ABSTRACT

The early experiments of seismic array use for discrimination purposes led, in the mid-1970s, to the view that large scale arrays were unattractive due to the loss of waveform coherence as scales larger than a few tens of kilometers. Consequently, small aperture arrays were preferred for detection, location and discrimination, and are an element of the present PIS.

A variety of large-scale regional seismic monitoring networks for seismic hazard reduction and basic research are now available. A highly sensitive and accurate array can suppress noise and enhance waveform features. However, the large station spread and independent station time bases virtually guarantee that crustal structure and instrument string variations will make absolute time measurements problematic. Relative time and slowness measurements, after adjustment for receiver statics, are quite feasible given the constraints. While having absolute time base impacts regional array use for event location, it is still beneficial for waveform- and waveform-based event studies.

We show two examples of how regional seismic arrays benefit earth structure studies: in subduction zones and in the inner core of the earth. The regional network in the United Kingdom (~100 stations, slowness resolution $8 \times 10^{-8}$ s/km) provided data with which the seismic discontinuities at 410 and 660 km were traced through the Lus-Brion subduction zone in the western Pacific. Array processing of nearby earthquakes illuminating the discontinuities revealed their locations by reflections and conversions of direct waves as the discontinuities. HiNet in Japan (~800 stations, slowness resolution $5 \times 10^{-8}$ s/km) provided data with which high frequency records of the inner core shear waves, PKIKP were obtained by array processing methods. Compared to PKP and PKIKP also recorded by Hi-Net, the PKIKP waveform has extra pulses in a that suggest shear-wave splitting in the inner core.

These studies show the potential that regional array use has for discrimination work. Greater waveform fidelity enhances detectability of depth phases associated with natural events. Relative slowness estimates between direct and later arriving phases provide rapid and large information that constrains source locations. The free availability of data also means that the analyses may be replicated by any national agency. The losers are all beneficial as an element of a global seismic event monitoring facility.