GEOGRAPHICAL FEATURES OF LANDSLIDES IN THE KOBE GROUP USING GRASS GIS

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ABSTRACT

Landslides in Japan are generally divided into three types, Tertiary landslides, fracture zone landslides and hydrothermal zone landslides. In the recent years, researchers study geographical features of these landslides using GIS (Geographic information system), and clarify the relationships between landslides in different areas, and geological and geographical features. The geographical features are performed similarly to the landslide area of the tertiary landslide in the Kobe group.

In this research, we inputted a new geological map with more details into GRASS-GIS-DATABASE and we performed detailed geographical features in this area, to clarify the relationship between the landslide geographical feature and the geology of Kobe group based on new geological map. This new GRASS-GIS-DATABASE is the basic data, which create more detailed hazard map in the future.

1. INTRODUCTION

In the recent years, with the wide distribution of many digital data and the improved performance of personal computers, analysis using GIS is performed in various fields. Also in the field landslide hazard, research using GIS is done by many researchers and many results are obtained. From that result, Landslide hazard mapping has been extensively investigated utilizing GIS-based techniques (e.g. Yokota, 1995; Rahavan *et al*., 1995; Fujita *et al*., 2001). In this research field, Fujita (1984, 1987, 1995 and 2000) studied geographical features of landslide using GIS and applied calculations for landslide generating danger.

In this research, the geological data of GRASS-GIS-DATABASE, which were created by Fujita et al. (2000), were changed into more detailed data. After that, re-classification was performed again using geographical feature data and landslide data. Based on this database built newly, geographical features of landslide were analyzed again. In this paper, those results are introduced.

2 GEOLOGY AND GEOMOROPHOROGY

The studied area is named Sanda Basin. Sand Basin is located in the northern part of Rokko Mountain. Paleogene Kobe Group is widely distributed all over the studied area.

These Paleogene Kobe Group sediments are well known as a landslide zone in southeastern Japan, because of frequent occurrence of landslides in this area (see Fig.1). In Fig.2 the distribution of the geological data and landslide configuration are shown, for the studied area using basic data made for the object of this research. The Sanda basin is surrounded by a mountainous land compared with the western side. The mountain ridge is 300-150, the average slope is 10 to 15 degree and the relief is about 30 to 50 m. Almost all areas appeared as a mountainous land or hilly areas of small relief.

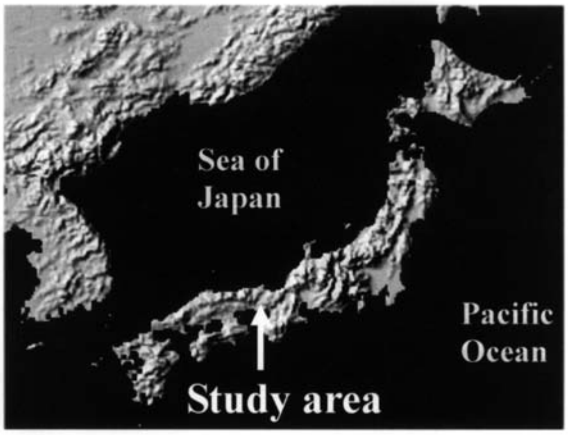


Figure 1. Location Map of the Sanda

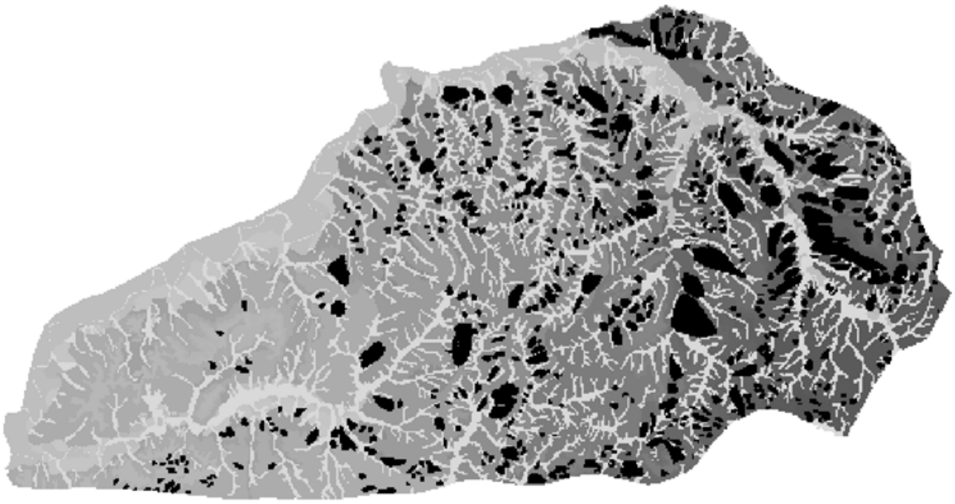


Figure 2. The Distribution of Geology and Landslides in the Research Area

The Paleogene Kobe Group consists of mudstone, sandstone, and conglomerate of lacustrine origin. The area is characterized by numerous tuff beds found in various horizons. The Tuff beds are useful as key beds in clarifying the Stratigraphy and structure. According to previous work, the Kobe group in the Sanda Basin is divided in the ascending order into Arino, Yokawa and Ogo Formations (see Table1).

In Fig.3 relationships between relief, slope, and dip direction and landslides occurrence were drawn. The general trend for these data is showing the form of the same geographical feature as the Sanda Basin. Landslide configuration features of this area form the loose slope of 15 or less degrees about the dip. These Landslide configuration features are 100m. to 300m. in length and 50m. to 100m. wide, which are considered as not high relief. However, the slump block of a small landslide may be compounded and generated and may seem to form the big change object as a whole.

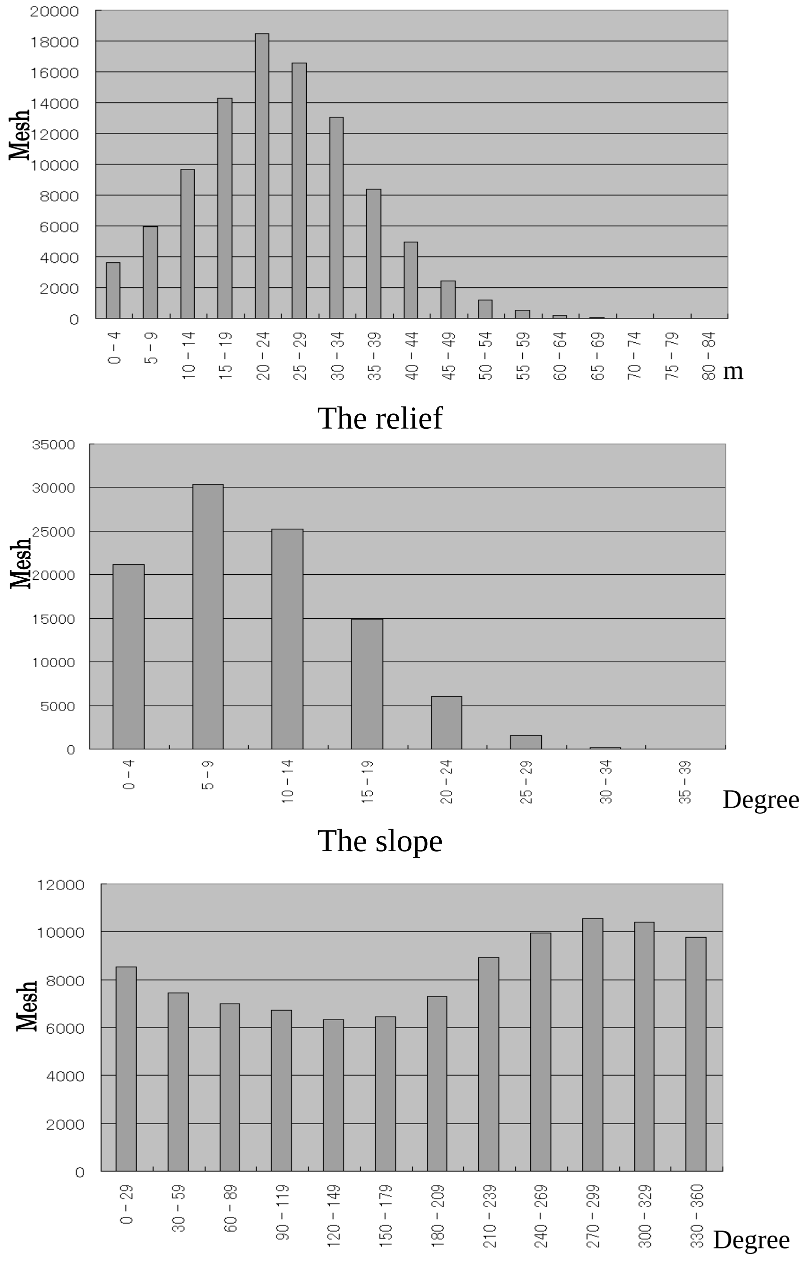


Figure 3. Relief, Slope and Dip Direction in Sanda basin

3 GEOGRAPHICAL FEATURES OF LANDSLIDES USING GRASS

The basic data used in the analysis by GRASS are as follows.

(1) Geographical feature data

Geographical feature data were changed into 30m meshes for aster data based on Geographical Survey Institute issue 50m mesh data.

(2)Landslide geographical feature distribution map

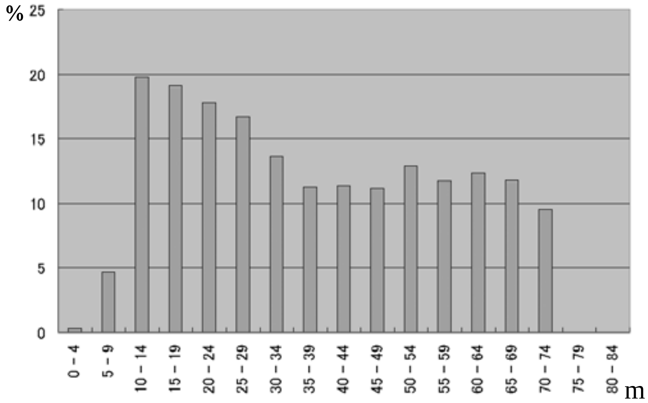
The landslide geographical feature distribution map took in what made the subject the conventional data written in 1/10000 topographical map, and gathered them in 1/25000 topographical map.

(3)Geological data

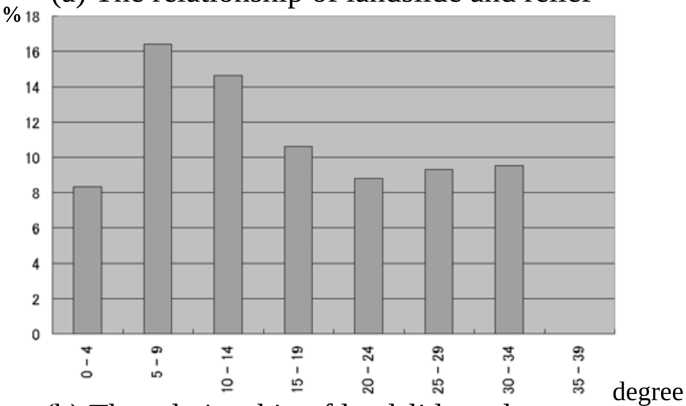
Geological data created based on the data created by Kinki Regional Agricultural Administration Office and Akiyama *et al*.(2004). Fig. 4 is the result of performing data processing using the data mentioned above. The figure shows the content of the landslide configuration over the relief, the aspect, the dip direction, and geological data from the top. Tab.1 shows stratigraphy and its correspondence number of geological data.

Table 1. The stratigraphy and its correspondence number of geology data.

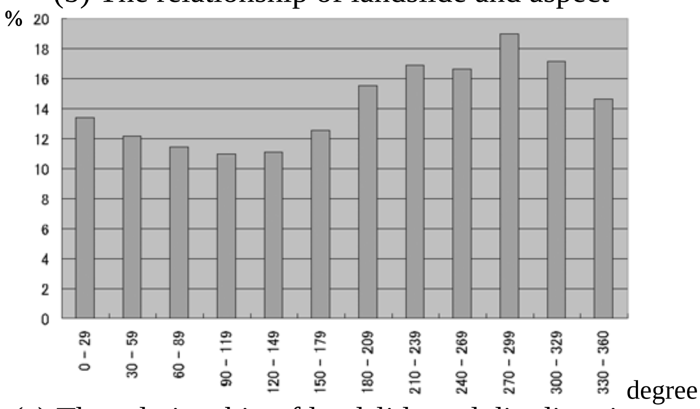
Stratigraphy				Number
Alluvium				21
Fan deposits				20
T_3 terrace deposits				19
T_2 terrace deposits				18
T_1 terrace deposits				17
Osaka group				16
Kobe group	Ogo formation	Lower	Ishikamiyama tuff member	15
			Nkazato sandstone and mudstone member	14
			Hasuikedera tuff member	13
			Mizuho sandstone and mudstone member	12
			Okutani tuff member	11
			Yutani conglomerate and sandstone member	10
	Yokawa formation	Upper	Kitahata tuff member	9
			Bisyamon conglomerate and sandstone member	8
			Ichihara tuff member	7
			Hisaihara conglomerate and sandstone member	6
		Lower	Toyooka tuff member	5
			Tenguiwa conglomerate and sandstone member	4
			Nakaoosawa tuff member	3
			Kamioosawa sandstone and mudstone member	2
	Arino formation	Upper	Taki tuff member	1



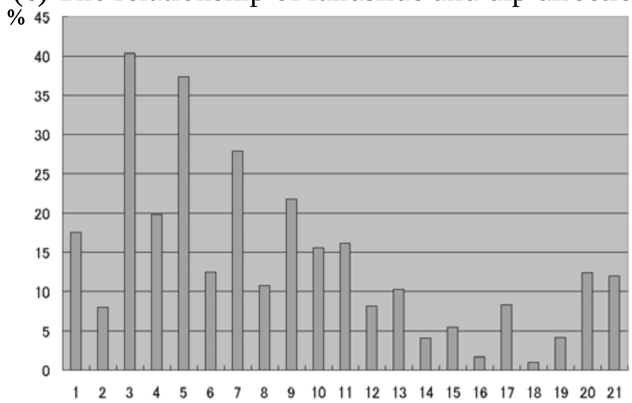
(a) The relationship of landslide and relief



(b) The relationship of landslide and aspect



(c) The relationship of landslide and dip direction



(d) The relationship of landslide and distribution of geology

Figure 4. Relation between a landslide, and relief, aspect dip direction and distribution of geology

4 CONCLUSIONS AND FUTURE WORK

From these results, we can know as follows where many landslides are.

(1) The relief is 5 to 14 m.

(2) The slope is 5 to 14 degree.

(3) The dip direction is west.

(4) Geological tuff beds, especially those exist in the lower part of Yokawa formation characterized by frequent occurrence of landslides compared with the tuff beds exist in the upper part of the same formation.

These results show high agreement with the result shown by Fujita *et al*. (2000) globally. However, we could predict the frequent occurrence for future landslides in the Lower parts of tuff beds by using detailed new geological data. In the future, analysis will be performed using GRASS-GIS-DATABASE, which created newly.

5 REFERENCES

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