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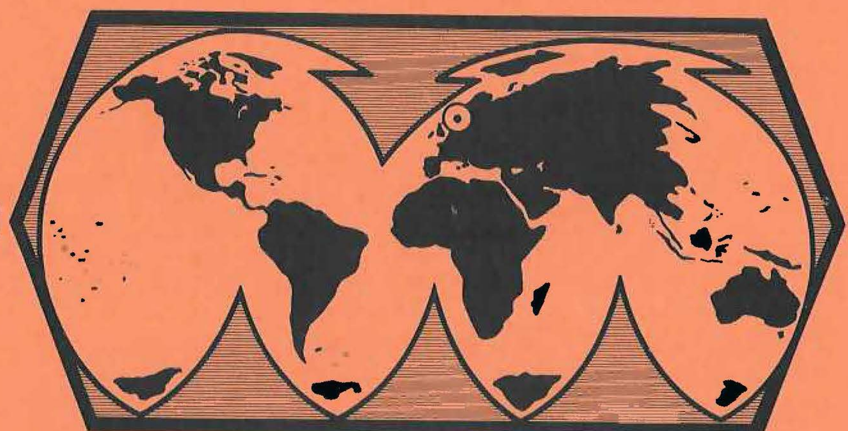

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L. IMPROVED IDENTIFICATION USING COMBINED CRITERIA

In Section K a relatively large data base was presented in an m_b:M_s analysis of seismic events from Eurasia. The same data base will be used in this section, only that we have proceeded one step further and combined the m_b:M_s data with more short period information in order to further improve the separation between earthquakes and explosions. Such combinations are often done through successive application of discriminants, starting with the best one. Combining discriminants linearly, however, results in several advantages. First of all, the same analysis applies to all events so that the analyst can enter with his interpretation at a higher level; secondly, a combined discriminant is easier to evaluate than a step-wise procedure. In this study we have defined a new two-dimensional discriminant which in many ways can be compared with the m_b:M_s discriminant.

The new discriminant is constructed by combining the m_b:M_s data with some parameters obtained by modelling the short period data, noise as well as main signal and coda, as auto-regressive time series. For more details we refer to Tjøstheim (1975); see also Section I, where it was found that such modelling is in fact possible, and in most cases a good approximation is obtained using a third order model. The three resulting coefficients then essentially describe the second order structure or the power spectrum of the particular time series under consideration.

The optimal linear combinations have been obtained through an extensive trial-and-error procedure, where a large number of combinations have been tested. The best one was obtained by defining the two parameters of the new discriminant as

$$X1 = m_b - B \cdot \hat{a}_1(S)$$
$$X2 = M_s + B \cdot (\hat{a}_1(C) - \hat{a}_1(N)) \qquad (L.1)$$

where $\hat{a}_1(S)$ is the first order coefficient from the main signal, and C and N denote coda and preceding noise respectively. It was reassuring to note that the above discriminant gave the best results even when applied to different data bases and different regions (in Eurasia, that is), and the same kind of stability was observed for the scaling coefficient B, whose optimal value usually was found to be around 0.5.

An example of the new two-dimensional discriminant as applied to data from around Eastern Kazakh is given in Figs. L.1 and L.2, where the m_b:M_s and the corresponding X1:X2 diagrams are given respectively. It is easily seen that the improvement in separation is considerable.

H. Bungum and D. Tjøstheim

REFERENCES

Tjøstheim, D. (1975): Autoregressive representation of seismic P-wave signals with an application to the problem of short-period discriminants, Geophys. J.R. Astr. Soc., in press.

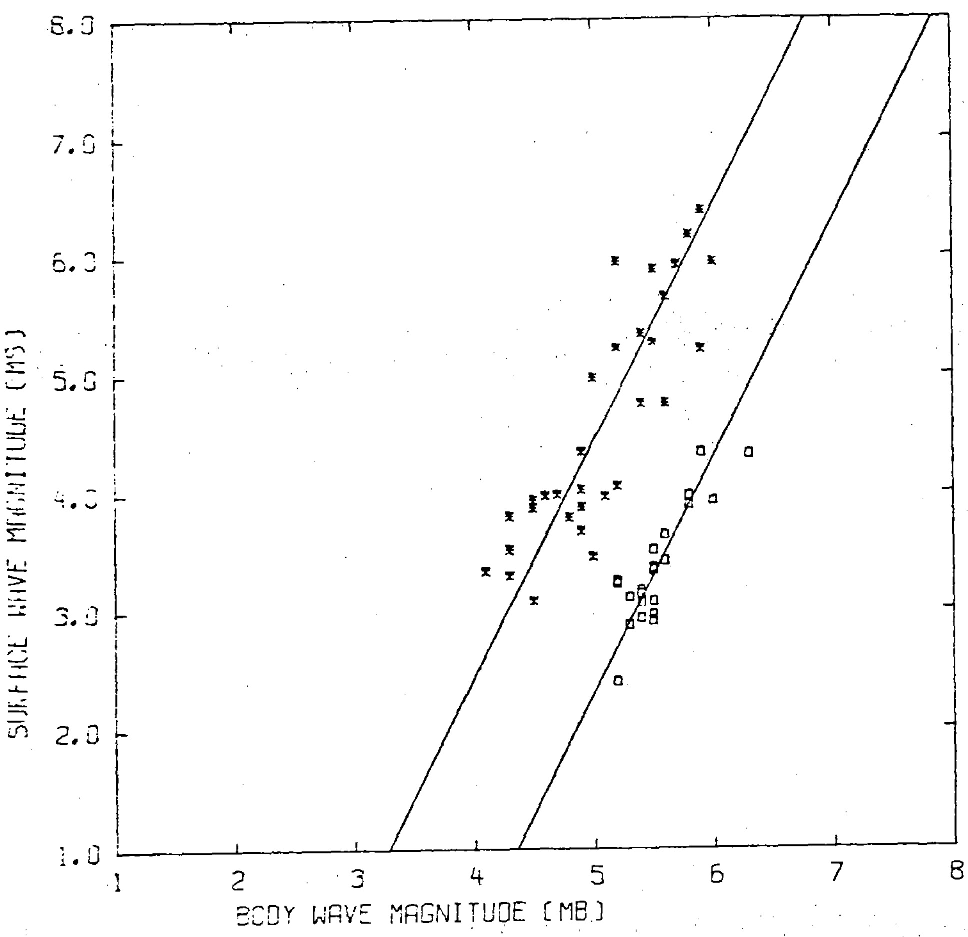

Fig. L.1

m_b:M_s diagram for the 'Eastern Kazakh' data base of 35 explosions and 31 earthquakes.

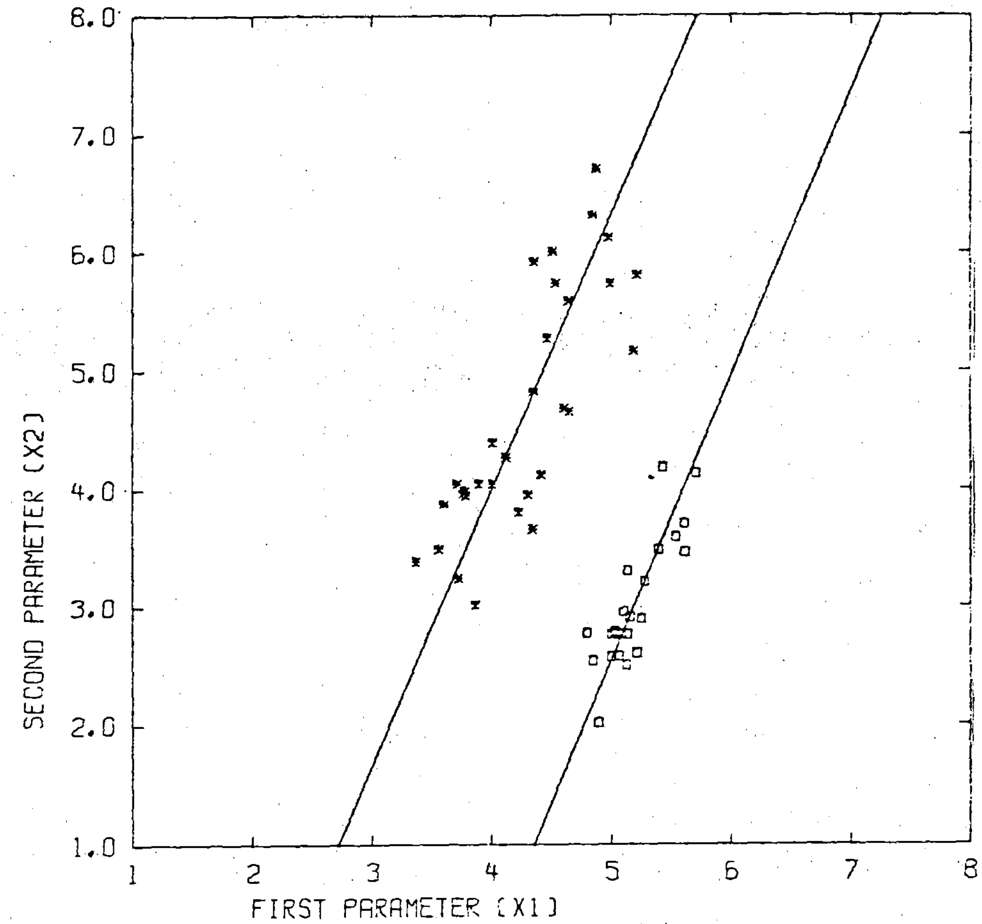

Fig. L.2

X1:X2 diagram for the same data as in Fig. L.1, using formula (L.1) with B = 0.5.