer monsoon rainfall is necessary and interesting.

During the past 130 years, daily rainfall measurements have been made in more than 300 stations in India. This rainfall data has been a valuable source for the study of the rich spatial and temporal structure exhibited by the Indian summer monsoon rainfall. Many investigators have looked for regular patterns of droughts and floods in this data. Some have speculated that the variations in sunspot cycle may be associated with regular patterns of droughts and floods. The standard tool used for the analysis of the rainfall data is the harmonic analysis. In this method, a given time series is assumed to be the sum of sinusoidal fluctuations of different periods. The harmonic analysis is, however, based on the assumption that the different periods of fluctuations are invariant in time. This assumption may, however, be dubious when we consider the Indian monsoon rainfall. Consider, for example, the Indian summer monsoon rainfall during the period 1871–1990. There were 10 droughts (i.e. All India summer monsoon rainfall 10% below normal) during 1961–1990 while there were just 2 droughts during 1931–1960. Thus droughts do not occur at regular intervals. Hence it becomes essential to look for a more sophisticated technique than the standard harmonic analysis to examine the fluctuations in the Indian summer monsoon rainfall.

In this issue, Kailas and Narasimha (**page 592**) have used a modern technique called the wavelet method to examine the quasi-cycles in the monsoon rainfall during the period 1871–1990. The wavelet method has evolved rapidly during the past twenty years because of the realization that standard harmonic analysis is not appropriate for the study of the temporal evolution of complex systems. The wavelet method extends the standard harmonic analysis to a new dimension since it is able to identify the dominant periods of variability and their temporal evolution. Kailas and Narasimha decompose the 130-year All India monthly rainfall series into time-frequency space and are able to identify the dominant modes of variability and their temporal variation. They employ local scaling to highlight modes that are not as strong as the dominant mode. The periods they identify are not all same as that would be obtained from a standard harmonic analysis. They obtain modes with periods associated with the sunspot cycle (12 and 22 years), the El-Niño phenomenon (5.8 years) and the well-known quasi-biennial oscillation (1.8 and 3 years). They have discovered new modes with periods around 79 and 48 years. These new modes are interesting since they may be associated with epochs of good monsoon and bad monsoon that occur with a period around 60 years. The wavelet analysis shows clearly that the periods and intensity of these oscillations *have not remained* constant during the past 130 years.

J. Srinivasan