PHYSICAL CONCEPT APPLIED TO SPACE OBSERVATION BY LANDASAT 7 TM

Submited on 12/05/2014 – Accepted on 24/03/2015

Abstract

Physical concept has been applied to space observation by using images and data of LANDASAT 7 in order to to extract quantitative information about the studied areas facilitate . The final product should respect a norm in presenting a list of physical indicators or minimal reference classes.

Keywords: *Colored composition, image processing, LANDSAT 7 TM, physical concept*.

C TOUMIAT
M BOUAFIA

National Institute of optical and mechanical precision, Setif, Algeria.

I. INTRODUCTION

The objective of satellite image processing is to extract the maximum of information which interests the future image user, and to evacuate all superfluous ones, which is the objective of this work; applying on LANDSAT7 TM data on the region of Setif.

The used data is obtained from LANDSAT 7 TM (tab.1) in which the diversity of channels .provides the interpretation with a multitude of information to manipulate (7 spectral bands). The used image was taken on the 9th of August 2010. The month of August corresponds to the period where vegetation is developed, and where the structure of sole influences lots of vegetation.

We have studied two LANDSAT 7 TM scenes situated in the North-East of Algeria containing North Setif. Both images were acquired with level 1 pretreatment corresponding to a radiometric correction of defects due to variations in sensitivity between detectors, and a geometric correction of intern distortions due to shooting conditions: Variation of satellite altitude, panoramic effect, earth curvature and rotation, etc… These images are georeferenced through UTM 31 N, WGS8. A LANDSAT 7 TM scene covers a large region (185km×185km) hence it is necessary to make extracts or windows for each studied region.

II. METHOTODOLOGY AND RESULTS

In fact, due to shooting conditions (atmospheric thickness, vision angle, shooting hour, meteorological condition…) and despite the normalization of satellite images (radiometric and geometric correction). Two images obtained from the same sensor and recorded at the same geographic area are never completely identical. Also, treatment methodologies should be adapted and are hence sensitively different.

However, the final product should respect a norm in presenting a list of physical indicators or minimal reference classes because the later will be taken into account for the analysis of environment evolution. [1]. The table I summarizes the characteristics of used data [2] [3].

TABLE I: DATA CHARACTERISTICS [2] [3]

Type	1st scene Orthorectified image LANDSAT 7 TM	2nd scene Orthorectified image LANDSAT 7 TM
Date of acquisition	09/08/2010	25/08/2010
Path/Row	4°24'0.68''E, 37°0'4.10''N	4°0'26.54''E, 35°34'8.47''N
Number of channels	3 (TM4, TM3, TM1)	3 (TM4, TM3, TM1)
Size of pixel (in meter)	30	30
Projection system	UTM, WGS-84 (zone 31)	UTM, WGS-84 (zone 31)

The TM radiometer aboard the LANDSAT 7 satellite provides coded data transmitted in a digital form, and organized in columns and lines. This data constitutes a matrix which can be restored in the form of images [4].

The digital image is characterized by descriptor producing the necessary orientations of treatments [5].

In order to obtain a visible restitution to these digital values, we turned to the realisation of a colored composition. It results from the colored additive synthesis between three colors.

The bands 1, 3 and 4 were chosen to form the colored composition 4-3-1 allowing for an easier study of lineaments because they demonstrate clearly the shadows.

The figure 1 represents the colored infrared composition of the 1st scene where we distinguish between images (figure 1, a) concerning TM4, TM3, and TM1 and figure 1, b which gives the superposition of three bands. The result is demonstrated in figure 1, c.

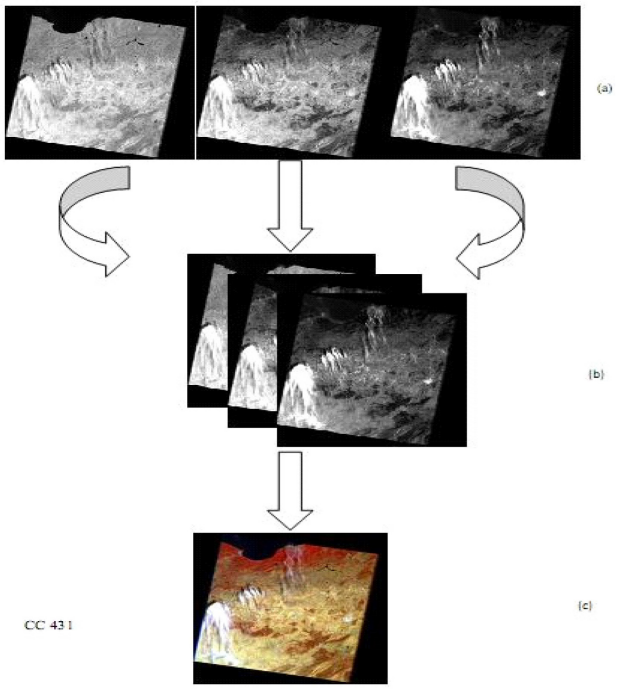


Fig. 1. The colored composition,infrared color.

After realization and display of images and colored compositions through ENVI, the statistical analysis of data reveals diversity in the existing themes. Besides, the water surface theme which is easily demonstrated on the image, a lot of other themes present a similarity in spectral responses, which implies some confusion among these themes. This constitutes an ideal test for the proposed classification.

The different themes contained in the explored zone (figure 2) correspond nearly to different peaks perceived on the histograms. These themes are eleven in number and are defined as follows:

Theme 1 : Water surface ; Theme 2 : Cereal ; Theme 3 : Vegetable gardens ; Theme 4 : Fallow ; Theme 5 : Exposed maquis ; Theme 6 : Non exposed maquis ; Theme 7 : Urban ; Theme 8 : Sabkha ; Theme 9 : Bare soil ; Theme 10 : Clouds ; Theme 11 : Burning.

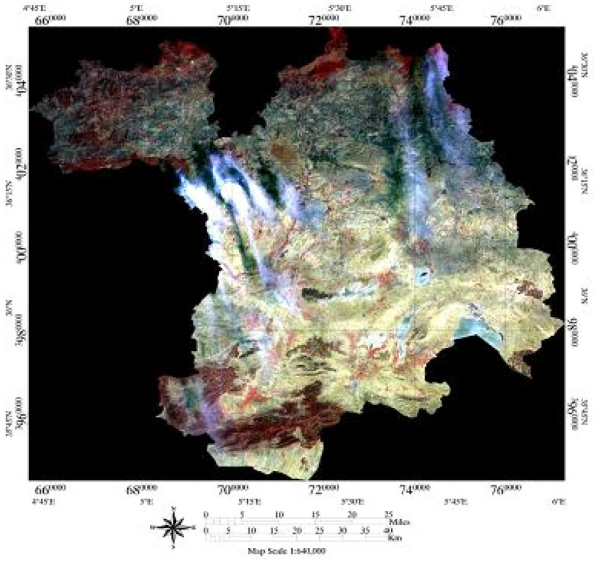


Fig. 2. Soil occupation card of the explored zone (Setif).

The restoration is based on a histogram analysis of the values contained in the image, a division in classes or a starch of the dynamic expressed by the histogram, the choice of a gray palette or adapted colors.

The digital image, like all statistic population, is characterised by descriptors, the function of which is to produce repairs for the orientation of treatments necessary to its exploitation [5].

The histogram expresses, in Gray scale class, the occurrence number (effective or absolute frequency) of digital accounts CNk observed in the image.

Divided by the total number of pixels, the frequency is said relative. The amended histogram proposes the distribution of the probability of gray scale appearance. The peaks are called modes. The bimodal image is thus an image presenting two peaks. The modes play a great role in the classification procedures.

The histograms realisation serves to classify the pixels according to their radiometric values. The figure 3 corresponds to the histogram relative to 3 channels TM4, TM3 and TM1 of LANDSAT 7.

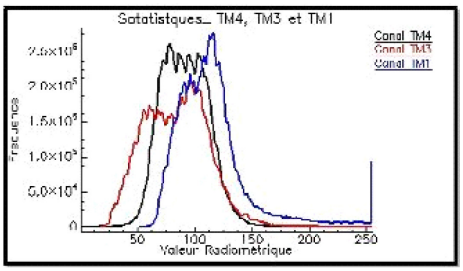


Fig. 3. Histogram of images relative to 3 LANDSAT 7 channels.

A value peak suggests the existence of a spectral class or a thematic category.

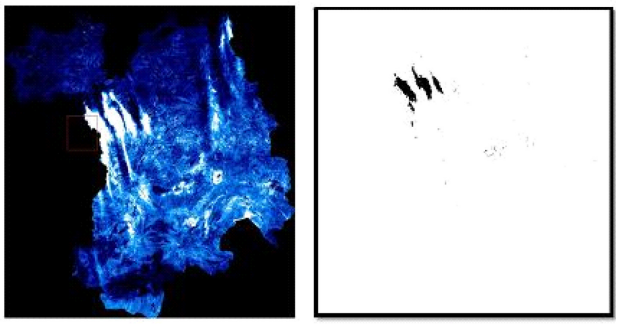
The histogram expresses the image dynamic, i.e the size of gray scales or yet the state of contrast. More larger is the dynamic, more better the image expresses nuances and details. In the same manner, we get the minimum and maximum histogram values. The dynamic is a good indicator of the capacity offered by an image in the extraction spectral classes which is one of the principal objectives of images treatment. A close dynamic signifies that a reduced number of different values is present and that numerous objects are expressed through the same digital account and will not, consequently, be differentiable. On the contrary, an extended dynamic, offers more segmentation possibilities, thus differentiating ones.

The statistics relative to 3 channels are regrouped in TABLE II.

TABLE II: STATISTICS RELATIVE TO 3 TM CHANNELS

Band	Min	Max	Average	Ecart-type
1	1	255	91.433299	20.173559
2	17	255	84.160775	27.884213
3	51	255	115.719371	33.793111

The clouds have a strong reflectance in the TM1 channel and a weak reflectance in the TM4 channel, thus we apply it on the TM1 channel, and then different thresholds test. The zones with values superior to 250 and inferior to 190 will not be masked (see figure).



(a) (b)

Fig. 4. Radiometric mask:
(a) Cloudy situation (image taken with the blue TM1 band)
(b) Clouds mask.

III. CONCLUSION

Concerning this work, we can say that the image treatment is intended to provide important informations, departing from raw images. It is necessary to define the quality as well in geometry (positioning of each point in a referential data) as in amplitude (express all values associated to each point in coherent units).conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

REFERENCES

[1] J. CAZAUX, 'Les systèmes spatiaux d'observation de la terre', CIHEAM, Options Méditerranéennes, Sér. A/ n°4, 1, La Télédétection en Agriculture, Toulouse, 1990.

[2] LANDSAT7 Orthorectified Imagery over Canada, Level 1 Product Specifications-Edition 1.0, GEOBASE, Canada, 2003.

[3] E.J.Sheffner, Jhonson,' The Landsat program and Landsat science'Controls World Services, NASA Ames Research Center, 1996.

[4] B. LOUNIS, A. BELHADJ AÏSSA, 'Processus de Correction Radiométrique Relative "PCRR" Appliqué Aux Images LANDSAT TM Multi Dates', SETIT, 3rd International Conference: Sciences of Electronic, Technologies of Information and Telecommunications, TUNISIA, 2005.

[5] A. HILLION, J. BOUCHER et C. ROUX 'Le traitement des images de Télédétection: aperçus et perspectives' Ed. UAPELF-UREF, Paris, 1989.