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WORKING PAPER ON A PROTOTYPE SYSTEM FOR INTERNATIONAL EXCHANGE OF SEISMOLOGICAL DATA UNDER A COMPREHENSIVE TEST BAN TREATY

Introduction

In March 1978 the Ad Hoc Group of Scientific Experts to Consider International Co-operative Measures to Detect and Identify Seismic Events submitted a report (CCD/558) proposing the establishment of a global seismological network to assist in the verification of a potential comprehensive nuclear test ban treaty (CTBT). The proposed system would have three main elements: (1) A network of more than 50 seismological observatories distributed around the globe, (2) International exchange of the recorded data, and (3) Processing of the data at special International Data Centres for the use of participant States.

The Ad Hoc group has since pursued its work by elaborating in detail how such a global system should be operated. Under its current mandate by the Committee of Disarmament (CD/PV.48 of 7 August 1979) the Group has inter alia been requested to co-operate in the review and analysis of national investigations into matters relevant to its work.

The subject of this working paper is to present a Norwegian contribution to the work of the Ad Hoc group. It refers to a prototype system developed for the purpose of rapid, flexible and inexpensive international exchange of seismological data within the framework of a future global system as proposed by the Ad Hoc group.

International Seismic Data Exchange under a CTBT

As envisaged by the Ad Hoc group, the international data exchange would take place at two levels:

- Level 1: Daily parameter reports of detected events from each station in the network
- Level 2: On request, complete waveform data for events of special interest.

Level 1 data were to be transmitted through the Global Telecommunication System (GTS) of the World Meteorological Organization (WMO). For the more voluminous Level 2 data, no single solution was recommended, rather the Group considered that this subject needed further study.

In the years that have gone by since CCD/558 was written, rapid and significant technological developments have taken place, both with respect to seismological instrumentation, computer technology and telecommunications. It appears only natural that some of the methods of data exchange suggested in CCD/558 must be reconsidered today. In particular, the exchange of Level 2 data may today be conducted rapidly and easily, even for fairly large data volumes.

A Prototype System for Seismic Data Exchange

Sponsored by the Norwegian Ministry of Foreign Affairs, Norwegian Seismic Array (NORSAR) initiated in 1980 a research project to evaluate how modern telecommunications technology could be used to improve data exchange within a global verification system. The project, which has been conducted in close co-operation with colleagues from the United States, has now been completed, and has resulted in the development of a prototype system with the following key features:

- Low-cost microprocessor (type North Star)
- Data transmission via ordinary telephone lines
- Handling of both Level 1 and Level 2 data as well as messages
- Simple and flexible operation.

The software developments comprise both data acquisition and communications functions, and contain the following major elements:

Real-time multitasks

- Clock and A/D converter tasks
- Copy samples to event buffer task
- STA and LTA (short and long term average) tasks
- Detection task.

Background tasks

- User interface
- Communication package
- Analog-to-Digital control routines
- Event directory and display routines.

Non-standard processing

- Word processing
- Mail/messages and software exchange
- Off-line data processing
- Remote computer processing.

Data communication is achieved using the SAFT (Simple ASCII File Transfer) protocol, and is based on dial-up connection to a computer centre or a seismic station equipped with compatible hardware and software.

Experiments conducted using the Prototype System

The following transmissions have been achieved during experiments taking place at Kjeller, Norway, and Geneva, Switzerland.

(1) To/from a data centre in Washington D.C., USA:

Purpose: Simulate communication between two International Data Centres.

By dialling up a PDP 11-44 computer at this site, both message exchange, retrieval of seismic bulletins and waveform data have been accomplished.

(2) To/from the NORSAR data centre at Kjeller, Norway.

Purpose: Simulate communication between an International Data Centre and a National Centre.

Similar functions as under 1 have been demonstrated, in addition retrieval of waveform and parameter data in near real time has been accomplished.

(3) To/from a small prototype seismic station in Trondheim, Norway.

Purpose: Simulate communication between an International Data Centre and a remote seismic station.

This experiment has been conducted to retrieve automatically detection logs and selected waveform data, without any operator intervention necessary at this unmanned station.

All of the above experiments have been successfully conducted, without any data loss and with no significant technical problems.

Conclusions

The essence of the demonstrations described above is that modern, international telecommunications services today permit easy exchange of Level 1 data, Level 2 data and relevant messages between most countries, using standard telephone services. The cost of a minimum configuration would be relatively modest, approximately in the order of US$ 5,000. Line charges would come in addition. Our recommendation is that further experiments using this and similar systems be encouraged, with the purpose to include this method of rapid data exchange in the global seismological system which might be established under a comprehensive nuclear test-ban treaty.