HIGH-RESOLUTION SEISMIC ARRAY EXPERIMENT IN THE HUALIEN AREA

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ABSTRACT

The island of Taiwan is located along the Philippine Sea - Eurasian plate boundary. It is characterized by the collision of a volcanic arc with a stable continental margin, and the transition between active subduction zones and an active collision zone. Earthquake activity along this very active boundary is among the highest in the world.Many tectonic features in and around the Taiwan region have started to emerge from the analysis of the available data base of the two modern telemetered seismic networks(IES and CWB networks,now these two networks have been merged together and operated by CWB), and from the island-wide gravity survey. Details of these tectonic features can , however not be resolved by analysis of the existing data base simply because of the inherent limitations of the traditional seismic networks. These limitations include low dynamic range, large station spacings, and single-component recordings.Further advances in our understanding of tectonic evolution and structures in and around Taiwan have to depend on new observations using better instruments.

Several PANDA (Portable Array for Numerical Data Acquisition, developed by the Memphis State University) projects have been successfully demonstrated the importance of sensitive and high dynamic-range seismic instruments in the improvement of data quality and their interpretations.After many meetings during the past few years between the authors, a project of the High-resolution Seismic Array Experiment in the Taiwan Area is proposed. The ultimate goal is to overcome the inherent limitations in today's seismic observations in the Taiwan region by combining as many state-of-the-art land seismic stations and

ocean-bottom seismographs (OBS) as possible to construct a comprehensive seismic array study that will take advantage of the abundant earthquake sources in and around Taiwan.Considering both the spatial resolution and spatial coverage associate dwith various scientific targets and limitations in radio telemetry due to high mountain ranges over two thirds of the island, an optimum seismic array study of the very complicated Taiwan area will need at least three deployments, each covering one third of the island, using about 200 three-component seismic stations and 12 OBS. However, we have agreed that a prototype seismic array experiment in the Hualien area before the large-scale experiment will provide an excellent exercise for us to gain unprecedented experience in designing optimum seismic array, seismic array operation, data processing, and interpretation of high-resolution results that are unique to the area and are critical for a future large-scale seismic array experiment for the entire area .

The 30 PANDA II(the second generation of the PANDA)stations have been currently deployed in the Hualien area since late-July 1993 and will be continued for a year. Each station is equipped with a 2-Hz three-component seismometer and has four channels with three data channels and one gain channel. The PANDA II system has a maximum of 138 dB dynamic range by using a five-step gain ranging system which will automatically adjust gain in 18 dB steps to all three components. Seismic signals are telemetered by radio to a recording center where two PC-486 computers are used for on-line digital data aquisition and off-line data analysis.This array covers an area roughly 60*30 km with 5 to 10 km interstation spacing, extending from oceanic crust (the Coastal Mountain Range) across a suture zone (The Longitudinal Valley) into continental crust (the Central Mountain Range).More than 2000 local and regional earthquakes with magnitude up to 5.4 have been on-scale recorded. Significant differences on waveform and travel time residuals can be seen between stations located on the oceanic crust and on the continental crust.Several secondary arrivals can also be clearly identified between the direct P and S arrivals. Accurate earthquake locations can be used to image the transition of crustal structures from oceanic into continental plates.