

A study on the selection process of tsunami evacuation sites using qualitative GIS approaches: the case of Ishinomaki city, Miyagi prefecture

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1. Introductions

The qualitative GIS is an approach that words and numbers are used together to compose contextualized visual narratives elaborated through geographical discourse to derive theories of social phenomena. Therefore, a qualitative GIS approach is powerful for analyzing behavioral geography as the integration of subjects and objects. In contrast to previous studies, this study tries to discuss the significance of the qualitative GIS approach using tsunami evacuation behavior. The purpose of this study is to clarify the true meaning of selecting evacuation sites by individuals. This study uses the "Digital Archiving of the Great East Japan Earthquake Survey." In this data, origin and destination of evacuees are created as the point feature, and the routes are represented as the line feature.

2. Methodology

The introduction of qualitative GIS to geographical phenomena is challenging. This is because there are significant discrepancies between the objective knowledge represented by visual images generated with GIS technologies and the people's partial and surrounding knowledge. The careful comparison of these two types of knowledge is useful to overcome this problem. Regarding the technical method of integrating quantitative and qualitative analysis using GIS, the qualitative data according to reasons for selecting evacuation sites were stored in the attribute table of the destination displayed as spatial objects. As a target area, Ishinomaki city, Miyagi prefecture, was selected in this study. Most of the data in the survey were collected in Ishinomaki city because the urban scale is larger than other struck areas. The routes of 140 people who evacuated on foot alone in the flatland area were employed to achieve the study purpose.

3. Results

Of the subjects, 104 people responded that they recognized the evacuation site at the time of the earthquake. However, 10 people out of them moved to "higher places" that they recognized. Then, their evacuation sites were overlaid on the Digital Elevation Model to understand the meaning of "higher" objectively. As a result, 6 people evacuated to a hill; then, the average elevation was 31.0m. On the other hand, the 3 people who evacuated to school were far from the hills and lived near the central city area. Therefore, "higher" for the residents of the central area can be regarded as robust public facilities. Against all their origin was at home, and the origin of 1 person who backed to his home was a workplace. His house was located on the most inland side, and the elevation in the surrounding was less than 1m. For this reason, it was found that "higher" for him did not mean higher elevation and public buildings, but it meant the second floor of his house, which was relatively far from the sea.

Next, an attempt was made to investigate the 5 people who answered "far away" as a reason for changing the evacuation place from the one they recognized. As a result, the average distance that was actually moved of the 3 out of 5 people was 1187.3m longer than the distance to the nearest evacuation facility. This result contradicts their feeling that the evacuation facility at the earthquake was "far away." Incidentally, these 3 people were damaged at the going out. On the other hand, 2 people whose actual

moving distance was shorter than the distance to the nearest evacuation facility, were damaged at their homes. Thus, the meaning of "Far" for them was the distance that was recognized from their homes. Therefore, it is considered that the accuracy of their cognition of distance was more accurate. Through these two cases, it is considered that their true evacuation site-selection is not "higher" or "closer," but is more closely related to the meaning that the home has. In particular, it is thought that the meaning that "my home gives a sense of security" caused the false cognition of "higher (i.e., safety)" and "closer (i.e., convenience)."

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