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Preface

Péter Varga

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The papers included into Special Issue are connected—directly or indirectly—to the problem of earthquake hazard. This problem is of importance not only for seismologists alone but can attract interest of scientists from many fields of earth sciences. The contributions are particularly timely given the unresolved issues related to the L'Aquila and Tohoku earthquakes.

The problem of the research on the likely social impact of earthquakes hazard is related to several issues not yet resolved on the level expected by society. They are inter alia the absence of long series of complete earthquake data what is a serious difficulty in seismic hazard research in preparation worst-case models for the location, size and peak ground acceleration (PGA) of potential future earthquakes. That is why predictions based on probabilistic principles do not fit aptly observed reality, not help to determine reliable design parameters even in the comparatively well-known past occurrences, despite their evidently serious mathematical foundations. For major earthquakes over the past decades, several significant differences were detected between the predicted and observed PGA values (Table 1). Therefore, recently more and more seismologists and designers turns to the deterministic method of seismic hazard assessment what is based on maximum credible earthquake events against which impact should be able to withstand the engineering installations. Of course, this approach, in its current elaboration, can not be considered unproblematic also (e.g. not the maximum credible earthquake event produces the maximum spectral acceleration amplitudes at all periods) but it is free from the key problem of probabilistic assessment what is lack of reliable probability model of earthquake recurrence.

Unfortunately, our "seismological memory" is too short in comparison with the recurrence time of earthquakes in case of all customary methods of micro- and macroseismology available. The instrumental seismology is just over one century old, and about the significant, destructive earthquakes, the picture is relatively complete approximately for the last 300 years. For successful assessment of earthquake hazard especially in low to moderate seismic regions (e.g. in case of intraplate areas of Central, Eastern, and Northern Europe) more accurate understanding of the seismicity of the historical and geological past is required.

P. Varga (✉)
MTA CSFK GGI, Sopron, Hungary
e-mail: varga@seismology.hu

Table 1 Peak ground acceleration (PGA) values estimated with the use of probabilistic seismic hazards assessment in case of some significant recent earthquakes and acceleration data obtained from records of seismological stations operating in the vicinity of the epicentre

Place	Time (y, m, d)	Magnitude	Number of victims	Predicted PGA (m/s^2)[a]	Observed PGA (m/s^2)
Kobe, Japan	1995. 01. 17.	7,2	5,100	0,40–0,48	0,7–0,8
Gujarat, India	2001. 01. 26.	7,6–7,7	20,000	0,16–0,24	0,5–0,6
Boumerdes, Algeria	2003. 05. 21.	7,3	3,500	0,08–0,16	0,3–0,4
Bam, Iran	2003. 12. 26.	6,6	26,000	0,16–0,24	0,7–0,8
Sichuan, China	2008. 05. 12.	7,9	68,000	0,16–0,24	0,6–0,8
Haiti	2010. 01. 12.	7,0	316,000	0,06–0,16	0,3–0,6
Chile	2010. 02. 27.	8,8	500	6,4	6,4
Christchurch, New Zealand	2011. 02. 22.	6,3	300	3,4–6,4	14,7–21,6
Tohoku, Japan	2011. 03. 11.	9,0	$\leq$18,500	2,0–6,4	$\leq$10

[a] 10 % probability of no-exceedance in 50 years

The historical approach to seismology needs a cooperation of historians and seismologists. The use of historical data necessitates caution. If information on historical seismicity is used it is necessary to take into consideration that usually it does not show the place where the event occurred but the place where its effect was described. Usually observers lived in the old days, responded to the earthquake's effect differently than a seismologist of our days. The paleoseismology is investigating geologic sediments and rocks and on this basis dealing with prehistorical earthquakes. More recently several interesting results were provided by paleoseismology. Earthquake recurrence was inferred from geological data at different places (e.g. in the New Madrid region in Mississippi valley (Atwater et al. 2004), along the Bree fault in lower Rhine graben (Meghraoui et al. 2000) and in the region north of the Caucasus (Rogozhin 2002)).

The complete determination of the seismic vulnerability is further aggravated by the need to take into account the local geological conditions. They have in certain cases a large impact on the level of earthquake hazard. Among these probably beside the slope failure the most significant is the soil liquefaction in which the strength and stiffness of a soil is reduced by earthquake shaking. The unfavourable soil conditions increasing effect of liquefaction are especially hazardous and enhancing the earthquake risk in the case of concentration of the built environment.

The effect of artificial earthquakes can distort the results of the hazard assessment. Distinction between natural seismic events and artificial ones is sometimes a complicated task. This can be particularly hazardous in mining areas when blasts in mines and quarries are frequent. The distinction based on seismograms is a fairly complex task, and necessitates a special waveform similarity analysis.

Hereinbefore vulnerability has been reviewed in a broader sense than usually. However, there are attempts to reduce seismic hazard based on new experimental trends which attempt to detect pre-earthquake processes, or with the use of alarms already occurred seismic events. These experimental procedures have the potential to significantly reduce expected losses caused by future seismic events.

The first two papers of present Special Issue of Acta Geodaetica et Geophysica are dealing with earthquake hazard problems. Then two contributions are related to historical- and

paleoseismology. These researches allow us extending our knowledge of seismic activity to remote past. The following two papers draw attention to the often overlooked problems of earthquake hazard assessment. Finally, the Special Issue contains studies which make it possible to reduce the impact of the events that have been emerging or even have already occurred.

Péter Varga
Guest Editor

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