Title

Discussion on the Surface Soil Behavior of Landslides in Keelung Area

1. Abstract

Sampling the topsoil at the locations where landslides occurred in Keelung City, compared the topsoils of different slope directions in the school, to understand the characteristics of the soils that have occurred in the past landslides. The surface soil of the landslide site is mostly coarse-grained sandstone, mostly facing the northeast, and the strata under the surface are mostly sedimentary rocks. The time of landslides is mostly winter to spring, which is the rainy season in Keelung City. Accroding to the spectrum of the sampled soil images, it is found that the surface soil in this area usually absorbs more long waves. Traditionally, precipitation is used to monitor where landslides may occur. If monitoring of surface soil can be added, the chances of preventing landslides can also be improved.

2. Research Questions

a. Select the land planned in the Keelung urban area as a potential area for landslides or debris flow, and conduct sampling on sunny days and discuss their geological similarities and differences.

b. Analyze the basic characteristics of topsoil using the soil sample analysis method of the Geological Research Institute and GLOBE.

c. Compare the samples with the spectral data of satellite data at different times, and compare the wavelengths of the spectrum taken from the image with the actual spectrum taken on the surface.

3. Introduction and Review of Literature

Soil, sand, gravel and other materials are mixed with water, mainly due to gravity, supplemented by water flow, and carried out in a flowing way (2005, Water and Soil Conservation Handbook). Landslides occur due to gravity, coupled with the reduction of friction between soil bodies. Where the two are the same, a certain degree of slope and loose soil and rock are required at higher elevations. The infiltration of precipitation can make the mechanism of the two or even the same. This study focuses on the similarities between the two and discusses the characteristics of the surface soil here, and discusses whether the conditions for landslides can be understood from the photography of the above image.

Regarding the characteristics of the top soil, the following are summarized:

a. Soil pH (pH value): affects the nutrition and growth of plants through the solubility of mineral salts and the activities of soil microorganisms. When the soil pH is 5.5 to 7.5, it is very suitable for the growth of most plants.

b. soil color :Soil color is an important physical property for identifying soil, judging soil properties, constituent substances, and forming processes.

c. weather: No matter what kind of landslide, it usually experiences a lot of precipitation before it occurs, which is often used as a basis for judging the occurrence of a disaster.

d. Slop: Since most of the soil and rock flows in China occur on mountain slopes and valleys when heavy rains occur, it is more clear that the soil and rock flows in Taiwan are ``occurring on steep valleys or slopes, and the loosening of collapsed soil or weathered gravel and rock fragments. The soil layer loses its original stability due to the surface runoff caused by heavy rain or the rise of the groundwater level of the soil layer. High-concentration soil and gravel flow along the natural slope under the action of gravity with the flood.” (Zhan Qian Den, 2000)

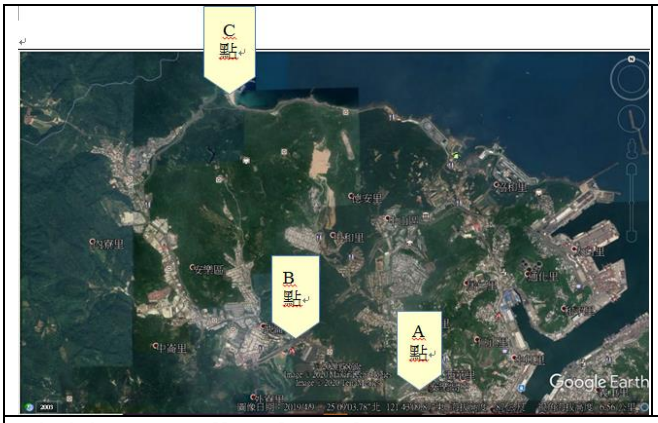
e. Water content: At present, in Japan, the Soil Water Index (SWI) is used as a long-term indicator to represent the moisture content in the soil. The current warning method of the Taiwan Water and Soil Conservation Bureau is to refer to the effective accumulated rainfall added to the previous rainfall.

Based on the above research data, it can be known that the conditions of the collapse may be related to the soil conditions with higher slope height and the geological conditions below which may allow precipitation to infiltrate and increase the chance of collapse. It is hoped that through the observation and image characteristics of vegetation on the topsoil or soil, we can understand whether aerial photographs or satellites can be used to improve the chances of preventing avalanches.

4. Research Methods

a. SAMPLING LOCATION

A、B、C have been a landslide. D、E、F No landslides have occurred, as shown in Figure (1)



Fig(1) **Sampling location**

a. Tables and graphics applying statistical analysis of data to show mean, dispersion, or grouping data.

b. Experimental Equipment

(1) On the wild field.

Gloves, shovel, inclinometer, thermometer, barometer, zipper bag, pen as shown in figure (2)

figure(2) Research tools

figure(3) Research tools

(2)In the lab

Petri dishes*6, Erlenmeyer flasks*6, droppers, glass rods, measuring cylinders, pH meters, black cloths, electronic scales, desk lamps, spectrometer , Cellphone as shown in figure (3)

c. Research Process

5. Research Results

a. What kind of weather conditions will cause a landslides event to occur

We want to know what weather factors cause landslides. We next did some related experiments. As shown in table (1)

site	國3南下3.1k	基隆市基金一路25號	南榮路和南新街路口旁	基金一路106號	B(國揚)基金一路106號	南榮路八堵隧道上方
date	2011/4/25	2015/3/24	2016/10/10	2016/10/10	2011/2/21	2019/12/21
temperature (°c)	23.6	14.6	23.4	24.1	15.4	20.7
wind direction	360	60	20	30	10	190
Air pressure	1009.6	1025	1008.7	1008.7	1016.8	1013.1
Wind speed	3.6	5.7	4.3	4.7	5.7	0.3
Precipitation/ precipitation hours Before the rain after the rain	0/1	0.6/1	5/1	0.3/1	0/1	0/1
	18.5	113.7	468.6	492.4	142.4	87
	2.1	121.7	235.5	220.8	15.8	1.5
Collapse time	14：29	20:35	11:30	23:00	night	12:34

site	華新一路147巷一處產業道路	武崙國中後山	C外木山	源遠路	崇法街	派出所
date	2011/10/1	2010/9/24	2020/5/23	2019/11/22	2019/11/28	2017.12.4
temperature (°c)	25.2	24.1	23	20.9	18.7	19.9
wind direction	40	40	20	280	10	310
Air pressure	1010.4	1008.4	1001.3	1011.7	1020	1014.8
Wind speed	6.1	2	3.5	2.4	9.8	2.0
Precipitation/ precipitation hours Before the rain after the rain	0/1	69/1	6/1	6.5/1	0.2/1	0/1
	57.7	271.4	242	162.5	150.3	73.5
	343.1	342.5	174.7	32	11.7	50.5
Collapse time		4:00	5:00			AM4:00

Figure (4) The landslide in Keelung City

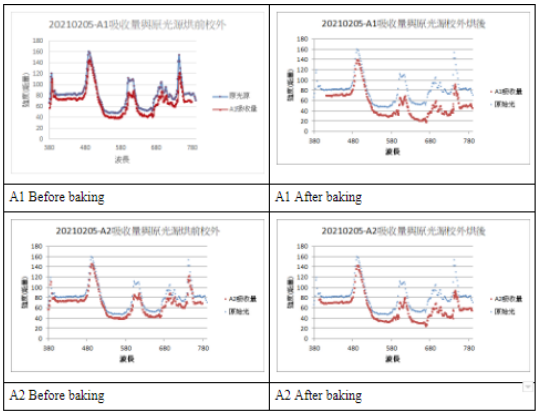
Table(1)

site	A1	A2	B1	B2	C1	C2
date	2/5 8:10	2/5 8:15	2/5 8:34	2/5 8:37	2/5 9:02	2/5 9:05
spectrum						
energy						
temperature (°c)	22.6	22.4	21.3	19.6	23.3	25.4
humidity(%)	68.2	63.8	72.9	79.2	68	56
Air pressure	1013	1012	1011	1009	1018	1018
Soil color(before)						
Soil color(after)						
pH value	5.2	4.7	5.6	4.6	6.4	6.1

site	D1	D2	E1	E2	F1	F2
date	2/5 10:21	2/5 10:25	2/5 10:09	2/5 10:14	2/5 10:29	2/5 10:31
spectrum						
energy						
temperature (°c)	23.5	24.3	23.6	23.6	24	24.3
humidity(%)	60.6	56.4	58.2	59	58	56
Air pressure	1013	1013	1009	1009	1011	1012
Soil color(before)						
Soil color(after)						
pH value	6.7	6.9	6.1	6.8	6.8	6.8

b. Changes in reflectance spectrum of collapsed ground outside school

From these pictures, it can be seen that the partial absorption of the long-wave spectrum after the baking soil is reduced, In the picture, the horizontal axis is the wavelength, the vertical axis is the energy, the blue line is the original light, and the red line is the soil absorbed light. as shown in Figure (5)



A1 Before baking | A1 After baking

A2 Before baking | A2 After baking

Fig(5)

c.NDVI(Normalized Difference Vegetation Index)

The red light and near-infrared light are converted into various vegetation indexes to monitor the ground vegetation. Its method of monitoring the temporal and spatial changes of vegetation biophysical characteristics is the most widely used vegetation identification and migration change. Therefore, we use this method to look at the four sentinel images of 20190131, 20190312, 20191117, and 20191217, and do the analysis of the changes in the images before and after.

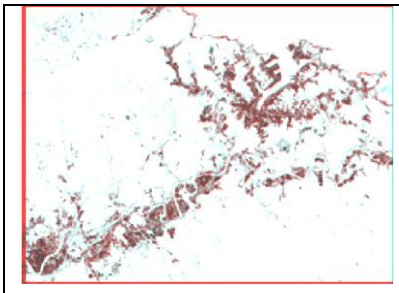
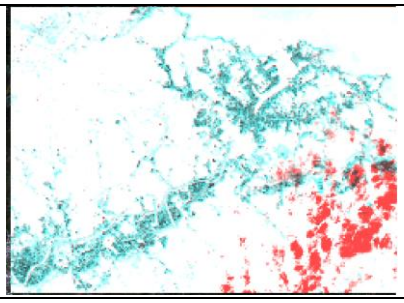
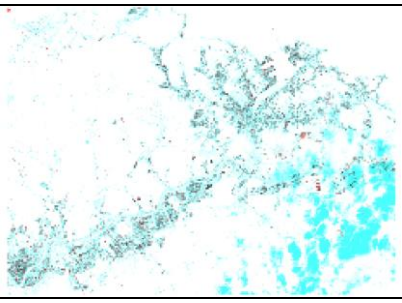
		

Figure (6), 20190131 and 20190312NDVI add up.	**Figure (7),** 20190312 and 20191117NDVI add up.	**Figure (8),** 20191117 and 20191217NDVI add up.

6. Conclusion

a. Collapse events in Keelung City mostly occur during or shortly after precipitation. The wind direction is mostly northwest to northeast wind, and the time is mostly from winter to spring. The grains of the soil layer on the collapsed ground outside the school feel coarse to the touch.

b. The water content of the soil before and after the drying is not significantly reduced, and the long-wave band of reflected light is less absorbed after the drying, especially at the location of the Anyi Road police station (A2). The difference in absorption of the topsoil before and after drying on the slopes in the school is small, and two places are more viscous to the touch.

c. The NDVI obtained by using satellite spectral calculations can also be used as one of the conditions for judging collapsed land by the growth and decline of vegetation. If the reflected light can be added to see the characteristics of the surface soil spectrum, I believe that the grasp of the collapsed land can be more accurate.

7. Bibliography / Citation

a.詹錢登(2000)，土石流概論

b. GLOBE soil protocal