Analysis of weak seismic signals from a small aperture array - possibilities and limits

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Data from the Australian Warramunga Array have been analysed with various array methods. Eleven weak coherent onsets have been found which can be interpreted as pPcP phases. Another interpretation is a SdP reflection at the top of D". This Interpretation seems unlikely since a large density and velocity contrast ist needed to get the observed amplitudes.

The travel time of pPcP depends on the source depth and the epicentral distance only whereas the travel time of SdP depends also on the contrast and depth of the D" reflector and may vary by +/-15 seconds when changing the depth of the D" reflector by +/-100km.

A synthetic seismogram analysis shows that SdP can be identified by using vespagram techniques although an array aperture of at least two degrees is necessary. Small arrays like the Warramunga Array are not appropriate for the detection of such small phases. In the synthetic seismogram sections phases with a similar slowness to SdP and pPcP can be seen in the same time window which are due to reflections and conversions at discontinuities in the mantle. Although the amplitudes of these phases are small compared with ScP they can cover the SdP and pPcP phases due to the bad slowness resolution of small arrays.

It is important to notice that array methods are limited if they are applied to small phases and small aperture arrays. the smaller the signal/noise ratio the more important is the calculation of the statistical variance of the slowness and backazimuth values. The errors can be so large that a calculation of the direction of incidence, slowness and backazimuth, respectively, is not possible.