Using Receiver Functions to estimate the new crustal thickness and Vp/Vs in the Northern region and adjacent provinces in Brazil.

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Abstract

The goal of this paper is to estimate the crustal thickness and Vp/Vs ratio in the Northern region of Brazil and adjacent provinces, using P wave Receiver Functions (PRF) to plot Hk stackings of the stations in these areas. The teleseismic waveforms were obtained from several broadband seismographic stations belonging to the Seismological Observatory. PRF are able to use three-component seismograms to compute temporal series, providing us the crustal thickness in relation to the Vp/Vs ratio of the region beneath a seismographic station. For this work, we chose stations from the network of the Seismological Observatory of University of Brasília (SIS-UnB) to calculate their PRF and analyze the results geologically, regarding their age, composition, and seismicity. The PRF method is done by a temporal series calculated on the three components of a seismogram that uses teleseismic events in distances ranging from 30º and 90º, with incidence angle close to the vertical. When the P-wave reaches a discontinuity, part of its energy is converted into S-wave (Ps). Therefore, in order to concentrate all the energy of the horizontal components of the Ps-wave, it is necessary to rotate the seismogram using the Radial-tangential coordinate system. In the present study, we are going to use deconvolution in the time domain, which is based on the theory of linear inversion. Once we have the results of the PRFs and selected the ones eligible, we follow up with the Hk Stacking method. It is literally the stacking of all the data generated in the PRFs, which will plot a diagram relating H (crustal thickness) and the Vp/Vs ratio. Therefore, a preliminary average thickness for the Amazonian Craton was obtained, varying from 40.0km to 45.0km. Among the results, we can also find values for the Vp/Vs ratio varying from a minimum of 1.70 to a maximum of 1.74. For adjacent provinces, the results for crustal thickness varied from 36.6km to 44.0km. For Vp/Vs values, we found a minimum of 1.65 and a maximum of 1.83. While those results are still preliminary, they show consistency with previous works and are important to increase the number of crustal estimate and Vp/Vs in Brazil and can be used to help improve our understanding of the crust evolution.