

NORSAR

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SEMIANNUAL TECHNICAL SUMMARY

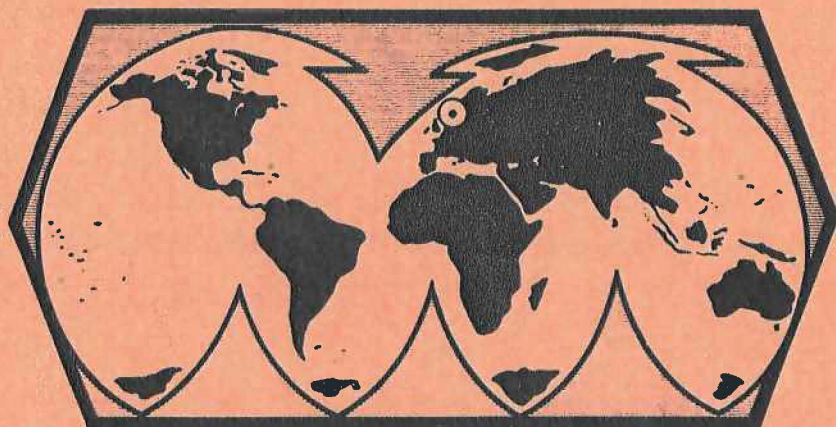
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VI. SUMMARY OF SPECIAL TECHNICAL REPORTS/PAPERS PREPARED

In this section a brief summary is given of the results of ongoing and recently completed research projects at NTNF/NORSAR. The presentation covers research conducted under NTNF/NORSAR's contract with ARPA as well as research projects sponsored by Norwegian authorities. Of particular interest to the seismic discrimination problem among the Norwegian-funded undertakings is the participation of two NTNF/NORSAR seismologists in the seismological expert group established by the United Nations. In addition, some of the research conducted at NTNF/NORSAR in connection with seismic risk studies is also of general seismological interest, and is therefore included in the following.

VI.1 Work of the Seismological Expert Group Established by the United Nations

On 22 July 1976 the Conference of the Committee on Disarmament (the CCD) of the United Nations established an Ad Hoc group of Government-appointed experts to consider and report on international cooperative measures to detect and identify seismic events, so as to facilitate the monitoring of a comprehensive test ban. Representatives of a total of 27 nations participated in the expert group, which met in Geneva, Switzerland, in five sessions. Its final report was transmitted to the CCD on 9 March 1978 and contained specific recommendations for a global system. In short, the main elements of the recommended system were:

- (i) A systematic improvement of the observations reported from a network of more than fifty seismological observatories around the globe.
- (ii) An international exchange of these data over the Global Telecommunications System of the World Meteorological Organization.
- (iii) Processing of the data at special international data centers for the use of the participant states.

The report also considered some steps, such as an experimental exercise, which could be taken initially to assist the establishment of such a cooperative data exchange system.

The Norwegian government appointed Dr. E.S. Husebye and Dr. F. Ringdal, both of NTNF/NORSAR, to represent Norway in the expert group. Dr. Ringdal was chosen by the group to act as its scientific secretary. While the participation in the expert group was funded by Norwegian authorities, part of the research work done at NTNF/NORSAR in this connection has also been of relevance to the NTNF/NORSAR's ARPA contract. For example, a comprehensive detectability study of nearly 500 globally distributed seismograph stations was undertaken, and the results have now been published (Ringdal et al, 1977).

For supplementary comments on the work of the Ad Hoc group, we refer to the editorial of Nature, 6 April 1978 (see Fig. VI.1.1), where political and scientific implications of the proposed measures are discussed.

E.S. Husebye

F. Ringdal

References

Ringdal, F., E.S. Husebye and J. Fyen (1977): Earthquake detectability estimates for 478 globally distributed seismograph stations, Phys. Earth Planet. Inter., 15, P24-P32.



6 April 1978

Twenty years of test ban talk

IN 1958, a conference of scientific experts in Geneva made the first steps towards devising an international seismic monitoring system which would verify compliance with any treaty banning underground nuclear weapons tests. In 1968, with political interest in a comprehensive test ban in the doldrums but with ten years of seismological research on a national basis completed, SIPRI, the Stockholm International Peace Research Institute, convened further informal meetings of scientists in an attempt to get a comprehensive test ban (CTB) talked about again. Now in 1978, with serious political discussion proceeding both at superpower level and amongst a wide range of nations at the UN Conference of the Committee on Disarmament (CCD), scientists have again reported on what must be done in an international context to monitor a test ban treaty. Their report, the result of deliberations by scientists from 27 countries over a period of a year and a half, has recently been released (as CCD document 558). It reflects substantial credit on its participant, especially on Dr Ulf Ericsson from Sweden, its chairman, and Dr F. Ringdal from Norway, its scientific secretary, for although there was a clear need to hammer out some form of consensus in the document, this has not prevented its message from being clear and unambiguous.

The science of test ban monitoring was mostly done in the 1960s. Techniques to increase detectability, to discriminate between explosions and earthquakes, to relate seismic magnitude to explosive yield, to locate events more accurately were all developed rapidly during that period, and have in recent years undergone relatively little further change. What has happened in the past ten years, however, has been a marked improvement in data handling. Studies which used to take months of data accumulation and hand measurement can now be done in a morning at a computer console. Many international communication links, both formal and informal, now exist and more are planned. This, of course, is true in many other branches of science and greatly benefits research, but in seismology the bonus is that it is now possible to talk of an international centre or centres, with rapid access to data of a high quality from seismometers all round the world, providing a routine flow of information highly relevant to the verification of a CTB. In many ways the recent report is a blueprint for such an operation, which might be preceded by an experiment taking up to two years.

It is of interest to compare the predictions of network capability which are being made in 1978 with those put

forward in 1968 (which came essentially from a pre-digital era). The detection of events almost invariably depends on the successful registration above noise levels of so-called body waves. This detection capability has improved roughly threefold; explosions of yields of 1 or 2 kilotons in hard rock in most parts of the Northern Hemisphere would now most likely be picked up. The improvement in detection of surface waves, necessary to the identification of explosions as such, is even greater. Identification might now be possible for shots as low as 5 to 10 kilotons in hard rock.

Not all the progress, however, is in the science and technology. For the past twenty years the Soviet Union's willingness to co-operate in a scheme of test-ban monitoring has been in doubt. Many times she has declared that she is perfectly prepared to sign a treaty, but that she regards 'national means' as adequate for verification. Since the Soviet national seismic network is of very limited value in monitoring the United States, this statement is open to the interpretation that the nature of US society is such that clandestine small-yield testing would be impossible. But the corollary is that the nature of Soviet society, and even the geography, leaves the door open to violation and that much wider open if the Soviet Union will provide no data to international agencies. It is too little realised that at present even the informal channels by which seismologists exchange data are closed on the days that the Soviet Union conducts an underground test.

The recent discussions, however, offer some promise. The Soviet Union, a rather hesitant participant to begin with, eventually co-operated fully, and even allowed five of its own stations to be used in various calculations—in contrast to the French and Chinese who stayed away. The next step will be when data from these five stations are supplied on a routine basis. This is unlikely to happen before a treaty is signed—the Soviet Union would regard provision of such material, containing possible evidence of weapons tests, as tantamount to handing out state secrets. But if the long-term intention is to participate fully, this must be regarded as an optimistic sign.

A comprehensive test ban needs much more than a good verification network to bring it into being. But this report is bound to provide some reassurance, particularly in the United States, that such a network, including Soviet stations, is possible. The proposals will not guarantee that tests at the kiloton level can be positively identified as such. But they do show some evidence—for the first time—of truly international goodwill. □