Permanent deep-sea seismic sensors

June 6 2005

A submarine seismic sensor was recently set in place at 2400 m depth, off Toulon. The instrument was attached to a neutrino telescope developed by the international scientific programme Antares. For the first time in Europe, this sensor, designed by a partnership between GÃ©osciences Azur (Mixed Research Unit IRD/CNRS/UPMC/UNSA, Villefranche sur Mer) and Guralp System (United Kingdom), with the financial support of INSU, Villefranche Oceanological Observatory and the Provence-Alpes-CÃ´te d'Azur Regional Council, can send real-time deep-sea seismic activity data recorded for the region and for the whole world.

Deployment of this broad-band sensor by the IFREMER ROV "Victor" allows testing of the installation parameters necessary for accurate observation of earthquakes that occur locally, within the region or elsewhere throughout the globe. The project has also resulted in new developments in deep-ocean technology and skills.

Three great challenges face scientists in efforts to achieve high-quality long-term observation: resistance of instruments and cables to enormous deep-sea water pressures; resistance of instruments to corrosion in the marine environment; and perfect coherence between the equipment and the electronic systems incorporated to ensure remote control and monitoring.

The Antares programme conducted off Toulon, for which the CPPM at Marseille-Luminy University is the host laboratory, gave the GÃ©osciences Azur team a unique opportunity to take up these

challenges and develop seismological techniques that could subsequently be 'exported' for application in the world's earthquake zones. In several coastal regions of the globe, seismic risk comes from strong submarine earthquakes that can occur. Accurate study of such activity is therefore important for devising improved risk-assessment systems. That is why marine sensors are necessary.

The observation tools scientists currently have at their disposal for conducting research programmes are stand-alone seismological sensors or OBSs (Ocean Bottom Seismometers), cast off from the surface with their batteries and built-in memory which confers several months' recording capacity. They come to rest freely on the ocean floor. At the end of the prescribed recording period they are brought to the surface by remote control. However, data analysis cannot be performed until the seismometer has been retrieved.

Even though it is not a means of earthquake prediction, seismological surveillance can allow rapid assessment of an event's magnitude and location; and hence of their impact. It requires real-time transmission of data provided by the sensor networks in place.

In this aspect too, the experiment under way is bringing with it an improvement in reliability of the technological systems used: digital ground movement recordings made by the sensor are transmitted by a 40 km long cable which links all the elements of the Antares experiment to the coast; from there they are relayed by the Internet to the GÃ©osciences Azur laboratory.

The laboratory's next objective is to deploy a similar sensor in the Ligurian Sea in order to complete its regional earthquake watch system.

Source: Institut de Recherche Pour le DÃ©veloppemen