Anais VIII Simpósio Brasileiro de Sensoriamento Remoto, Salvador, Brasil, 14-19 abril 1996, INPE, p. 341-342.

CHANGE DETECTION OF POLLUTION AND SEDIMENT CONCENTRATION ON RIO DE LA PLATA

Mirta A. Raed *
Gloria Pujol **
Diana Rodriguez **
Sergio Haspert **
Jorge Gari ***

* DEPTO. DE CS. BASICAS - UNLU, CENTRO SENSORES REMOTOS F.A.A
Ruta 5 y 7 - 6700 Luján - Argentina

** SERVICIO METEOROLOGICO NACIONAL F.A.A.

*** CENTRO SENSORES REMOTOS F.A.A.

1 Objectives

After having observed and done previous papers that haved used multispectral and multitemporal digital NOAA/AVHRR data correlated with laboratory parameters, such as organic matter, weighted metals, chemical and biochemical oxygen demand, dissolved oxygen in water, turbidity, sediment concentration, it is important to continue this kind of investigation to arrive at a mathematical model that describes a good relation between temporal phisico-chemical water situation and NOAA/VHRR digital, temporary data.

In the previous paper, on this subject, it has been proved a good correlation, on each date, among NOAA digital data and laboratory parameters, such as how the importance of the correlation depends temporarily with each parameter.

To design a mathematical model that relates digital NOAA data with pollution and sediment concentration on water surface, it is necessary to take into account ak previous statistical study of laboratory measurements related with digital data done at the same time, with many checking points, on each chosen station.

In the objective of this paper, to bring to light multitemporal change detections on all the Rio de La Plata water body, on both coasts (Argentina - Uruguay), covering the Rio de La Plata estuary from parallel 34^0 up to parallel 35^0 Southern latitude, and 56^0 up to 58^0 Western longitude, just before designing a mathematical model that relates actual river situtation by means of NOAA digital data.

2 Materals and methods

It has been chosen several out of cloud, 1995 NOAA Images, just to compare the differences among dates, including: Setember 15, Setember 24, October 21, October 29, October 31, November 22, November 28, December 1, with a spatial resolution of 1.1km.

The selection of an appropiate change detection mathematical model is based on an analysis of several important factors. The analyst must know the biophysical characteristics of the study area.

There are several classes of change detection models that include image differencing, image rationing, classification comparison, comparison of preprocessed imagery, principal components transformation.

a) <u>Image differencing</u> involves subtracting the imagery of one date from that of another, or the subtraction of the albedos of channel 1 and channel 2 of the same date, giving the distribution of the suspended matter.

The C_1 - C_2 values can be mapped and then replaced by the concentration values estimated from a regression model.

It can be noticed that, in any of the two cases, above mentioned, the subtration results in positive and negative values in areas of radiance change and zero values in areas of no change.

b) Image rationing tends to remain invariant when changes results from factors such as shadows, seasonal reflectance differences due to sun angle, that degrade the identification of homogeneous different areas present on ground.

These ratios are, especially, useful for change detection when several dates of imagery are used iln an analysis, because they can reduce the environmental effect and multiplicative factors present.

As soon as these factors are carefully controlled the probability of accurate change detection will take place.

c) Postclassification comparison identifies change by comparison two independently produced classification maps. Some authors consider a priori postclassification comparison as the superior change detection method and it is used as the standard for evaluating the results of other methods.

d) Spectral/temporal change classification detects changes by performing a single classification on a multiple-date data set. The method may employ supervised classification techniques, choosing training sites that are used to determine differentiated features for desired classes or unsupervised classification techniques, in which case the homogeneous classes are clustered based on their statistical properties. In any case, change classes will have significantly different statistics from non-change classes.

e) Principal components transformation applied to multispectral/multitemporal data produces a series of linear transformations of the observed variables that result in a new, smaller set of mutually ortogonal variables. Because each consecutive new variable accounts for the maximun amount of variability within the original data, the transformation provides uncorrelated variables, with the first component containing 90 to 95% of the variance.

Thus, principal component analysis may reduce the dimensionality of the change detection problem without losing useful information.

Another important NOAA/AVHRR channel to take into account, separately, is channel 4, just to measure surface temperature of Rio de La Plata water body to describe its hydrodynamics and to relate these properties to patterns of biological activity in this river.

3 Conclusion

It can be concluded that NOAA/AVHRR date are useful to discrininate different level pollution areas, as well as sediments covering water surface.

4 References

Raed, M., Barturen, O., Martinez, C., 1991, Estudio de Contaminación y Concentración de Sedimentos en las Costas del Rio de La Plata, mediante Datos Satelitarios”, shown at V Simposio Latinoamericano de Percepción Remota, and printed at Selper paper, Vol.8, n$^{0.}$1, March 1992.

Raed, M., Pujol, G., Leis, J., 1993, “Estudio de Contaminación y Concentración de Sedimentos en la Costa del Río de La Plata mediante la Utilización de datos Satelitarios NOAA/AVHRR”, shown and printed at VI Simposio Latinoamericano de Percepción Remota.

Raed, M., Pujol, G., Vila, D., Vila, D., Sedeno, A., 1995, “Análisis Multitemporal de Contaminación y Materiales en Suspensión en la Franja Costera Sur del Río de La Plata mediante Información Satelitaria NOAA/AVHRR, “shown at VII Simposio Latinoamericano de Percepción Remota, and in press.