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VII.7 Event processor program package

In NOR SAR Scientific Report No. 2-86/87, a general detection processing (DP) package for array or single-station data was described (Fyen, 1987). This package was built around an interactive analysis system (SSA - Seismic Signal Analyzer) developed at NOR SAR (Harris and Kværna, 1985). Today, the DP package is used in the routine on-line processing of NOR SAR, NORESS and ARCESS recordings, and it has also been successfully applied to data from the FINESA, Alice Springs and Gräfenberg arrays, as well as single three-component stations.

Building on the same principles, an Event Processing Package (EP) has recently been developed, and is now in regular use to process ARCESS data (since late 1988) and NORESS data (since early 1989). The EP package represents an extension of the RONAPP system (Mykkeltveit and Bungum, 1984), and is designed primarily for automated processing of single-array or three-component station data, with options to conduct various types of multiarray and multistation analyses in an automatic or interactive mode. In the automatic mode of operation, phase detections will be analyzed, grouped and associated, with automatic location solutions provided together with trace plots as shown in examples later in this section.

Besides the regular (continuous) mode of operation, the EP package also offers the flexibility to provide complete interactive or semi-automatic analysis of seismic recordings, using the SSA macro-language to create, in a simple fashion, sequences of commands that may be built up to execute very complex analysis procedures. This is a feature that has been found extremely useful, both in research projects and for the purpose of evaluating array performance and data quality.

The EP system possesses the same flexibility as the DP and SSA packages as far as diversity of input data is concerned. Thus, it does not rely upon a single data format, but uses instead the general purpose NOR SAR package ARMAN for reading data. ARMAN supports at present the following data formats: NOR SAR, NORESS, ARCESS, FINESA, Gräfenberg, CSS

2.8 and the GSE format. Input medium may be either disk loop (i.e., on-line disk data), disk files or magnetic tapes.

Fig. VII.7.1 gives a flow chart illustrating the general structure of the NORSAR analysis packages (DP,EP,SSA). The systems are modular, with the common interface between the processes consisting of a "data stack" and a "blackboard" resident on disk. A further description of these features may be found in Harris and Kverna (1985).

Figs. VII.7.2 - VII.7.4 give examples of automatically generated output plots from the EP process for a regional event recorded at NORESS. The following three panels are shown: a) six minutes of filtered data, including best P and S beams, b) one minute of P-wave data, including filtered and unfiltered beam traces, c) a corresponding plot for the S (or Lg) phase. Previous experience at NORSAR has shown that this amount of detail is essential in order for the analyst to obtain a proper evaluation of array performance.

In future applications, the EP package will provide a supplement to the IAS system currently under implementation. Whereas the IAS will emphasize the expert system approach to multi-array detection, location and characterization of seismic events, the EP system will comprise extensive automatic and interactive analysis of array data using more traditional methods of analysis. We thus expect that a comparison of the performance between these two systems will give an excellent opportunity to evaluate the improvements offered by IAS. At the same time, we anticipate that this mode of parallel operation and continuous comparison will contribute to identify possibilities for further enhancements of the initial IAS version. Furthermore, the flexibility offered by the EP package will continue to make it useful as a tool in a more general research and evaluation context.

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References

- Fyen, J. (1987): Improvements and modifications. Semiann. Tech. Summ., 1 Oct 1986 - 31 Mar 1987, NORSAR Sci. Rep. No. 2-86/87, Kjeller, Norway.
- Harris, D.B. and T. Kværna (1985): Interactive analysis program for use with NORESS data, Semiann. Tech. Summ., 1 Oct 1984 - 31 Mar 1985, NORSAR Sci. Rep. No. 2-84/85, Kjeller, Norway.
- Mykkeltveit, S. and H. Bungum (1984): Processing of regional events using data from small-aperture arrays, Bull. Seism. Soc. Am., 74, 2313-2333.

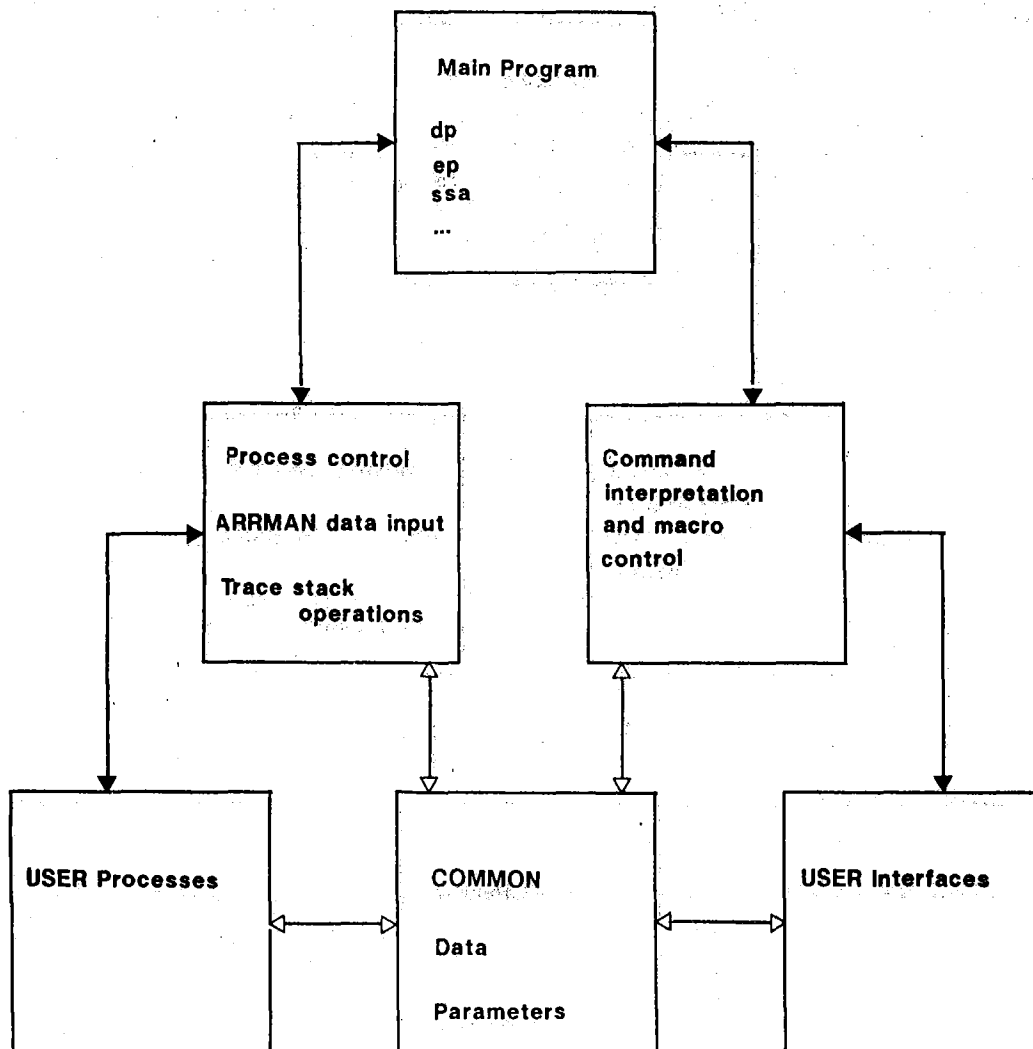


Fig. VII.7.1. Schematic overview of the DP, EP and SSA program structures.

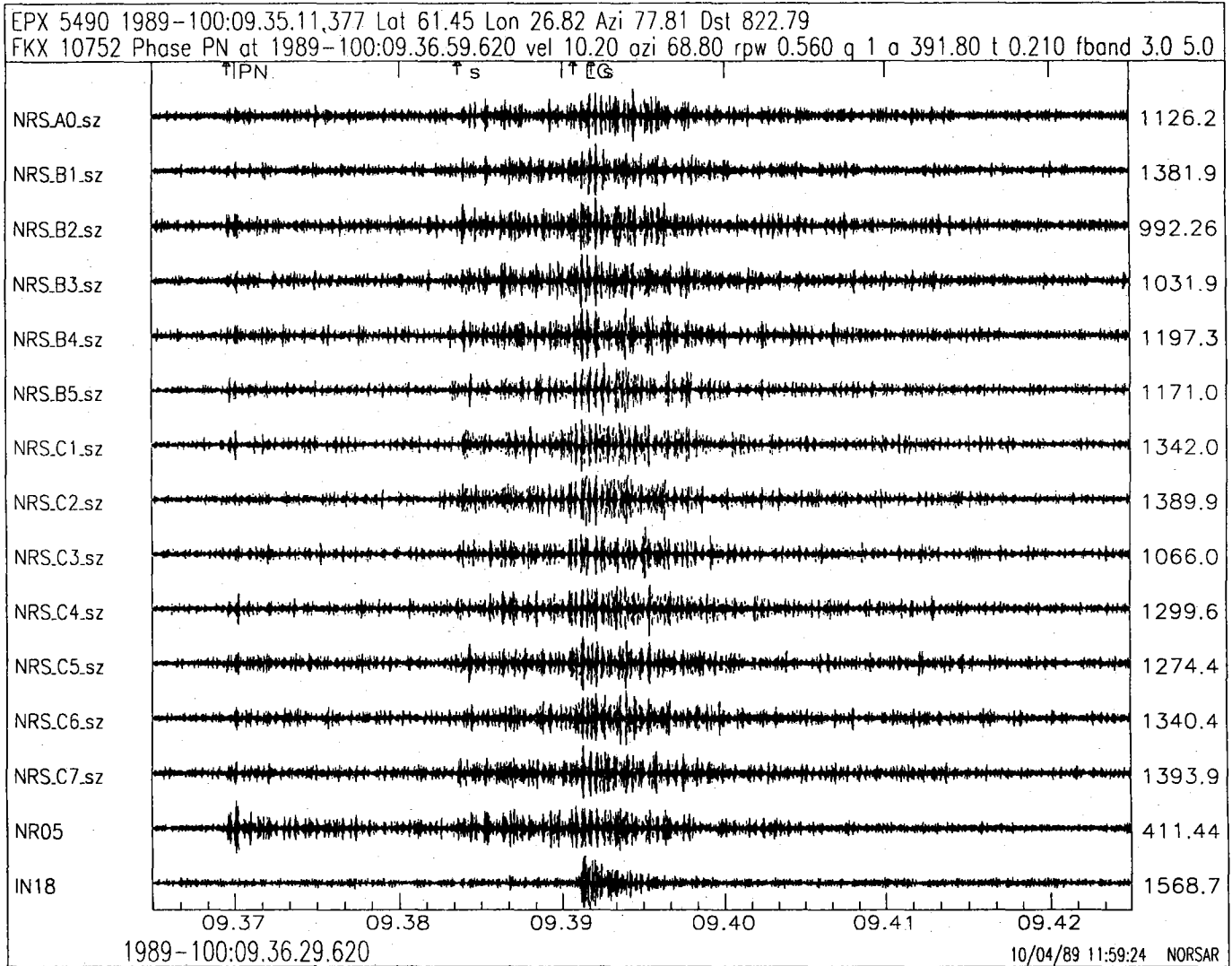


Fig. VII.7.2. Six-minute plot of a regional event located by NORESS. "Best" P and S beams are displayed as the two bottom traces.

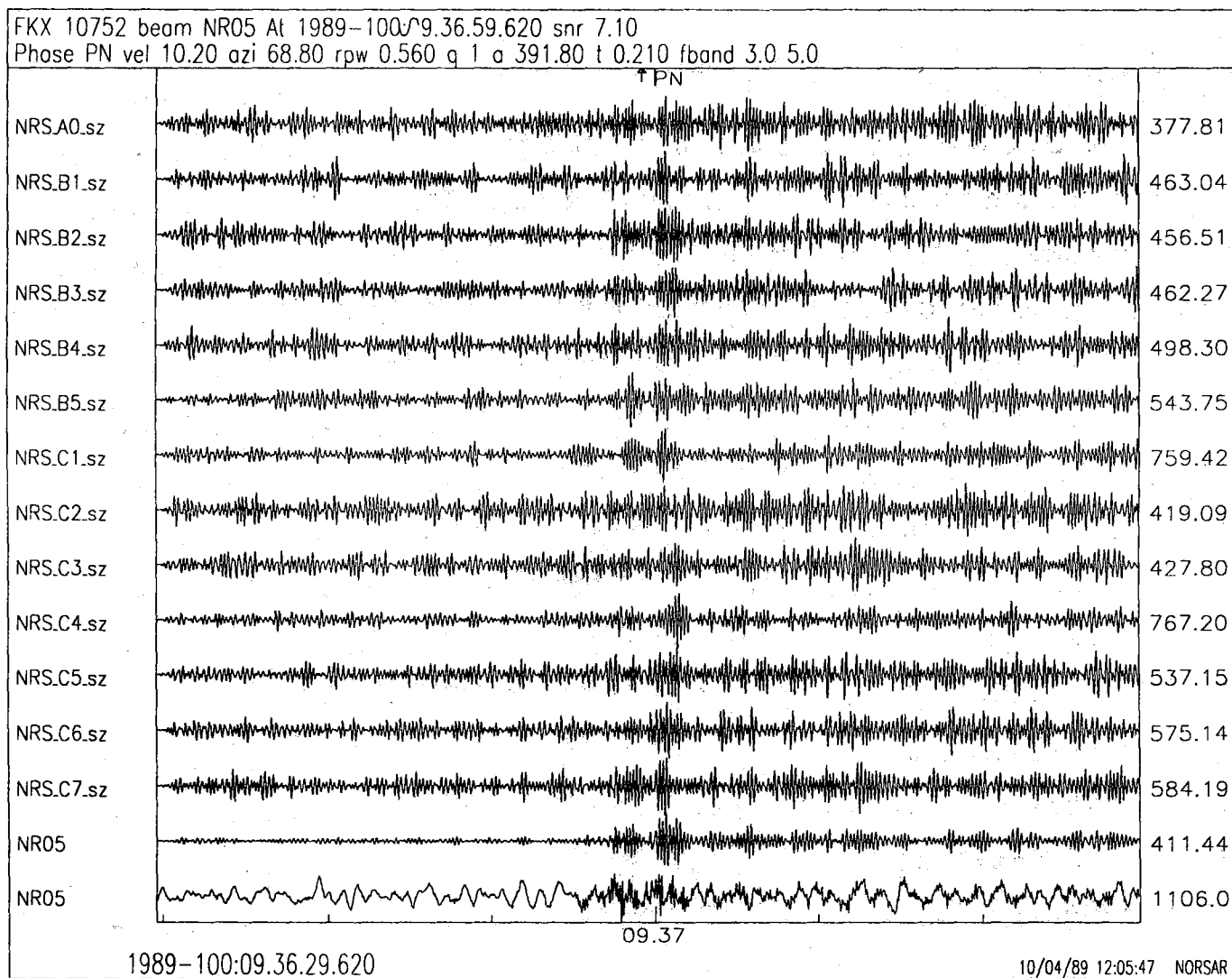


Fig. VII.7.3. Expanded display of the P-phase for the event of Fig. VII.7.2. One minute of data is shown. The best P-beam is shown both filtered and unfiltered.

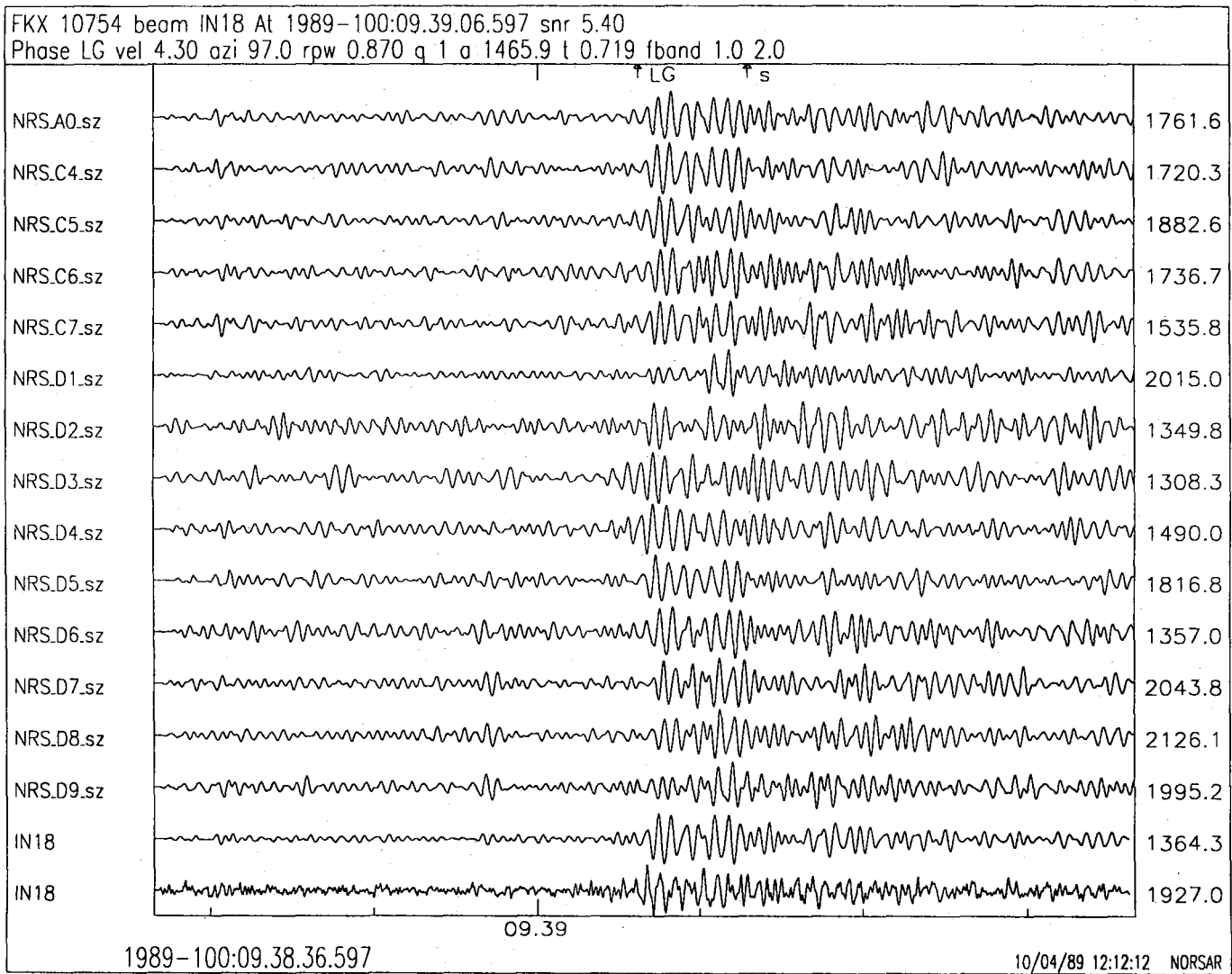


Fig. VII.7.4. Same as Fig. VII.7.3, but corresponding to the Lg phase.