Looking for PmP in vertical and radial components in Brazil using waveform autocorrelation technique

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Abstract

Receiver Function (RF) is one of the techniques used over time to obtain crustal structure. It is an approach that utilizes the incidence of a wave at an associated station, based on a P-wave radiated from a teleseism, ideally with an epicenter located between 30° and 90° away from the respective station, in order to obtain a nearly vertically oriented ray beneath the subsurface. This record conveys characteristics of the source, the medium it propagated through, as well as the instrument response. RF allows, through the process of deconvolution, the isolation of the medium response beneath a station, enabling the calculation of the depth at which the interface is located beneath the surface. To achieve this, RF is based on the recovery of seismic trace phases related to the conversion of the primary wave (P) into the secondary wave (S) upon interaction with an interface. However, a disadvantage of the method is that only such phases are recovered. By using autocorrelation between the vertical and radial components of the record, combined with the results proposed by RF, it is possible to recover the phase associated with the Moho reflection (PmP), which is discarded during the deconvolution process. The PmP phase allows for obtaining an average P-wave velocity (Vp) of a medium independently, which brings forth more reliable parameters, as it is possible to determine the S-wave velocity (Vs) and the layer thickness in an associated manner, considering the mathematical expressions that relate them. This eliminates the need to infer one of the parameters and propagate uncertainties, resulting in more reliable data. In addition to PmP, the autocorrelation process allows for the recovery of other phases associated with the transmitted wave, and it is also possible to recover noise amplitudes that are not initially associated with the transmitted wave. For the applicability of the technique, it is necessary to select teleseismic events with epicentral distances between 30° and 90°, as well as magnitudes associated with generating a signal of good quality, that is, with sufficiently clear arrivals, considering the good signal-to-noise ratio. Furthermore, other preprocessing steps are required, such as data filtering and trimming, ensuring that traces have the same number of points and highlighting the window of interest. With the above in mind, the necessary processing steps are performed to obtain the new estimates of the medium.