UNMANNED AERIAL VEHICLE: GEOMORPHOLOGY STUDY

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This research aims to comparedata of Geomorphology from Unmanned Aerial Vehicle and field trips. The data for comparison focuses on landform sinkhole, cliffs and walls. This study used Unmanned Aerial Vehicle, Arc GIS and field trip equipment and used statistic and description for analysis

Landform such as length, width, height, the depth of the holes, area, density and its fragmentation. Photos which were taken from this unmanned aerial vehicle were used setting a studying points. From measuring and comparing the samples in the same point can find that a dislocation of two methods is not over 2 percentages. The precision and reliability are about 98 percentages but the depth of the hole sometime found that it has fragmentation as cannot collect the data and have to go to the field and use this unmanned aerial vehicle side by side.

This article suggested the way to collect the field's information and to use an unmanned aerial vehicle by the comparative method. This is the way to save time and money in the study.

Keywords: Unmanned aerial vehicle, Geomorphology, Landform

Introduction

Geomorphology is an area of geology that study about landforms, their process that have created them and development including their change. There are five factors for understanding landforms i.e.

1. Landforms – It consists of shape, size, topography, slope, surface of landforms, the height above sea level and landforms height.
2. Sediments structure or the type of bed rock of landforms – there are the key factors that control the evolution of topography and landforms.
3. Any process that shapes landforms – it explains that how landforms have be shaped, what the components to create landforms are.
4. Components of landforms – to explain the components of both parent materials and bed rock. Though, landforms have the same components yet, when in a different environment durability may not equal.
5. Period of time to shape and destroy landforms are the real factors that can reveal the exactly age of land or compare ageing of serial landforms.

In addition, data from filed trips are always used for understanding geomorphology including data from GIS especially data from remote sensing. There are many high-resolution satellite imageries service for international while Thailand has the THEOS satellite to explore natural resources. THEOS can Panchromatic and multispectral imagery yet satellite images and aerial photography are limited. Professional technicians and budgets are required. However, the quality of aerial photography is not meet the users' goals.

Therefore, unmanned aerial vehicle is a new and significance tool for studying landforms. It can controlsmall aerial vehicle via radio wave from remote area to produce an aerial photography. The operation cost of the unmanned aerial vehicle is low prices and period of time to produce outputs is short length and operation is comfortable, save time and cost of study. Users can use data from unmanned aerial vehicle to understand sub landforms (width, length, height, density and physical condition of area' study). The data of landforms from unmanned aerial vehicle are quite accurate and reliable.

Study area

Area of study is located in Badlands geomorphology at Lalu which was created by runoff. This area has 63 rai at Tubraj subdistrict, Tapraya district, Sakaew province.

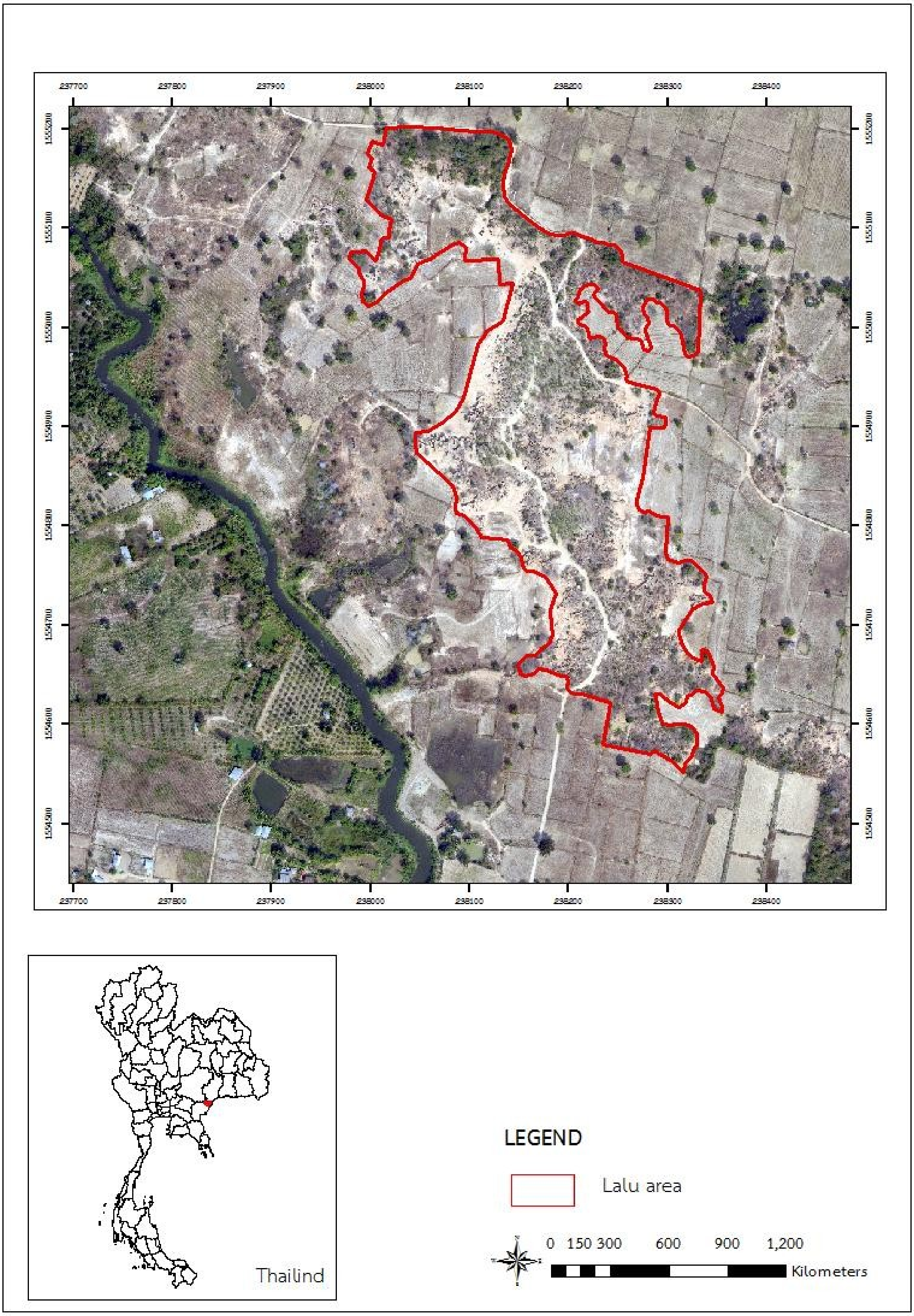

Figure1 Site of study

Methodology

This research aims to compare data of landforms from two different type of tools between unmanned aerial vehicle and field trips.This research compare data of landforms in three categories are sinkholes, soil cliffs and soil walls. Lalu area were divided into a grid area 20x20 meters. Each categories of landforms is selected for 30 cases with simple random method.

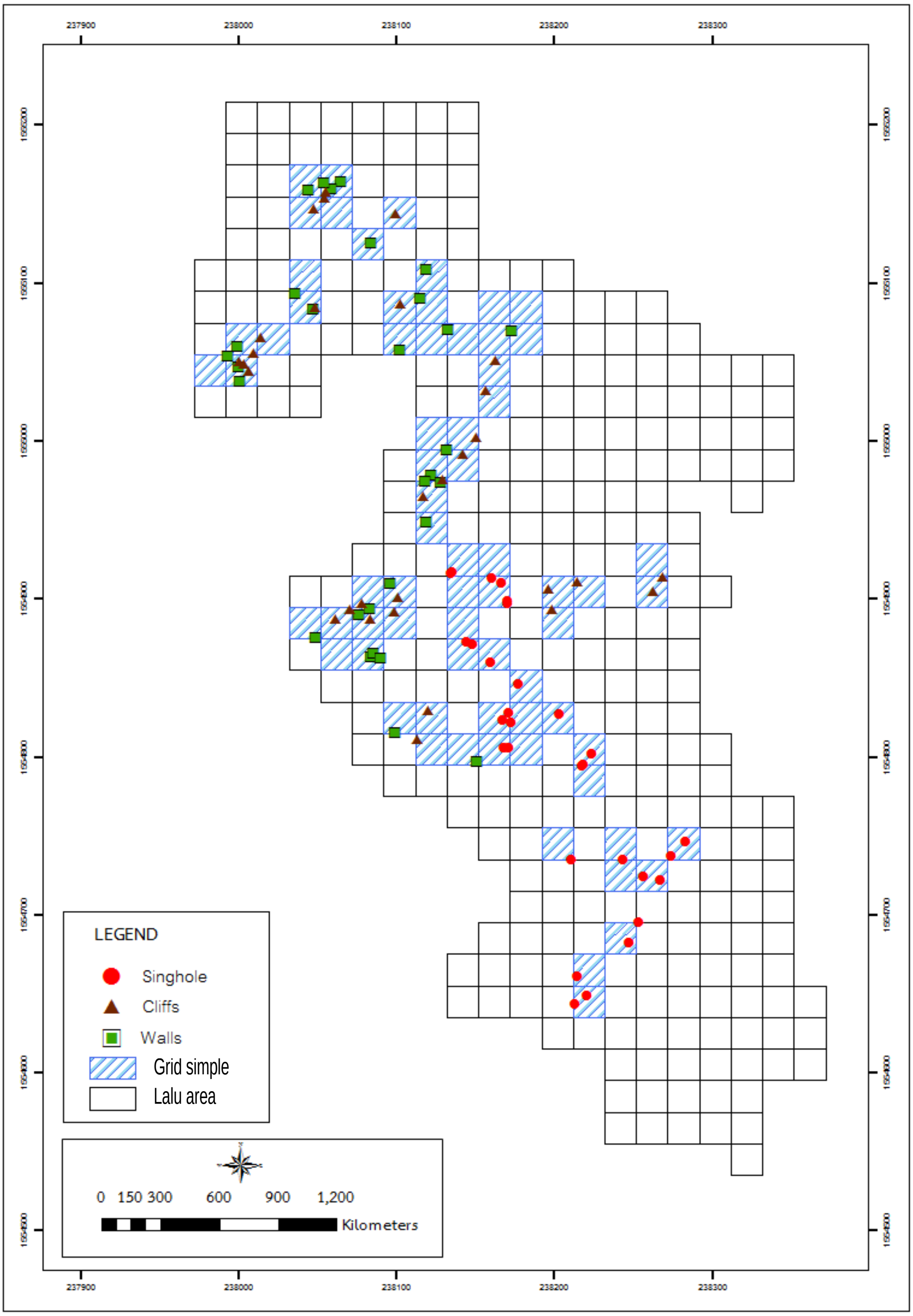

Figure2 Sampling size

1. Procedure

1.1 Data (adapted deviation) from UAV (5.4 centimeters) were used to size of landform via Arc GIS program.

1.2 Badlands formations at Lalu consist of

1.2.1 Sinkholes sinkholes form were analyzed by density, formation process, figure and form, wall shape and surrounding of sinkholes. The number of sinkholes for 1 square meters were count for find density of sinkholes.To determine the sinkhole's size, the height and length of sinkholes were measured. The width of sinkholes were measured from the edge of the long side at least one side to the other side of the border. The length of sinkholes were measured from the edge of the longest side to the other side of the border. While the depth of sinkholes were measured from the deepest point of sinkhole on the top edge.

1.2.2 Soil cliffs this landform were examined by size, formation process, inclination of cliffs, surface of soil cliffs, basement shape of cliffs i.e. holes, type and size of sediments at the front of the basement and scale of slope. To determine the cliff's size, the width and length of cliffs were studied. The width of the soil cliffs measured by the thickness of the clay cliffs at the edge of the cliff. The length of the soil cliffs measured from the rim of the soil cliffs on both sides. The height of the soil cliffs measured from the base of the cliff to the top of the soil cliffs.

1.2.3 Soil walls, factors that determine soil walls are as same as soil cliffs. Size of soil wall were measured with width, length and height. The thickness of the walls of the end of the wall were measured to determine the width of the walls. The length of the wall measuring from the rim fromone end of the wall to the other end. The height measured from the base to the top of thewalls.

2. Analyzing data by statistic and description

Results

From study found that

1. Sinkholes are the first landform of Badlands formation process. Most of sinkholes scatter at the East of Lalu while some of them are located at the North East and the North of Lalu. The highest location which found sinkholes are 130 meters from sea level, while the lowest location which found sinkholes are 124 meters from sea level and average of sinkholes are 127.43 meters. This landform are determined from size, formation, figure and shape and surrounding around sinkholes.

Size of sinkholes – Due to the area of study has an abundance of plants; therefore, sampling size could be selected only 15 cases from 30 cases. When UAV data compared to field research trips is accurate. Size of sinkholes were measured by UAV found that the width and the length have less than 10 percent deviation as in figure 3 and figure 4.

Sampling points	UTM	Height (Meter)		Error (%)	Length (Meter)		Error (%)
		UAV	field trip		UAV	field trip	
1	238141E/1554915N	2.66	2.87	-7.31	3.72	3.77	-1.32
2	238138E/1554913N	2.76	2.82	-2.12	3.02	3.00	0.66
3	238127E/1554794N	1.87	1.87	-	2.31	2.44	-5.32
4	238218E/1554795N	2.44	2.64	-7.57	3.53	3.55	-0.56
5	238150E/1554850N	1.85	2.00	-7.50	2.03	2.11	-3.79
6	238161E/1554913N	1.00	1.10	-10.9	1.00	1.11	-0.92
7	238168E/1554911N	1.14	1.22	-9.09	1.54	1.59	-3.14
8	238172E/1554901N	1.50	1.57	-4.45	1.50	1.66	-9.64
9	238173E/1554899N	1.41	1.56	-9.61	1.72	1.86	-7.52
10	238173E/1554827N	3.20	3.36	-4.76	6.49	7.01	-7.41
11	238171E/1554820N	3.00	2.90	3.34	3.43	3.58	-4.18
12	238168E/1554817N	2.51	2.60	-3.46	3.90	3.94	-1.01
13	238162E/1554815N	2.88	2.67	7.86	3.67	3.82	-3.92
14	238167E/1554809N	3.01	3.12	-3.52	5.32	5.55	-4.14
15	238167E/1554802N	2.00	2.11	-5.21	3.00	3.03	-0.99

Figure3 Comparison table on data of sinkholes from UAV and field research trip

Figure4 Measure the size of sinkholes from UAV (left) and field research (right)

2. Soil cliffs are landforms that are created from development process of sinkholes which be eroded by rain, run off and leaching. These factors made sinkholes surface transformed to be soil cliffs that have an upper surface of cliffs connect with surrounding area. Soil cliffs are located scatter around the edge of Lalu area especially at the East, the North East and the North of Lalu. The highest soil cliff is 134 meters above sea level and the lowest soil cliff is 121 meters above sea level. The average height of soil cliff is 126.07 meters.

Size of soil cliffs – UAV only measured of 14 cases from 30 cases because of plants at that area. Only length of cliffs were measured by UAV while width and height of cliffs could not measure; therefore, data from field trips of these two parts were used. After length of cliffs were measure, length of cliffs from UAV were compared with length from field trips found that data deviation of both tools areless than 2 percent and 98 percentreliable. See figure 5 and figure 6.

Sampling points	UTM	Length (Meter)		Error (%)
		UAV	field trip	
1	238098E/1554892N	1.68	1.70	-1.17
2	238156E/1555032N	10.04	10.00	0.40
3	238098E/1554892N	1.68	1.70	-1.17
4	238101E/1554901N	10.04	10.00	0.40
5	238120E/1554829N	5.96	6.00	0.66
6	238113E/1554811N	3.00	3.00	-
7	238061E/1554887N	6.02	6.00	0.33
8	238083E/1554887N	8.16	8.20	0.48
9	238129E/1554976N	6.00	6.00	-
10	238142E/1554992N	6.95	7.00	0.71
11	238142E/1554992N	6.95	7.00	0.71
12	238150E/1555002N	7.16	7.00	2.28
13	238158E/1554824N	4.00	4.00	-
14	238268E/1554914N	7.09	7.00	1.28

Figure5 Comparison table on data of soil cliffs from UAV and field research trip

Figure 6 Measure the size of soil cliffs from UAV (left) and field research (right)

3. Soil walls are developed from soil cliffs which be eroded till split from main land into several parts at the rim of soil cliffs. While the soil cliffs at main land be separated so, soil cliffs are short and narrow. Soil walls scattered around in front of soil cliffs at Lalu area especially at the East, the North East and the North of Lalu. The highest soil wall is 130 meters above sea level.

Size of soil walls – data from UAV 15 cases and field trip found the deviation of both methods is less than 4 percent and the reliability of about 96 percent see figure 7and figure 8.

Sampling points	UTM	Length (Meter)		Error (%)
		UAV	field trip	
1	238132E/1554995N	7.00	7.00	-
2	238128E/1554974N	3.30	3.33	0.90
3	238118E/1554975N	2.00	2.00	-
4	238122E/1554979N	3.00	3.00	-
5	238085E/1554866N	4.05	4.00	1.25
6	238119E/1554949N	1.70	1.70	-
7	238102E/1555058N	3.09	3.00	3.00
8	238151E/1554797N	4.16	4.00	4.00
9	238076E/1554890N	2.04	2.00	2.00
10	238083E/1554894N	2.99	3.00	-0.33
11	238096E/1554910N	2.98	3.00	-0.66
12	238115E/0555091N	5.99	6.00	-0.16
13	238119E/1555109N	1.52	1.52	-
14	238133E/1555071N	3.02	3.00	0.66
15	238173E/1555070N	3.21	3.20	0.31

Figure7 Comparison table on data of soil walls from UAV and field research trip

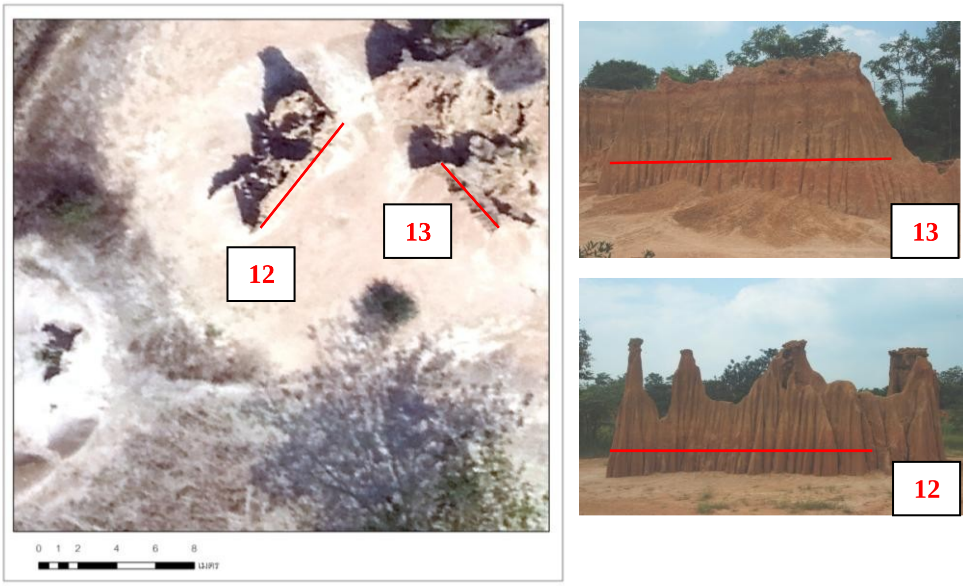

Figure 8 Measure the size of soil walls from UAV (left) and field research (right)

Conclusion

To study landform always use data from field research trip. However, today UAV is useful tools to help us for collecting data because it can save time and cost. After UAV was used to measure size of sinkholes found that the deviation is 10 percent. Nevertheless, the area of sinkholes are plenty of plants and some of sinkholes are quite small therefore, UAV cannot collect them. The deviation is 2 percent for soil cliffs and 4 percent for soil walls due to some of them are covered by trees.

Cost of using UAV is cheaper than using aircraft for producing aerial photography. UAV can shoot in the same area over different periods of time as needed. In addition, it is suitable to be used in small area which aerial photography cannot do.

Suggestions

Although UAV is a useful tool but it still has a limit for producing photo in three dimensions. UAV fit for produce photos inplains or mountains which are not much different level. If the area is at different level such as valley, the error of data will increase. Therefore, to improve the position of the Earth with satellite positioning (GPS) of that area thoroughly and accurately should be added.

The camera of UAV cannot produce accuracy photos in the area which is covered with plants or cloudy because UAV cannot reach to an Earth‘s surface, cannot get all details that want. Sensors or any kinds of storage should be improved such as infrareds camera or radar should be added for record data in the area which is covered by plants and for getting surface data which cannot produce by digital camera.

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