PhD Seminar on
Probabilistic Approach to Natural Hazards Assessment

Prof. Dr. Michael H. Faber and Kazuyoshi Nishijima

Societies are exposed to a variety of natural hazards: floods, avalanches, rock falls, earthquakes, wind storms and so on. The occurrence of these natural hazards may directly cause physical damages to engineering infrastructure and indirectly affect societal activities beyond the damages. Thus, managing risks in society due to natural hazards requires the assessment of the degree of potential dangers due to natural hazards. In present practice, the assessments are made with probability-based approaches employing scientific knowledge on the process of natural phenomena that may lead to the natural hazards as well as historical data related to the natural hazards; the results of the assessments are often presented in terms of hazard maps. These maps represent, for each type of natural hazards, the geographical distribution of the quantile value of the annual maximum distribution of a hazard index, e.g. peak ground acceleration in the case of seismic hazards.

Whereas the approaches to the probabilistic assessment of natural hazards may differ between different types of natural hazards, the methodology behind the approaches seems common. However, the methodology commonly used in practice may not be suitable for the applications to consistent engineering decision making; in order to make consistent decisions different types of uncertainties, i.e. aleatory uncertainties and epistemic uncertainties, must be considered consistently in accordance with the general principles for the probabilistic assessment of events subject to epistemic uncertainties. Note that the uncertainties involved in the probabilistic assessments of the hazard events are not only the aleatory uncertainties that represent the randomness of the phenomena dictated by nature, but also the epistemic uncertainties which concern, e.g. our imperfect understanding of phenomena and imprecise modelling of phenomena.

The present seminar first introduces a standard methodology for the probabilistic assessment of natural hazard events, following the presentations of some practical examples. Half-way in the course, the methodology and the examples are reviewed in the light of the application to decision making consistent with the general principles. Thereby, possible modifications and improvements for the methodology are discussed. In the latter half of the course, one type of natural hazards is considered; for which a hazard map is developed applying the methodology with due consideration of the proposed modifications and improvements. The participants of the course are asked to contribute in parts to the development of the hazard map. The goal of the present seminar is to understand the methodology on how hazard maps are developed and can be applied to engineering decision making.

Who should attend?

Researchers, Ph. D. students, post-docs and graduate students as well as practitioners interested in the probabilistic assessment of natural hazard events and the applications to engineering decision making. No experience on the assessment of natural hazard events is required. The participants should, however, have basic skills for probability calculations.

Mode

The seminar will be conducted as a study group under the responsibility of Prof. Faber. All participants will in turn be responsible for presenting a part of the material and for developing the example. Self study, presentations and discussions will constitute main components of the course.

When and where?
Wednesdays, 16:45 – 18:00, ETH Hönggerberg, HIL E 6.

Agenda (course plan)

W	Date	Speaker	Topic
1	17.09.08	Prof. M.H. Faber	- Introduction
2	24.09.08	K. Nishijima	- Practical example (Seismic hazards in Japan)
3	01.10.08	M. Graf	- Practical example (Typhoon hazards in Japan)
4	08.10.08		- Practical example
5	15.10.08		- Reviews on methodology and the application examples
6	22.10.08		- Selection of a type of natural hazard considered in the latter half of the course (rock fall hazard), and definition of the problem
7	29.10.08		Work on the rock fall example
8	05.11.08		Work on the rock fall example
9	12.11.08		Work on the rock fall example
10	19.11.08		Work on the rock fall example
11	26.11.08		Work on the rock fall example
12	03.12.08		Work on the rock fall example
13	10.12.08		Work on the rock fall example
14	17.12.08		Work on the rock fall example

Abstract	During the course each student participates actively in the lectures through literature research, presentations and discussions on the probabilistic assessment of natural hazard events. First we will take a look at the basic methodology of the probabilistic assessment of natural hazard events. The presentations of some practical applications on the natural hazard assessment follow. Then, we will discuss on the methodology used in practice from a decision making perspective. Thereby, the consistent treatment of the different types of uncertainties and their representations in terms of hazard maps are focused. One type of natural hazard is selected, for which a hazard map is developed. The participants are to be involved in part in the development of the hazard map.
Objective	The aim of the present course is to train the PhD and MSC students in their abilities to study existing literature for the purpose of establishing the understanding, assessment, modeling and spatial representation of natural hazard events from a probabilistic perspective. Researchers, and post-docs interested in the general modeling and mapping of natural hazard events are welcome.
Content	Societies are exposed to a variety of natural hazards: floods, avalanches, rock falls, earthquakes, wind storms and so on. The occurrence of these natural hazards may directly cause physical damages to engineering infrastructure and indirectly affect societal activities beyond the damages. Thus, managing risks in society due to natural hazards requires the assessment of the degree of potential dangers due to natural hazards. In present practice, the assessment is made with probability-based approaches employing scientific knowledge on the process of natural phenomena that may lead to the natural hazards as well as historical data related to the natural hazards; the results of the assessment are often presented in terms of hazard maps. These maps represent, for each type of natural hazards, the geographical distribution of the quantile value of the annual maximum distribution of a hazard index, e.g. peak ground acceleration in the case of seismic hazards.

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Literature	
Notice	The seminar will be conducted in English.

ECTS credits	2 credits
Examiners	M. H. Faber
Type	Ungraded semester performance
Language of examination	English
Course attendance confirmation required	No
Repetition	Repetition only possible after re-enrolling for the course unit. If the course unit is part of an examination block, the credits are allocated for the successful completion of the whole block.