USING HRV SPOT DATA FOR STUDY OF ENVIRONMENTS EVOLUTION IN THE SULINA SITE FROM THE DANUBE DELTA

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ABSTRACT

In this study, the change-detection occurred at the level of principal morphohidrological elements and vegetation in the Sulina site from east region of the Danube Delta has been followed. The possibility which are being offered of HRV SPOT data have been tested, the study based being on two scenes acquired in May 27,1986 and April 27, 1993 respectively. The applied technique is post-classification comparison achieved on the base of composite images. For each one scene a composite image of first two components and Normalised Difference Vegetation Index (NDVI) was make. Afterwards, the composite images were submitted at one supervised classification process by maximum likelihood method carried out, followed of a mode type filtering. For change identification, the classified and filtered images were compared by difference. The studies point out that the HRV SPOT data are one efficient means for in deltas environment bath change identification and their amplitude estimate. A better accuracy of the classification and implicit of change-detection is obtained, if the threshold value of mode filter is proper selected.

1 INTRODUCTION

The study of environments and change-detection require using of the efficiency evaluation methods. Between this, the remote sensing offers and particularly interests, because of its essential specific features of the analysis and registration. The remote sensing offer one global view of phenomenon and is in same time the privileged study means, which can facilitated the best environment administrations. Thus, the observations Earth satellites are intensively used for regional and continental monitoring. Repetitively acquired data of same zone distinguished the signs of environment degradation and consequently facilitated evaluation of level degradation. In context of this means, in the Sulina site from the Danube Delta one study was realised.

2 STUDY ZONE AND DATA SOURCE

The Danube Delta and the coastal zone of the Black Sea represent areas of high scientific interest, which contain a unique series of interrelated ecosystems. This cover about 564,000 ha of which 442,000 ha (82%) lie within Romania. Inside the delta some main ecosystems are to be found among which we can mention: running water, stagnant water, wetland and flooded areas, fluvial and marine levees, the amended areas (for agriculture, forestry and fish culture) (Gastescu, 1992).

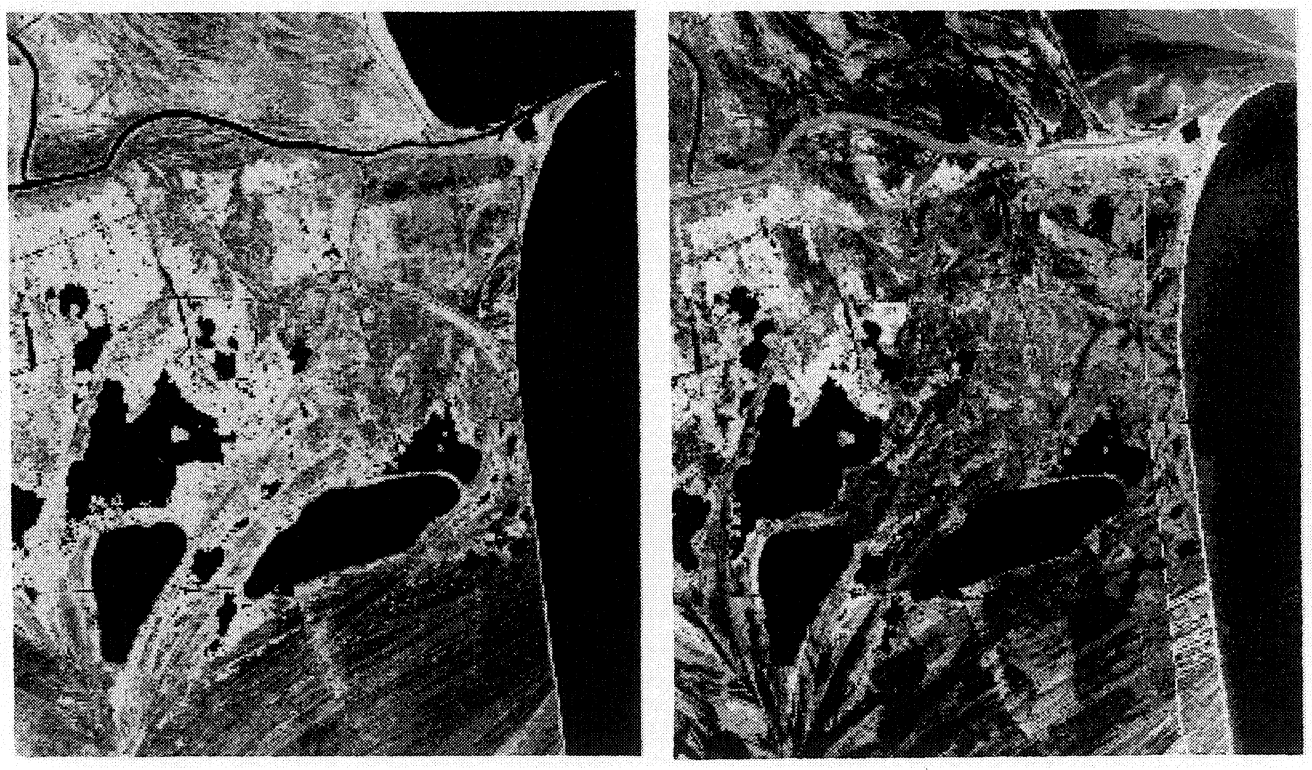
Ecosystem of running waters comprises in the first place the Danube's arms, bat also a series of more important streamlets and channels.

Ecosystem of stagnant waters includes in the first place lakes, to which ponds, streamlets and channels are added. They are characterised by a rich floating and submersed flora.

Ecosystem of marshy and flooding surfaces (of reed plats and floating reed islet) is dominated by emerged vegetation prevalent constituted of common reed. Floating reed islet formation, which is a mixture of reed roots herbs and soil, usually floating or fixed on the bottom of depressions, has a peculiar place within the ecosystem.

Fourth main ecosystem is river banks and levees ecosystem. This is centred on the riverbanks which had been the domain of all kind of trees which had been broke up in their greatest part and instead, Canadian poplars had been cultivated.

Based on the HRV SPOT scenes had been realised a study of environments evolution in the Sulina site from the Danube Delta. (Fig.1)



a) b)

Figure 1. Study zone: a) May 27,1986 scene; b) April 27,1993 scene

The study areas cover the Southwest side of Sulina City. This is characteristically for the fourth main ecosystems. The sites neighbouring with Black Sea a specifically series problems creating. Also, by its harbour activity and of upkeep of navigable channel Sulina, the city Sulina unbalances generating in natural evolutions of the ecosystem from the site.

Two scenes HRV SPOT from May 27 , 1986 and respectively April 27 ,1993 used has been. Their characteristics in table 1 are presented.

Table 1. The satellites data characteristics

Acquired date	May 27,1986	April 27, 1993
Bands	1 2 3	1 2 3
K / J	98 / 259	98 / 259
Resolution (meters)	20 x 20	20 x 20
Rectification (pixels)	± 0.391	± 0.275

3 METHOD

The change detection realised with aids of multispectral data need: the preliminary processing, classification and specifically proceedings post-classification (Allum, Dreinger, 1987; Hill, Sturm, 1991; Jensen et al., 1995)

3.1 Preliminary processing

One from important temporal reason for change-detection is the acquiring month of the imagery. Images acquired during the period with power sun light, present a very good contrast between various details (Jansen, 1983). For example, in this case, the contrast from covered with vegetation soil and uncovered is very strongly. Using the scene acquired in the same years period are suggested to change-detection with purpose to reduce the problems which appear because sun-angle difference, vegetation-phenology changes and differences in soil-moisture.

In this study for radiometric processing the technique based on reference image are used (Hall et al., 1991). Image of 1986 has been thought, because its minimum values are weakly. These techniques apply the standardisation in respect with reference image and adjust the calibration sensor errors. Also she adjusting the effects due to atmospheric differences and lighting between images. For this the fifteen pixels in each zone more darkness (near to level 0), respectively more brightness (near to 255) has been choose. Radiometric transformation which tie the two values of two images have the form $y(i) = a(i) + b(i) * x(i)$, where y (i) is pixels radiometric value from reference image and x(i) is the correspondent radiometric value pixels of corrected image.

After the radiometric correcting, the geometrically rectified images have been, so that the same pixel at one date overlaps the same pixel for the other date. The accuracy of change-detection is directly conditioned of geometric rectification. For this operation twenty ground control points obtained by aerotriangulation was used. The aerotriangulation is performed on aerial photos at 1:20,000 scale acquired in 1990. The root-mean-square (RMS) error at rectification of the two images was under 0.20 pixels.

For resampling of images was applied the method of the nearest neighbour.

3.2 Composite images generation

In principal component analysis of images stand out restrain of first principal component of each image. In means this is 76% of input data variance. Also, and the second principal component was retained, which the value represent 21% of variance. For each image at this two principal component was added the Normalized Difference Vegetation Index (NDVI).

$$NDVI = (XS3 - XS2) / (XS3 + XS2 + 1) * 128$$

Using of this allowed clear to distinguish of vegetation covered zones of the uncovered terrain zones. This index are advantageously for separation between the areas with very rich vegetation and the areas with the mobile and quasi-mobile sand correspondingly to river and sea banks (Caraorman, Lumina, Lat, Rosu, Puiu, Ivancea and Cerbului) or sea beaches. Also, facilitated the separation of very little and fine town structures from city Sulina of vegetation.

The composed images were used in post-classification comparison process.

4 THE POST-CLASIFICATION COMPARISON AND CHANGE-DETECTION

Using of the post-classification comparison methods is advantageously, because the image acquired at different times are separately classified. This method allow minimising the effects dues to different atmospherically conditions and using different sensors for multispectral images acquiring (Singh, 1989). Thus different studies showed that by association of mode filtering with classification procedures are possible the improve accuracy of change-detection (Jansen et al., 1993).

Mode filter applied in 3 by 3 neighbouring with a threshold value in generally three, allows to suppress the isolated pixels or poor classified or the pixels dues to noise (Jansen et al., 1993). It replaces central value pixels by a majority value. Majority threshold corresponds to threshold of which going, majority value replace central value pixels.

For classification was applied a hibryd classification process. In this technique by clustering are optimised defining the sample classes, which will be used in the supervised classification process.

For spectral signature file establishing first was appllied a clustering method (Isodata from Erdas). Afterwards, the file to supervised classification realised by maximum likelihood has been.

The classification of composite images from 1986, respectively 1993 was performed in accordance with seven classes: uncovered soil, stagnant water in lakes, running water, sea water, compactly common reed, mixture common reed-mace reed, town structures. The mode filtering technique was applied to the two classified images in a 3 by 3 neighbouring.

The accuracy classification from two date was estimated by using for each the standard, single-date, qualitative accuracy assessment procedures (i. e., an error matrix and Kappa analysis) (Congalton, 1991).

The reference data was extracted of pedologychal map, vegetation's map and topographical map of the Danube Deltas.

The images classification from 1986 have been one generally accuracy of 76% and 0.43 Khat value, while for 1993 images was optained 72% and respectively 0.38.

For change-detection the classified images was compare by differencing.

4 DISCUTION AND CONCLUSION

The principal changes distinguished with the image obtained by diferencing the classifications of the two composite images has been:

- the increased variation of shore lines characterised by expansion zones or forwards to sea (depositions zones) or retreating zones (erosion zones) or forwards to land, with amplitudes of 2.5-5 pixels;
- changing of the lakes shape dues to floating reed islet formation moving;
- decreasing of compactly common reed areas where this was intensively exploited (for instance decreasing with 25-30% of same areas of south lakes Rosu) and extensions of areas with common reed- mace reed mixture;
- news channels opening (parallel to shore line the channel Tataru and the channels for agriculture Sulina precinct plotting of land) and news fishery areas from east Caraorman locality.

This study clear distinguished that can be localised and in amplitude estimated the principals changing in deltas environment, using the HRV SPOT data. The result accuracy are directly conditioned by applied methods.

The post-classification comparison is advantageously because minimised the effects, which arise dues different acquiring images data. If the classification of used images enough accuracy, good results of change-detection are obtained. In this context mode type filtering technique prove to be adequately for accuracy improving. The threshold value of mode filters must be choosing to suppress one maximum pixel number due to noise or inadequate classification.

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