SEISMIC RISK MAPS IN ASIAN COUNTRIES
- CHINA, PHILIPPINES, INDONESIA AND OTHERS -

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SUMMARY

Seismic risk maps in Asian Countries were made using the seismic data in the past, some attenuation models and the method of extreme value fitting. The maps consist of the following two kinds: (1) The maximum particle velocity(kine) on the base rock and (2) The maximum acceleration(gal) on the ground. The return periods of these maps are 50, 100 and 200 years, respectively.

1. INTRODUCTION

It is needless to say that earthquake prediction is indispensable. However, seen from the standpoint of preventing earthquake disaster, it is not sufficient only to predict hypocenters, magnitudes and occurrence times of earthquakes in the future. It is also important to estimate earthquake motions due to earthquakes which may occur in the future and to forecast disasters caused by them, and furthermore, it is necessary to consider counterplans to prevent them. Ideally speaking, it is very desirable that destructive earthquake motions which will be experienced at an arbitrary point in the future can be estimated as in the following.

$$\overset{1}{\left[f(tsn)_{BP},\ tn\right]}\overset{2}{\left[Gp\right]} = \overset{3}{\left[f(tsn)_{SP},\ tn\right]}$$

(1) Earthquake motions on the base rock at the time tn(tsn; the time axis of the earthquake motion).

(2) Ground characteristics

(3) Earthquake motions on the ground at the time tn.

However, it is impossible at present to realize perfectly the above equation with sharp accuracy because of the following reasons: (a) For reliable estimations of the occurrence time tn of earthquakes, we must wait the progress of prediction techniques in the future. (b) It is difficult to obtain the ground characteristic of such wide areas as the whole one country for a short time and in detail. (c) The estimation of $f(tsn)_{BP}$ can not always satisfactorily be made.

Nevertheless, aseismic designs for buildings or civil engineering structures which will remain for decades and centuries must be made being founded on the knowledge obtained up to the present. As a substitute for the above ideal one, the author proposed to use the seismic risk map made by the following procedures for the whole vicinity of Japan: (1) The seismic inputs on the base rock were estimated from the spatial characteristics of the seismicity in the past (S(S)). (2) The ground characteristics

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were presumed by utilizing strong motion seismograms (M(S)). (3) The temporal variations of the seismicity were estimated from the accumulative energy curve (S(T)). (4) The more reasonable seismic risk map was expressed by combining the above S(S), M(S) and S(T) (1,2,3,4).

The above first one (S(S)) is the most basic step to get the more reliable seismic risk map. This research was undertaken to make the above mentioned first one (S(S)) for the Asian countries.

2. ANALYSES AND RESULTS

The seismic data in the NOAA - magnetic tape were mainly used. The relations among magnitudes by different definitions were studied and a unified magnitude was used in this research.

Two kinds of attenuation model were used: (1) Kanai's attenuation model which gives the maximum particle velocity on the base rock(5). (2) Oliveira-McGuire's attenuation model which gives the maximum acceleration on the ground (6,7). The former one had been used by the author for the seismic risk map in the vicinity of Japan. Therefore, this one was used because if it is used, we can compare directly the present seismic risk maps in many Asian countries with the ones of Japan. On the other hand, the maximum acceleration on the ground is convenient for the practical use of earthquake engineering. An attenuation model which was made by averaging attenuation models by Oliveira(6) and McGuire(7) is comparatively close to the other ones and it seems to give presumable values. This is the reason for adopting the latter one.

Adding to the seismic data and attenuation models the method of extreme value fitting (Gumbel's third asymptotic distribution) was used to expect the maximum earthquake motions.

The final results of this research are seismic risk maps in many Asian countries, which are shown in Figs. 1-5.

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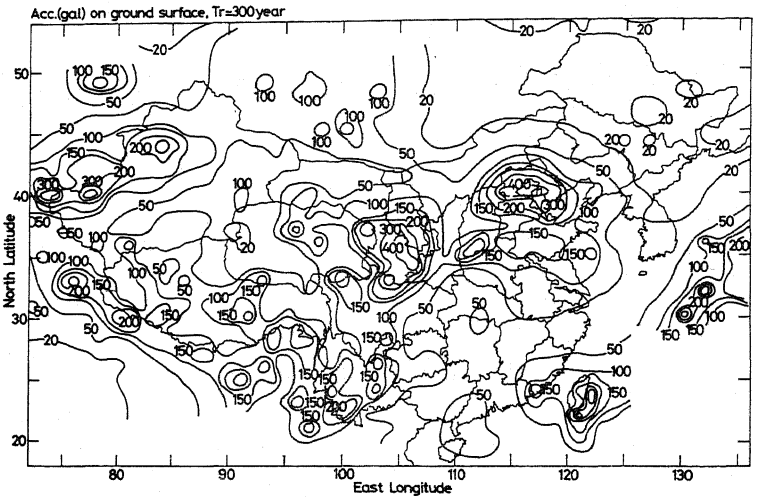

Fig. 1. Seismic risk map in and around China.

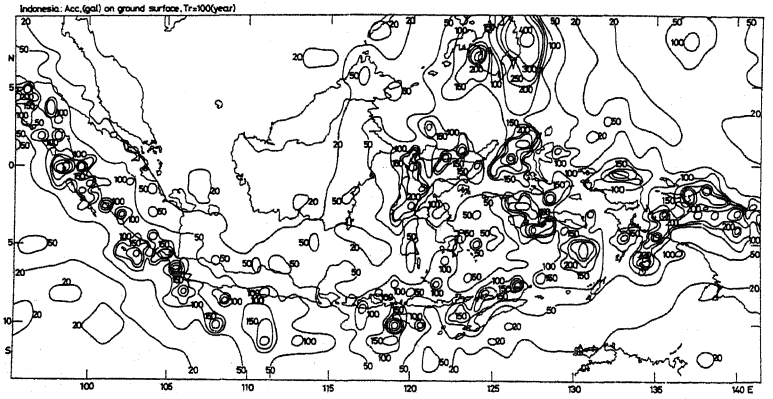

Fig. 2. Seismic risk map in and around Indonesia.

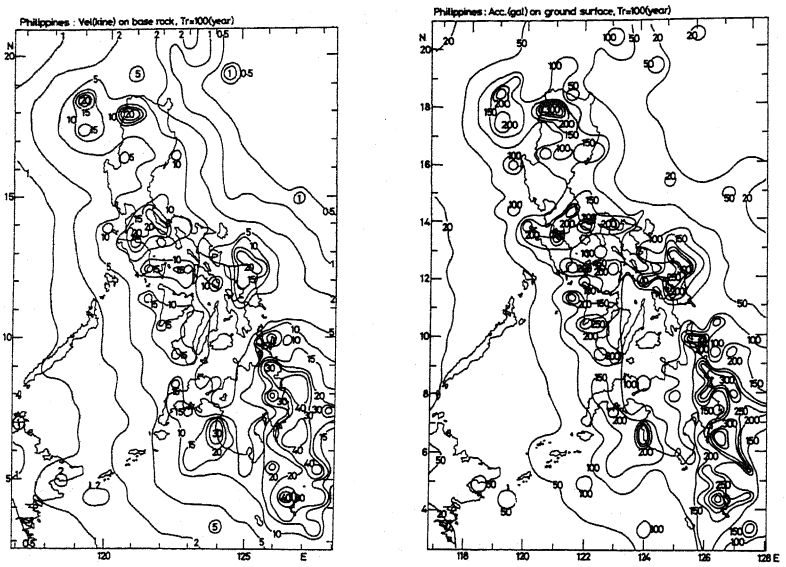

Fig. 3. Seismic risk maps in and around Philippines.

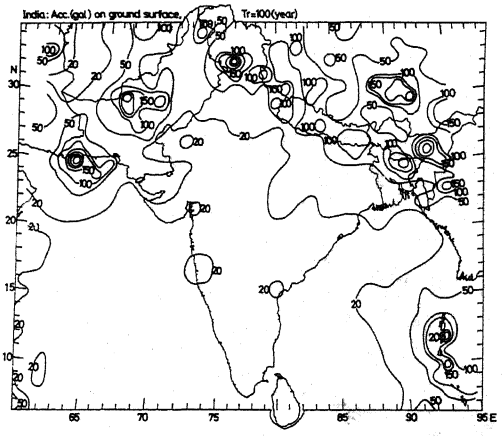

Fig. 4. Seismic risk map in and around India.

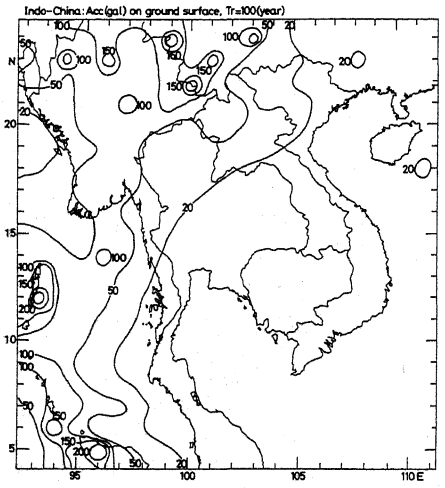

Fig. 5. Seismic risk map in and around Indo-China.