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Converting surface motions to subsurface wavefields

Dave Nichols[1]

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ABSTRACT

The measured quantities in nine-component seismic data recorded at a free surface are displacements in the X, Y, and Z directions. The quantities we would like to use in seismic imaging are the amplitudes of the upcoming P, S1 and S2 waves. If the properties of the near-surface are known exactly it is possible to obtain the wave amplitudes from the measurements. However if the properties of the near-surface are unknown they must be estimated as the conversion is performed. It is not possible to estimate accurately all the elastic properties of the near-surface from reflection seismic data, so some approximate conversion scheme in which only a few parameters need to be estimated is required. The conversion scheme most often used is valid for waves propagating vertically or near vertically in a medium exhibiting orthorhombic symmetry. I present a scheme that uses approximations valid for waves arriving over a larger range of angles in a medium with the more general monoclinic symmetry. Three main classes of methods may be used to choose the parameters that "best" perform the conversion from surface motions to wave amplitudes. These are, searching the full parameter space, interactive selection of parameters, and automatic search of the parameter space.

[1]**email:** not available