

## Tsunami Risk Perception in Questionnaires and its use for the Modeling of Start Time Evacuation Behavior

## Tsunami Risk Perception in Questionnaires and its use for the Modeling of Start Time Evacuation Behavior

Erick Mas<sup>1\*</sup>, Fumihiko Imamura<sup>1</sup>, Shunichi Koshimura<sup>1</sup>

Erick Mas<sup>1\*</sup>, Fumihiko Imamura<sup>1</sup>, Shunichi Koshimura<sup>1</sup>

<sup>1</sup>Grad. Sch. Eng. Tohoku University

<sup>1</sup>Grad. Sch. Eng. Tohoku University

Questionnaires are a popular and fundamental tool for acquiring information on human behavior, public knowledge and perception of risk [2]. There is a lack of research in tsunami human behavior [1] specially on the start time decision for evacuation, even though a great improve on technology for early warning has been achieved, still some people decide not to evacuate from tsunami [4,5]. Most of survivals who did not evacuate give as a reason, the fact that the sea did not retreat, no information or warning confirmation came, or they considered themselves in a safe place already, etc. [3]. It is true that, if we do not consider cognitive aspects of the human being during the process of evacuation, the results provided by such models might be far from reality [6]. In this study, Risk Perception (RP) was the key for the construction of the model of start evacuation decision. RP is a subjective judgment of a risk, an idea of how risk could be the situation. It was treated as a dynamic level, from a moment of no threat through a decision stage in which an alteration of the environment is perceived and risk perception rises until the individual has to consider an action (e.g. evacuate or not), this, based on experience, social or external sources of influence and time pressure; and finally enters a last stage of risk recognition where the decision becomes a protective action. For this, a Tsunami Evacuation Behavior Questionnaire was conducted in La Punta, Peru. Risk perception level was calculated for each individual and a risk perception framework for evacuation decision was integrated into a model and verified with actual data from questionnaires. Reference Risk, Prospect Reference Theory, Subjective Judgment Matrices and Bayesian Learning were used as tools to construct this Risk Perception Framework for Tsunami Evacuation Decision. An improvement on predicted times for the sample group was obtained in comparison with traditional models [7]. The proposed risk perception model of decision shows consistency and a promising future in human behavior modeling for tsunami events.

### Acknowledgments

We would like to express our deep appreciate to the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and JST-JICA (Peru) for the Financial support throughout the study. Also our gratitude to La Punta municipality and residents, and Callao Regional Government through its Civil Defense Office and members.

### References

- [1] E.N. Bernard, H.O. Mofjeld, V. Titov, C.E. Synolakis, and F.I. Gonzalez. Tsunami: scientific frontiers, mitigation, forecasting and policy implications. *Philosophical Transactions of The Royal Society, A* 364:1989-2007, 2006.
- [2] D.K. Bird. The use of questionnaires for acquiring information on public perception of natural hazards and risk mitigation - a review of current knowledge and practice. *Natural Hazards and Earth System Sciences*, 9:1307-1325, 2009.
- [3] M. Hoppe and H. Setiyo. 30 Minutes in the City of Padang. Lessons for Tsunami Preparedness and Early Warning from the Earthquake on Spetember 30, 2009. Working document no. 25, GTZ-IS-GITEWS, 2010.
- [4] F. Imamura. Dissemination of Information and Evacuation Procedures in the 2004-2007 Tsunamis, Including the 2004 Indian Ocean. *Journal of Earthquake and Tsunami*, 3-2:59-65, 2009.
- [5] T. Katada, M. Kodama, N. Kuwasawa, and S. Koshimura. Issues of resident's consciousness and evacuation from the tsunami - from questionnaire survey in Kessenuma City, Miyagi Prefecture after the earthquake of Miyagiken-Oki, 2003 -(in Japanese). *Japan Society of Civil Engineers*, 789/11-71:93-104, 2005.
- [6] T. Thiago. An approach for modeling human cognitive behavior in evacuation models. *Fire Safety Journal*, 40:177-189,2005.
- [7] S. Tweedie, J. Rowland, S. Walsh, R. Rhoten, and P. Hagle. A Methodology for estimating Emergency Evacuation Times. *The Social Science Journal*, 23-2:189-204, 1986.

キーワード: human behavior, risk perception, tsunami evacuation, tsunami modeling  
Keywords: human behavior, risk perception, tsunami evacuation, tsunami modeling