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A new software tool for wide-angle reflection/refraction seismic data processing and representation (WASPAR)

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The seismic methods are the most powerful existing technique to image the structure of the Earth's subsurface. Depending on the system layout, the seismic methods can be divided into near-vertical reflection (NVS) techniques and wide-angle reflection/refraction (WAS) techniques. In contrast to NVS, the development of WAS preprocessing tools has deserved only minor attention to date and most existing tools have been developed by research institutions in order to process data from their own instruments. WAS processing is also done using existing tools as Seismic Unix, but these tools have been chiefly designed for NVS geometries and not all the techniques are therefore well-suited for proper WAS processing.

The main purpose of this work has been to develop a new tool to represent and process WAS data. We have thus created a multi-platform modular software tool called WASPAR that allows processing data from its raw state to a processed record section, and representing it using a friendly interface. WASPAR has been designed in a modular way, using a plug-in architecture to manage all processing modules and raw data access. That way, it is easier to maintain the software tool as well as to expand it with new functionalities. In addition, it is an open and free multi-platform software, written in C++ and already available on Linux and MS Windows. It has been designed as a generic tool, originally developed to process active wide-angle reflection/refraction data with a single interface. The main characteristics of the program are the following ones:

First, the program can potentially read raw data recorded by any supported equipment.

The implemented architecture has been designed to simplify the addition of new raw data formats: when required, a new library (or plug-in) can be defined, which will be directly interpreted by the program.

Second, raw data can be used to create either record sections or a time representation. In record sections the data created in the generation process (or those read from a SEG-Y or SU seismic file) are displayed in traveltime-offset diagrams. The representation is then made by combining some parameters such as fixed-gain, distance-gain, threshold and speed reduction. It is also possible to perform phase-picking operations over the record section representation. In the time representation mode, the program uses a single trace from the record section or a raw data trace. The user is also able to perform various types of zoom and to send the representation to the printer or to an image file that handles different formats. Some key functionalities, such as an algorithm to relocate and re-orientate receivers in marine experiments using water wave arrivals recorded in OBS (Ocean Bottom Seismometers), are still under development.

Finally, the program includes a number of processing facilities and, thanks to its plug-ins architecture, allows easily implementing new ones without modifying the program source code. Each processing technique is included into a different library that is recognised by the program. The first release includes two techniques consisting on a simple frequency filter and a more elaborated one based on polarization properties. At present, we are developing other signal processing techniques, such as phase-weighted stack algorithms and slowness filters that will be added to the program in the future.