INTRODUCTION

The routine process of the IMS data at the CTBTO International Data Center (IDC) is aimed at identifying in the seismological bulletins all the seismic events the source of which is certainly natural. This process, named screening, is carried out on several tens of earthquakes per day. It is important that the methods used for the screening process are as reliable and efficient as possible, so as to substantially reduce the number of suspicious events without classifying any explosion as natural events.

The principal identification method applied at the CTBTO IDC is based on the difference between the Ma magnitude, computed from the amplitude of the surface Rayleigh waves with period close to 20 s, and the mb magnitude computed from the amplitude of the body waves with period close to 1 s. The applicability of this method is, however, limited by the difficulty of detecting surface waves for events of low mb magnitudes, so as to allow the computation the Ma magnitude for such events, which are very numerous. For CTBT verification, in case of events of small magnitude, the use of stations at regional distances from the epicenter, is crucial. In this context, another category of seismological screening, the so-called regional discriminants, can be applied. This method is based on the amplitudes of the surface waves (5s) at much higher frequencies (8-12 Hz). Unfortunately, these high-frequency waves are not easily detectable, and the method requires regional calibration curves for each specific site, calibrations that are not available on a global scale.

DISCRIMINANT ANALYSIS

A discriminant method should be optimized and tested by means of rigorous statistical methods. In our work, we adopt a mathematical-theoretical framework named "Discriminant Analysis". The Discriminant Analysis is known as a statistical tool in a variety of applications for classifying single observations in two or more sets through the search of the optimal linear functions of the parameters describing the observed data. In the learning phase, this method allows the adjustment of the contribution of each single parameter to the discrimination algorithm.

The Discriminant Analysis allows you to find the perfect separation between the two groups $G_1$ and $G_2$, looking for the carrier that maximizes the standardized difference (the problem of maximum bound)

$$
\frac{(\overline{y}_1 - \overline{y}_2)}{s} = \frac{1}{\sqrt{\sum_{i=1}^{p} s_i^2}}
$$

where $\overline{y}_i$ = $\frac{1}{n_i}$ $\sum_{i=1}^{n_i}$ $y_i$ is the vector of amplitude observed variable $y$, $s_i^2$ is the vector of amplitude observed variable $y$.

Or any p-dimensional vector $y$, consists of the measures made on

$$
\begin{align*}
Y_1 &= \beta_0 + \beta_1 y_1 + \cdots + \beta_p y_p \\
Y_2 &= \gamma_0 + \gamma_1 y_1 + \cdots + \gamma_p y_p
\end{align*}
$$

The Discriminant Analysis allows you to find the perfect separation between the two groups $G_1$ and $G_2$, looking for the carrier that maximizes the standardized difference (the problem of maximum bound)

$$
\frac{(\overline{y}_1 - \overline{y}_2)}{s} = \frac{1}{\sqrt{\sum_{i=1}^{p} s_i^2}}
$$

For the test, we have considered mb, Ms and depths reported in REB from 806 natural earthquakes distributed on the whole globe. Of these, the Discriminant Analysis has classified 798 events as earthquakes and left 8 events classified as explosions. The "false alarm" rate is quite smaller than that achieved by the standard IDC screening procedure, although we can not guarantee that the number of explosions missed by the method would be zero.

RESULTS

On the basis of the rule obtained by discriminating the events are allocated as follows:

- earthquakes
- explosions
- 798

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