

Contribution of the Permanent Seismograph Station at Terra Nova Bay to Global Seismological Research

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During the Austral summer 1988-89 an advanced seismic station was installed close to the Terra Nova Bay Base (location code TNV) in the framework of the participation of *Istituto Nazionale di Geofisica* (ING) to the Italian *Programma Nazionale di Ricerche in Antartide* (PNRA). After test runs, in the Austral summer 1990-91 the station started continuous unmanned operation. Electrical power is provided by a system developed by ENEA, and data acquisition is on the microVAX of the Base. A satellite communication link with the Base computer allows, on request, the monitoring of the state of the instrumentation, as well as the viewing and transferring of data of events related to special interest.

The seismographic sensors installed are Streckeisen STS1/VBB, with a flat frequency response in velocity between 10 Hz and 360 seconds. High-resolution 24bit Quanterra analogue-to-digital converters allow full linearity in a 140 dB dynamic range. This configuration makes up an instrument which can be qualified as very-broad band in frequency response, with a very high dynamic range. The response characteristics make this equipment capable of recording virtually all signals of seismological interest — from earthquakes at regional distance to teleseismic events. Sensitive seismographic sensors require good coupling with solid bedrock and insulation to thermal and air pressure variations. For these reasons they are installed in a 8-meter deep tunnel excavated in granite rock in the surroundings of the Base. No measure was taken for low temperature protection, and instrumentation did not suffer from operating in that environment. The continuous data acquisition — as opposed to a triggered recording mode — and the fully automatic, unmanned operation, secure complete monitoring of ground motion in time. The management is co-ordinated with the Mediterranean Network MEDNET operated by ING. A more detailed description can be found in Morelli et al. (1991).

Data collected span the duration of the Austral summer expeditions of 1989-90, 1990-91, and the first months of 1991 (before a failure of the data transmission cable) and 1992 (before a power failure). Records from 1993 will be retrieved by the next expedition expected to arrive at the Base in november. Seismic records analysed so far have shown a relatively high background noise level at medium-high frequency, possibly due to the rough environmental conditions (wind, ice creep) and to the bustling anthropic activity of the Base (Vinci et al., 1992). Because of this, the choice of installation in a tunnel — for better protection — has shown to be a particularly important factor. The

amount of data collected by station TNV is reaching the amount needed for studying the main features of crustal structure using the receiver function approach for teleseisms.

Installation of equipment with these characteristics in any region of the world is of great importance for seismologists. It gathers even more prominence when the site is situated in a location so alien to seismic instrumentation as Antarctica is. This happens because of the obvious, basic need of seismology for a uniform and dense global distribution of observation points of the elastic field generated by earthquakes. The presence of large gaps in geographical distribution of high quality instruments limits the resolution obtainable by studies of the deep structure of the Earth, and by studies of the source characteristics of large earthquakes. Large efforts are being made by many Institutions — national and international — to improve the distribution of digital seismograph stations, with special emphasis on areas left uncovered because of difficult situations.

In this framework the permanent seismograph station installed by PNRA in Terra Nova Bay has been greatly appreciated by the international community. A significant recognition of the consideration it received is its inclusion in the primary set of 100 stations, distributed world-wide chosen by the international Federation of Seismograph Digital Networks. Of these stations 5 are located in Antarctica, most of them however with worse instrumental characteristics than TNV.

Besides global applications, a very-broad band seismograph also yields useful data for more local studies, based on the recording of local and regional earthquakes. In addition, techniques based on the retrieval of the broad-band receiver function allow reconstruction of the main features of crustal structure. This approach complements other seismological investigations such as those based on active seismics.

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