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Study on Simulation Model of Tsunami and Human Behavior for Higashi Matsushima community

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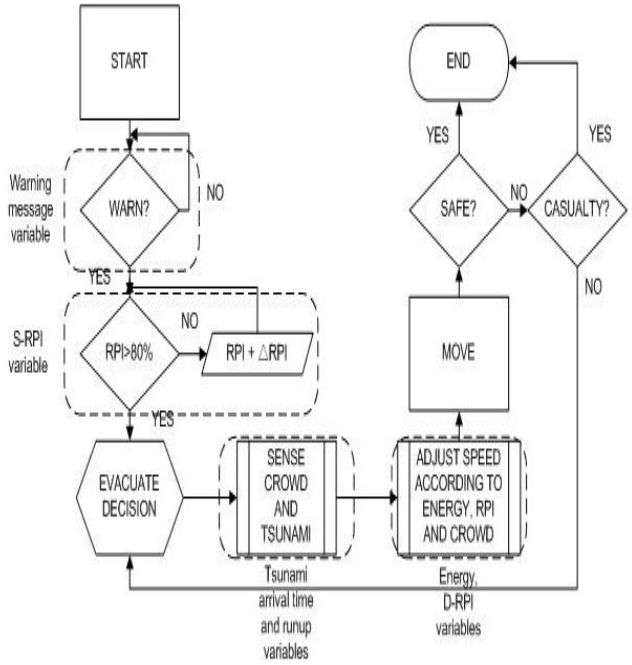

Figure 1 Individual Agent behavior

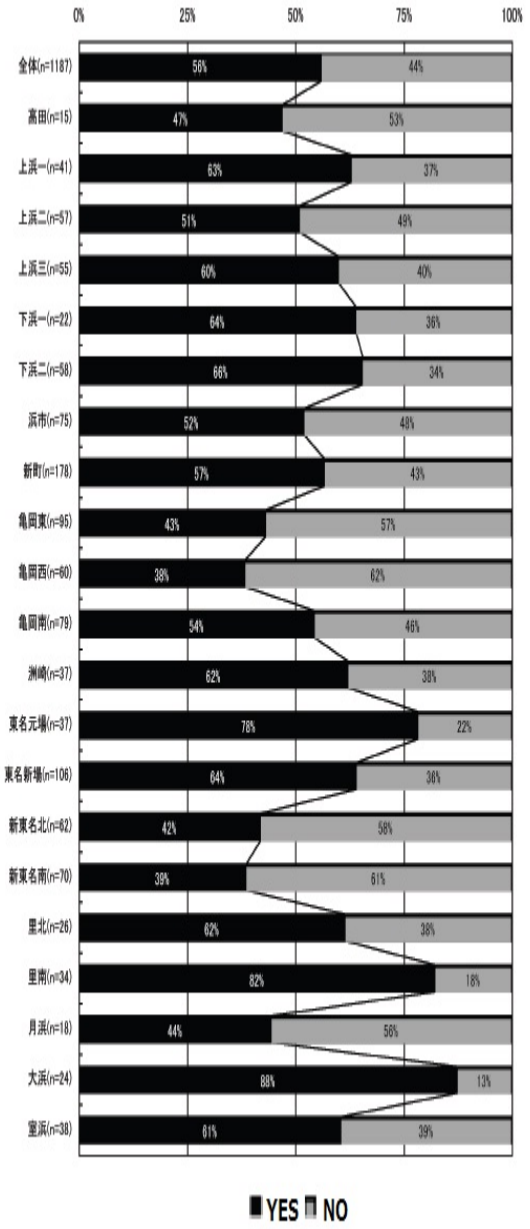

Figure 2 Tsunami Experience at each community in Higashi Matsushima

The number of tsunamis per year worldwide has increased, and more population in coastlines has made death tolls climbing. Population safety is the goal of most of the tsunami countermeasures; thus, in this paper, a study on evacuation procedure will be presented. Through the development of a Tsunami Model and Human Evacuation Behavior simulation using Multi Agent System, we are going to investigate some parameters of evacuation behavior. As part of verification and calibration for the model a study area in Japan was selected, Higashi Matsushima in Miyagi Prefecture, where questionnaires and workshops were conducted in order to obtain prior beliefs, experience, knowledge and decisions of some residents against tsunami hazard and tsunami events. Steps that can lead to a safe evacuation are taken into account. Moreover, Risk Perception variable is used in the model as the pivot for human behavior and decision process during emergence situations.

The Multi Agent System paradigm is used for the individual human behavior simulation. An evacuee is define as an agent, who, as well, has sense, decision capability and mobility. Furthermore, the evacuation behavior is enabled by every agent autonomously (Figure 1), thus the agent receives the warning message, evaluates his static risk perception, motivation for evacuating, performs the evacuation and in the way interacts with his surrounding through the adjustment of speed and path, according to population density, dynamic risk perception, tsunami threat, and available energy. So far, from the result of simulations, following situations were found : (1) warning coverage variable is of high sensitivity for the model, (2) randomness on risk perception should be calibrated and (3) tsunami hazard parameters (arrival time and runup) are directly related to casualty probability estimation in the model.

Data from questionnaires and workshops conducted in Higashi Matsushima will be part of the parameter calibration for human characteristics and preferences. (Figure 2).

Acknowledgments
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References
Imamura F. (2009), Dissemination of Information and Evacuation Procedures in the 2004-2007 Tsunamis. Journal of Earthquake and Tsunami. Vol. 3, No 2. 59-65.

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