NORSAR

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6.5 Recent developments in connection with the seismic station in Amderma, Russia

Summary

Since 1991, NORSAR and the Kola Regional Seismological Centre (KRSC) have had a cooperative agreement on geophysical research and development. This has led to the establishment in Apatity of an advanced seismic observatory and a data center for geophysical monitoring. A dedicated 64 Kbps connection has been established between Kjeller and Apatity to exchange data on seismic measurements and associated scientific information. This link currently enables both parties to use data from the entire array network in northern Europe in their daily analysis of seismic events in the European Arctic.

The Amderma station (AMD) has been in operation by KRSC for more than 10 years. The location is 69.742N 61.655E, which is just south of Novaya Zemlya (see Fig. 6.5.1). The station is emplaced inside a deserted underground mine. Initially, AMD operated as a standard Russian analog recording station. In 1993, KRSC installed a microarray (with digital recording) at the Amderma site. The hardware comprised short-period S-500 vertical and horizontal seismometers, Nanometric 18 bit digitizer and a Norac array controller. From August 1998, the microarray has been replaced by a broadband 3-component seismometer system of the type RefTek DAS 72A.

Data recorded by AMD is sampled at 100 Hz and registered on a local disk system. Continuous data are transferred to an Exabyte cassette recorder and shipped by mail to Apatity. Typically, these data are available within 1-2 months of the date of recording.

Software to connect the Amderma station to Apatity via an Inmarsat link was developed by KRSC in 1998/99. This software, which is written in Borland Pascal, is documented on KRSC's homepage on the Internwt (http://www.krsc.ru/). The software allows for the retrieval of the following types of data:

- Waveform segments for specified time intervals
- Detection lists
- Compressed STA trace of filtered vertical channel data (filter band 4-12 Hz)
- State-of health indicators.

The Inmarsat link can furthermore be used to remotely controlling the station parameters, and restarting the system in case of occasional failure.

The capability of the Amderma station to detect low-magnitude seismic events in the Barents/ Kara Sea region should by now be well documented. The rapid availability of digital data from this station is therefore expected to contribute significantly to confidence-building and enhanced analysis of future seismic events of monitoring concern in this region.

As examples of the rapid retrieval of waveform segments from AMD, Figure 6.5.2 shows vertical component data for the earthquake in the Kola Peninsula on 17 August 1999. Both long-period surface wave data and short period P and S phases can be clearly seen in appropriate frequency bands. Figure 6.5.3 shows the three components of the Amderma station for the same event, filtered in the band 2-4 Hz. An example of the compressed STA trace at the time of the 17 August 1999 event is shown in Fig. 6.5.4. The two peaks correspond to the P and S phase respectively.

Examples of teleseismic P-wave recordings are shown in Figures 6.5.5 and 6.5.6. These figures show broad-band AMD data, filtered in a suite of frequency bands, for two earthquakes which occurred on 30 May 1999. These time intervals were requested via the Inmarsat link by the KRSC staff in Apatity during the next day, and were subsequently transmitted to NORSAR via the direct link Kjeller-Apatity. As can be seen from the figures, the plots were generated at NORSAR on 1 June 1999.

We plan to continue to use the Inmarsat connection to retrieve detection lists as well as seismic data for events of special interest. Because of the significant cost of the Inmarsat transmission, we currently do not plan to regularly transmit waveform data. However, an interesting possibility is to transmit on a regular basis the STA traces, which can be highly compressed. The STA traces, for appropriately filtered waveforms, form the basis for the Threshold Monitoring technique. Such STA traces, if rapidly available, could therefore make useful contributions to the NORSAR Threshold Monitoring system for the Barents/Kara Sea region.

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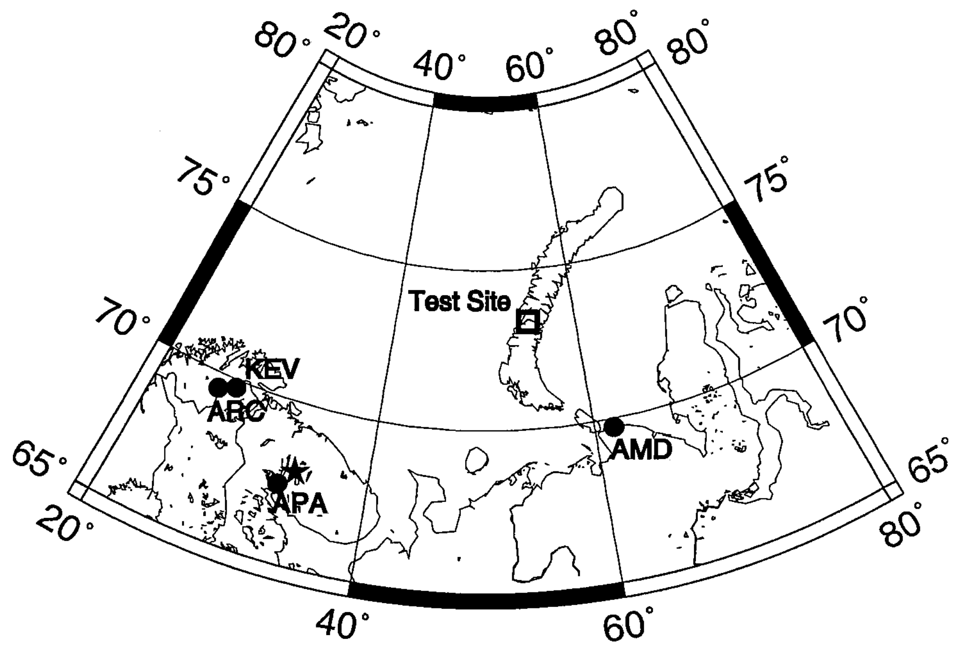

Fig. 6.5.1. *Map showing the location of the Amderma seismic station (AMD) in relation to others stations in the European Arctic. The Novaya Zemlya nuclear test site is indicated, and the location of the 17 August 1999 Kola earthquake is shown as a filled star.*

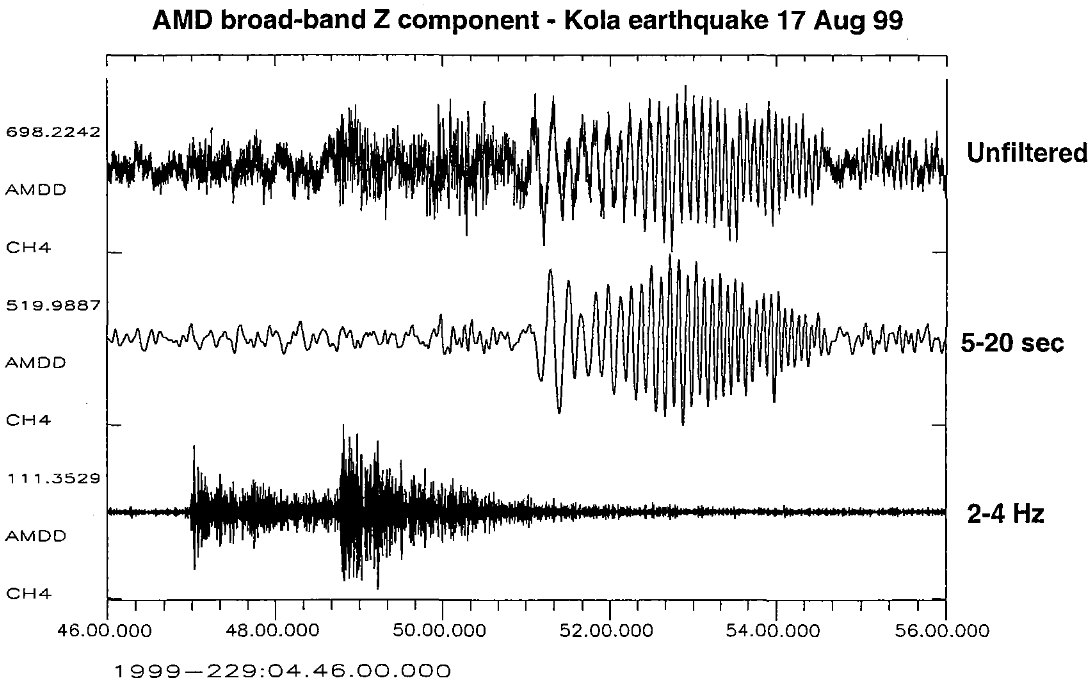

Fig. 6.5.2. *Vertical component broad-band data for the earthquake in the Kola Peninsula on 17 August 1999. Both long-period surface wave data and short period P and S phases can be clearly seen in appropriate frequency bands.*

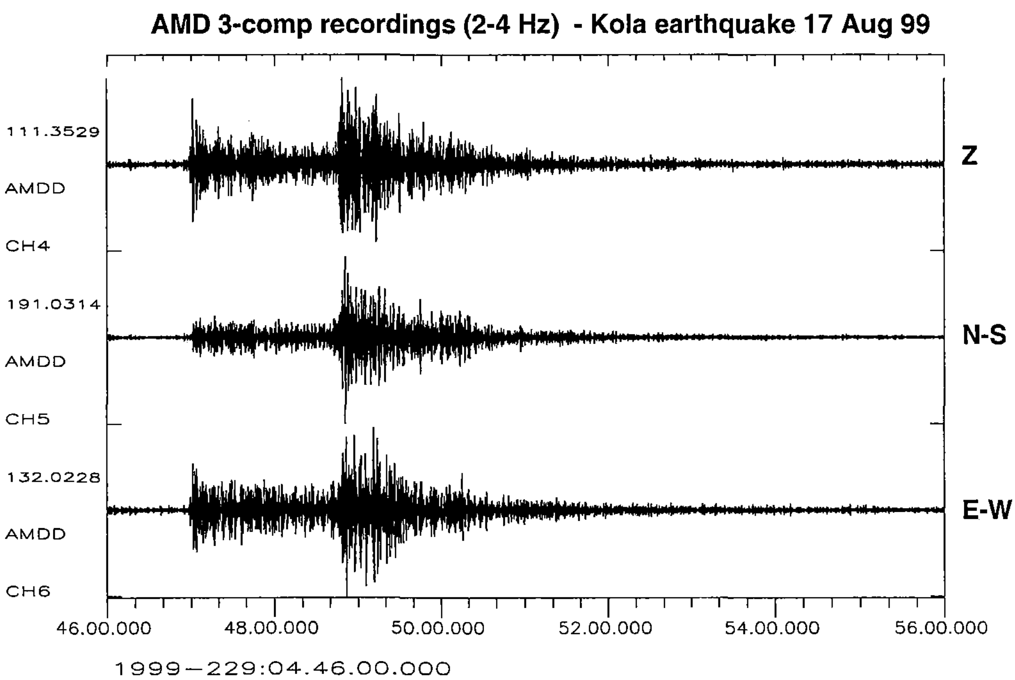

Fig. 6.5.3. *Three-component data of the Amderma station for the 17 August 1999 event, filtered in the band 2-4 Hz.*

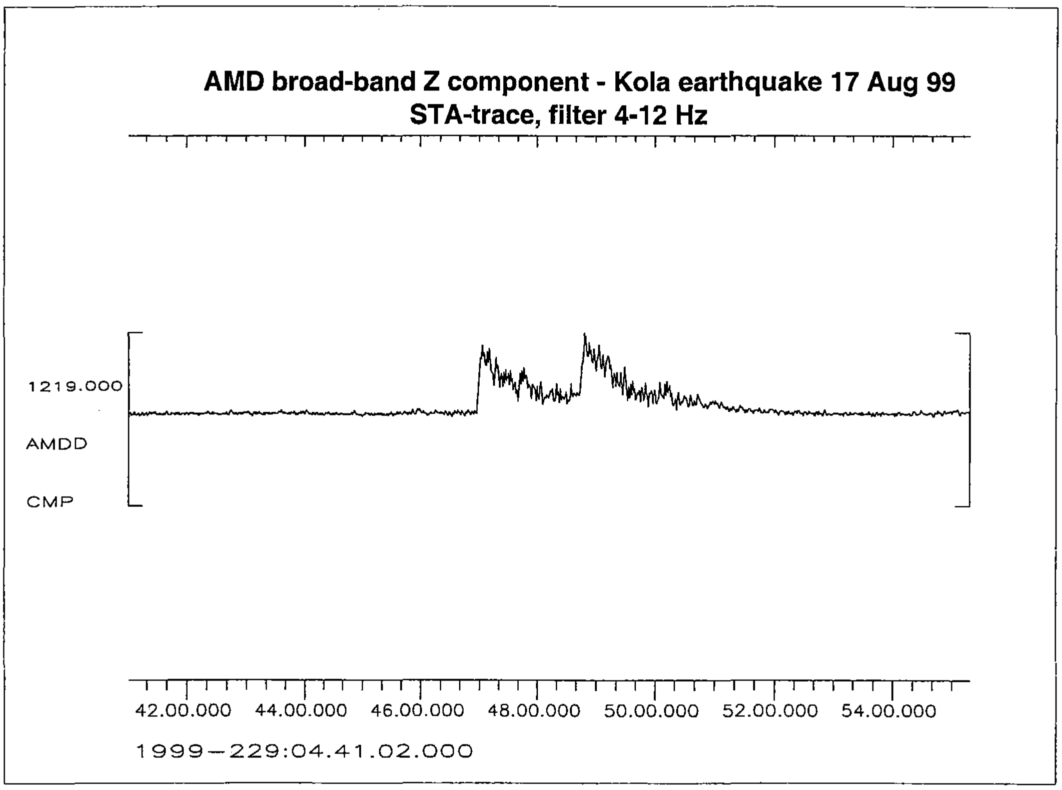

Fig. 6.5.4. *Example of compressed STA trace (filter 4-12 Hz) at the time of the 17 August 1999 event. The two peaks correspond to the P and S phase respectively.*

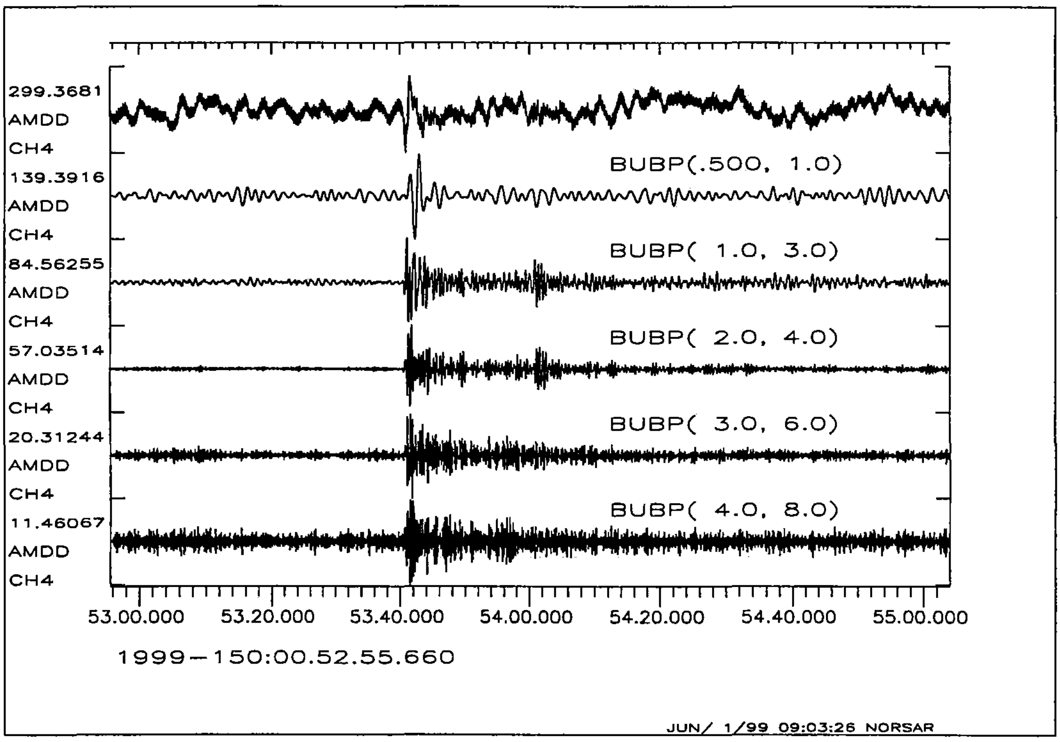

Fig. 6.5.5. *Broad-band AMD data, filtered in a suite of frequency bands, for an earthquake in the Philippine Islands region on 30 May 1999.*

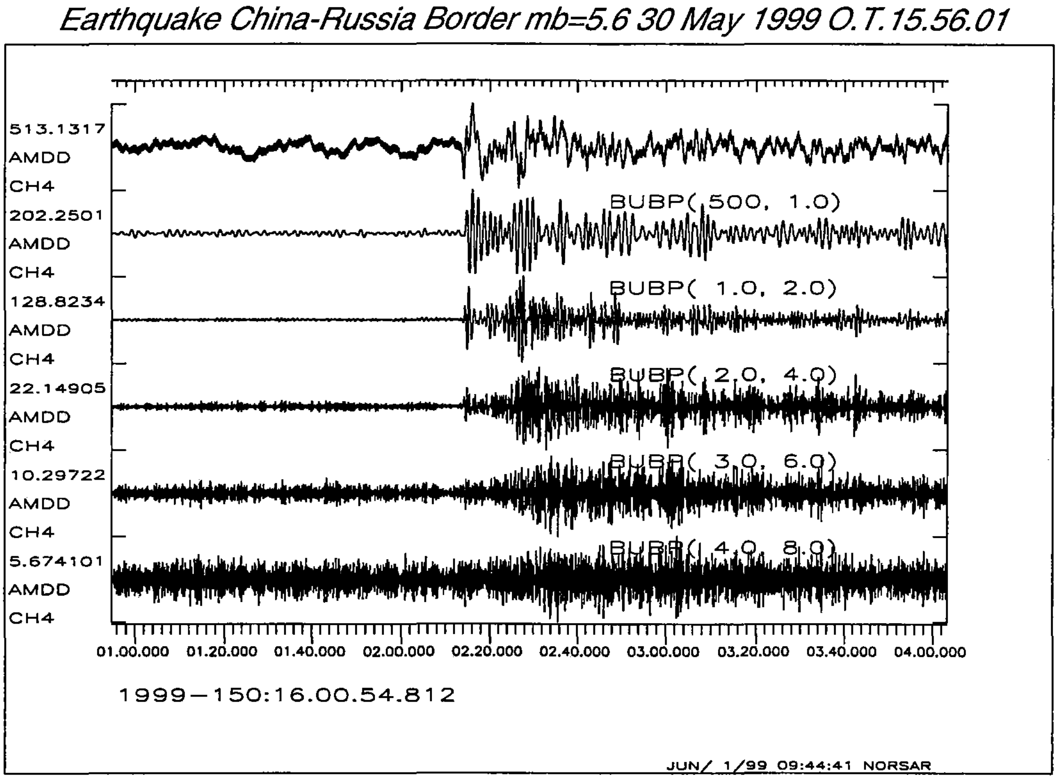

Fig. 6.5.6. *Broad-band AMD data, filtered in a suite of frequency bands, for an earthquake in the E. Russia, NE. China border region on 30 May 1999.*