

Waveforms of P, PP, S, and SS Waves Traversing Beneath Northwestern Australia

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In order to understand upper-mantle velocity structure for a region including an old continental lithosphere, we study waveforms of P, PP, S, and SS waves from shallow earthquakes around Papua New Guinea for the epicentral distance range from 10 to 45 degree. These events traverse the mantle beneath the north and west of Australia with Precambrian outcrop. The SKIPPY project with a set of deployments of portable broad-band instruments across Australia from 1993 to 1996, has been followed by further deployments by the Australian National University in the Kimberley region of north-west Australia in 1997-1998 and in Western Australia in 2000-2001. In this study, we exploit data from these deployments with a bandpass-filter between 0.03 and 0.1 Hz preceded by integration in time to obtain the displacement waveforms. Clear waveforms of P, PP, S, and SS can be observed in several record sections where the mid-points lie beneath the Arafura Sea and Northern Territory. We compute theoretical seismograms for 1-D velocity models derived from short-period travel-time data, including the global model ak135 and the regional models from Kennett et al. (1994) and Kaiho and Kennett (2000). The synthetic seismograms are compared with each other and with the corresponding observations. For S and SS waves, in addition to variations of the travel times depending on the nature of the models, differences in waveforms are expected for epicentral distances less than 20 degree and from 25 to 45 degree. For record sections recorded in Western Australia in the distance ranges, the regional models, which have a lid of slightly higher speed than ak135, generally match the observed waveforms. The models with a lid of very high speed for Central Australia tend to predict too fast arrivals for S and SS waves and too complicated waveforms for SS waves. Attenuation models can affect the waveforms in long distances, although the effect is not always significant. P-wave waveforms also vary, depending on the models, but the variations are not as large as those of S waves.