Land use classification and extraction of parameters related water basin using remote sensing data

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ABSTRACT

Generally, a geomorphological element is largely classified into a plateau, a alluvial fan, a natural levee, a back slough and a delta, and each element has respective characteristics of geology, travel ranges of floods and water supply feature. Land use classification, such as a paddy field, a dry field, a city area, a bare ground and a forest, are reflected by a geographical element in principle, and the land use classification is interdependent on the geographical element.

In this research, the characteristic elements of flood prone areas are extracted using the stereoscopic and visible near infrared spectra data of Terra/ASTER and visible near infrared data of LANDSAT/ETM+. The research area is the Saigon river which flows in the north of Ho Chi Minh City from northwest to southeast direction. The surface spectrum feature differs in every land use classification. The geographical feature classification technique and the index of brightness feature are examined using the ground brightness observed from the satellite.

Moreover, using the DEM data produced based on ASTER stereoscopic data, the amount of the geographical features (such as the inclinations, the relative relief, the drainage density, and the slope direction) are calculated and the basin areas are classified by the basin pattern. The geographical feature classification results are compared with those of the brightness feature classification. The parameter of water infiltration / runoff is presumed based on the brightness features and the geographical features.

The utilization of the technique to estimate the parameter of water infiltration / runoff based on remote sensing data is expected to be effective in numerical simulation and in environmental watershed management.

1. INTRODUCTION

Even though urbanization of Ho Chi Minh City is being extended recently to the outskirts, the area is prone to flood damages including inner cities and it is hindering effective improvements of city planning and infrastructure development. Flood generation in the city area and suburbs of Ho Chi Minh City is influenced by the amount of rainfall, a tide level, and the condition of rainfall in the river upstream, and the period and the extension of submerge is subject to change dependent on the geographical feature and the geology. The research area is located in upstream region of Ho Chi Minh City along Saigon river and shown as Figure 1.

Generally, a geographical element is largely classified into a plateau, a alluvial fan, a natural levee, a back slough and a delta, and each element has respective characteristics of geology, travel ranges of floods and water supply feature. Land use classification, such as a paddy field, a dry field, a city area, a bare ground and a forest, are reflected by a geographical element in principle, and the land use classification is interdependent on the geographical element. Moreover, from the viewpoint of flood control throughout the entire area, it is important to grasp the features of water infiltration and outflow of every land classification. These are applied to the river environmental analysis or the flood simulation.

Here, the result of the amount of the geographical feature features and the result of a land classification are reported as the part.

2. DATA AND METHODOLOGY

Terra/ASTER and Landsat/ETM+ data are used in this research. Terra/ASTER Level 3 data (radiance with relative DEM) are used to extract the land use classification and geomorphological parameters. Terra/ASTER level 3 data consist of geo-corrected radiance and DEM data. Those spatial resolution are 15m as VNIR, 30m as SWIR, 90m as TIR and each DEM. The acquired date of Terra/ASTER and Landsat/ETM+ data are 13 February 2002 and 23 July 2002 respectively. Both sensors have middle – high spatial resolution and multiband of visible – thermal infrared wavelength region, and low time resolution.

The geomorphological parameters (inclination and slop aspect) and stream order are calculated using DEM data created as 15m spatial resolution from ASTER stereoscopic image. The land use classified by maximum-likelihood method using ASTER band 1 -9 data.

The classification categories are decided from perspective that a category have the same characteristics of runoff and load generation (Park et al., 2003). The categories are shown in Table 1.

Table 1. Land use classification categories.

Classification	Detailed Land Use
Mountain area	Forest, Bare soil area
Paddy Field	Paddy Field
Dry Field	Vegetable Field, Fruit farm
Urban area	Building, Road
Water area	Lake, River, (Sea, shore)

3. GEOMORPHIC PROCESSING

The DEM map, inclination map and slop aspect map using DEM analysis are shown in Figure 2, 3, 4, 8, 9 and 10. In this area the inclination is less than 15 degrees aporoximaetry. The distribution of inclination will be used the runoff analysis of surface and streams. The slop aspect distribution have no clear trend and are using with classification of land use. The flow path distribution map are shown in Figure 6 and 12. This results are include some wrong path by comparison to the false color images, and should be modified by interpretation result using false color images.

4. LAND USE CLASSIFICATION

The result of land use classification at A nad B area is shown in Figure 7 and 13. In this results there are some wrong classification along the river. Reconsideration of a setup of teacher area for the accuracy of a classification is made. Using these classification results, the rate of osmosis is set up to each category, and it uses for formation of an outflow model.

5 CONCLUSION

Some results about geomorphological feature and land use classification using satellite date are shown. The satellite data have a high potential to runoff modeling. These results and other hydrological data will be examined, and construction of an runoff model and examination of the watershed environment-assessment technique will be performed.

6 REFERENCES

Park, J., Kojiri, T. and Tomosugi, K. 2003. Development of GIS Based Distributed Runnoff Model for Basin Wide Environment Assessment, *J. Japan Soc. Hydrology. & Water Resource.* vol. 16, No.5 pp.541-555.

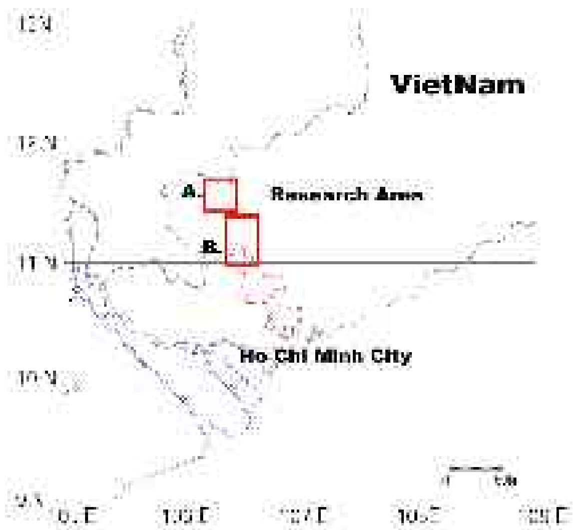

Figure 1. Location map.

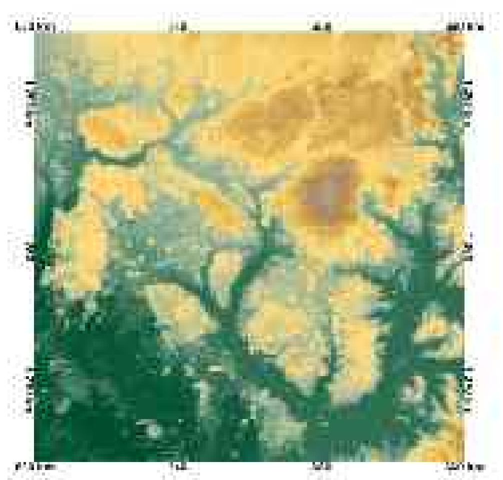

Figure 2. Graduated coloring DEM image at A area. (Green:Low - Brown:High)

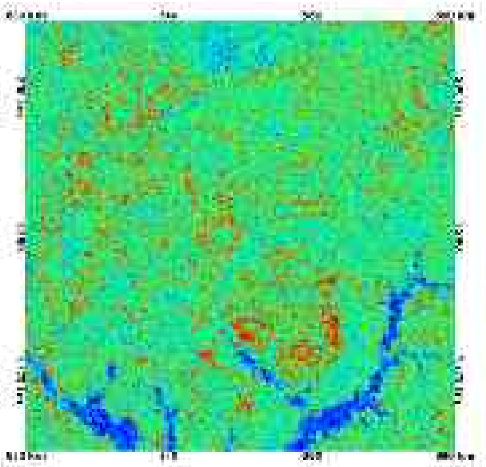

Figure 3. Color image of inclination at A area. (Blue:0 - Red:45 deg.)

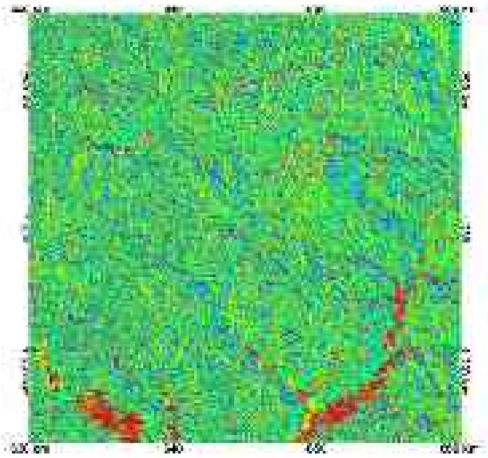

Figure 4. Color image of aspect at A area. (Blue: 0- Red: 360 deg., 0:North clockwise)

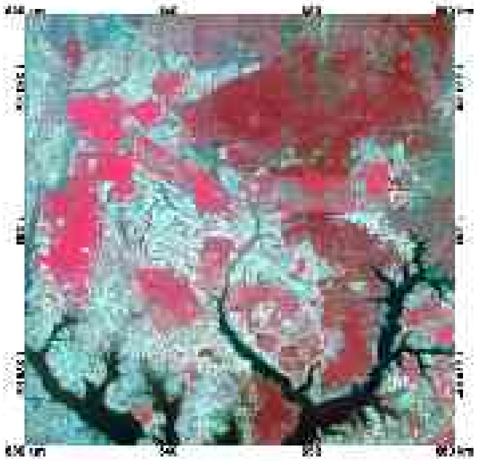

Figure 5. False color image at A area. (RGB=ASTER band3,2,1)

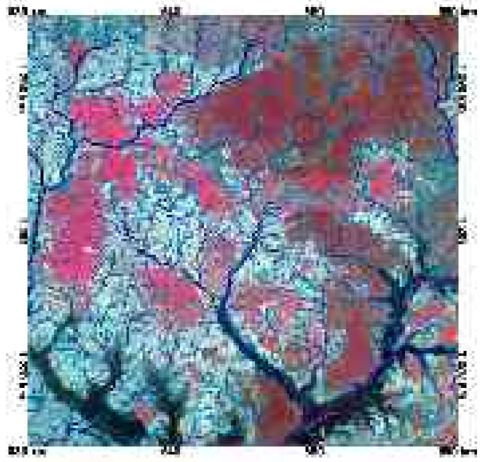

Figure 6. Flow path and stream order at A area.

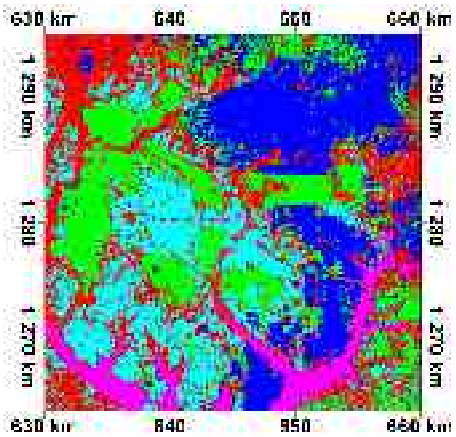

Figure 7. Classification map at A area. (Pink:water, Blue:mountain, Green:paddy field, Cyan: dry field:)

Figure 8. Graduated coloring DEM image at B area. (Green:Low - Brown:High)

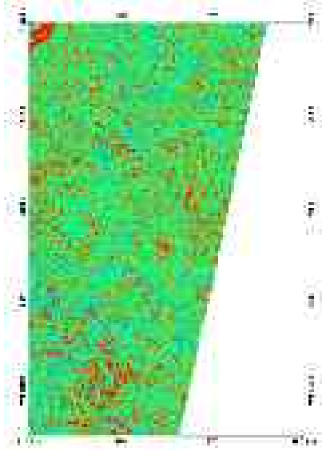

Figure 9. Color image of inclination at B area. (Blue:0 - Red:45 deg.)

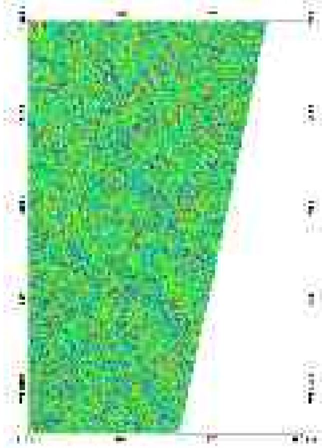

Figure 10. Color image of aspect at B area. (Blue: 0- Red: 360 deg., 0:North clockwise)

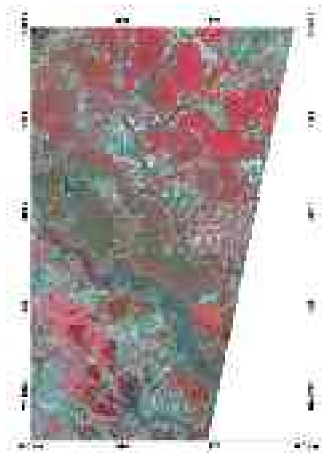

Figure 11. False color image at B area.

(RGB=ASTER band3,2,1)

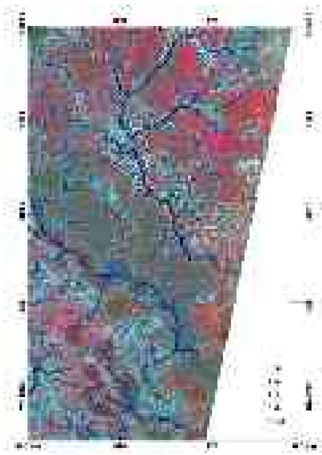

Figure 12. Flow path and stream order at B area.

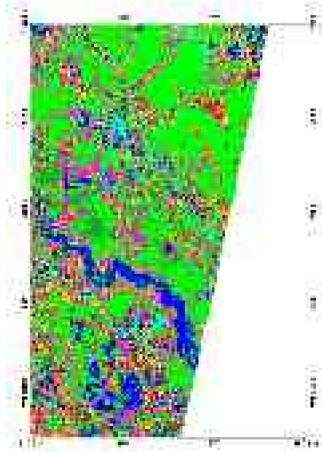

Figure 13. Classification map at B area. (Blue:water, Green:mountain, Cyan:paddy Field, Pink:, dry field:)