T1.2-P13

CRUSTAL STRUCTURE OF THE AMAZON CRATON, BRAZIL

Diogo F. Albuquerque[1], George S. França[1], Lucas V. Barros[1], Lucas P. Moreira[2], Marcelo Assumpção[3].
[1]Seismological Observatory (SIS-UnB), [2]Federal Institute of Brasília (IFB), [3]University of São Paulo (IAG-USP).

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Introduction

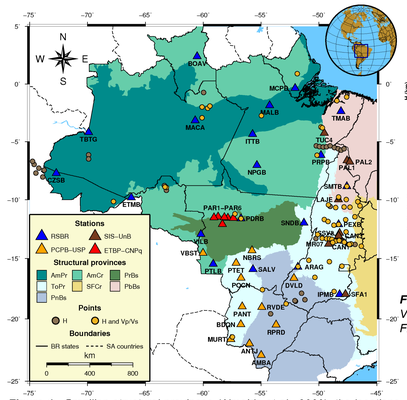
The study of the crust using receiver functions provide valuable geological information, such as average crustal composition, formation dynamics and tectonic evolution of a region, as well as serve as an initial reference for the generation of seismic wave velocity models to improve earthquake location. In order to fill in the crustal information gaps in the Amazon Craton (Brazil) and adjacent provinces, we used receiver functions (Ligorría & Ammon, 1991) and H-k stacking (Zhu & Kanamori, 2000) to estimate crustal thickness and the Vp/Vs ratio for 47 broad-band stations (Figure 1).

Methods

The **receiver functions (RF)** were computed using the iterative time-domain deconvolution (ITERDECON) of Ligorría & Ammon (1999).

Crustal thickness (H) and Vp/Vs ratios were estimated using **H-k stacking** (Zhu & Kanamori, 2000), with the following input parameters: Vp=6.4 km/s and w_1=0.7, w_2=0.2 and w_3=0.1 (weights for Ps and multiples).

Data from 47 stations (figure 1), belonging to 4 networks, were processed in this research: RSBR (20 stations), SIS-UnB (9 stations), ETBP-CNPq (6 stations), PCPB-USP (12 stations).



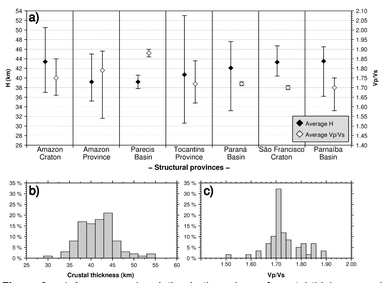


***Figure 1** - Brazilian structural provinces (Almeida et al., 2000), the locations of the seismic stations, of thecrustal thickness and Vp/Vs estimates obtained in the references. Caption acronyms: Amazon Province(AmPr), Amazon Craton (AmCr), Parecis Basin (PrBs), Tocantins Province (ToPr), São Francisco Craton(SFCr), Parnaiba Basin (PbBs) and Paraná Basin (PnBs).*

***Figure 2** - a) Average and variation in the values of crustal thickness and Vp/Vs ratio; b) Frequency distribution (%) of crustal thickness; c) Frequency distribution of Vp/Vs .*

Other 100 data points (Figure 2) were added to better sample the study region (e.g. Krüger et al., 2002; França, 2003; Soares et al., 2006; Bianchi, 2008; Lloyd et al., 2010; Pavão et al., 2012; Assumpção et al., 2013; Albuquerque, 2014; Trindade et al., 2014; IRIS/EARS, 2017).

Results

The crustal thickness (H) in the Amazon Craton and adjacent provinces is quite variable, with the lowest value found for the Amazon Province (27.4 km, Fig. 3, sattion CZSB) and the largest for the Amazon Craton, in the region known as the Guiana Shield, reaching 55.3 km (Fig. 3, station BOAV).

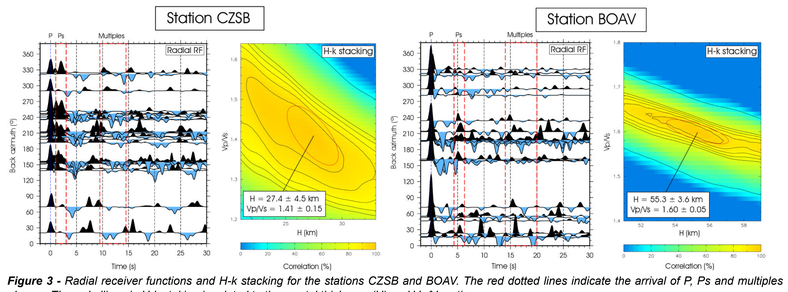


***Figure 3** - Radial receiver functions and H-k stacking for the stations CZSB and BOAV. The red dotted lines indicate the arrival of P, Ps and multiples phases. The red ellipse in H-k staking is related to the crustal thickness (H) and Vp/Vs ratio.*

The regions with thicker crust, often over 43 km, located in the Amazonian Craton and Paraná Basin, may be related to ancient cratonic blocks (Fig. 4), which were part of the paleocontinents Amazon, São Francisco/Congo and Paranapanema, also confirmed by geophysical data (Mantovani et al., 2005).

There is a good correlation between crustal thickness and the limits of the Amazon Craton. Therefore, it is possible to delimit it as the NW crustal region with thickness greater than 39 km (Fig. 4, black dotted line). The distribution of seismicity tends to concentrate around the Amazon Craton boundaries.

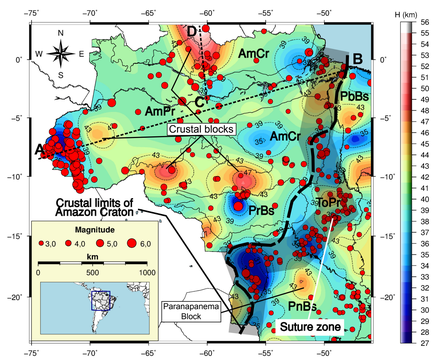


***Figure 4** - Interpolation of the data obtained in this work and in the literature. The red circles represent earthquakes occurred between 1950 and 2016. The dashed black line indicates the crustal boundaries of the Amazon Craton and the darkened region indicates the suture zone between the craton and the other provinces.*

According to Mooney et al. (2012) the the limits of a craton are regions of stress concentration. Assumpção et al. (2014) also interpret the seismicity as a function of lithospheric thinning, as we can see in the suture zone of the craton and other provinces (Fig.4).

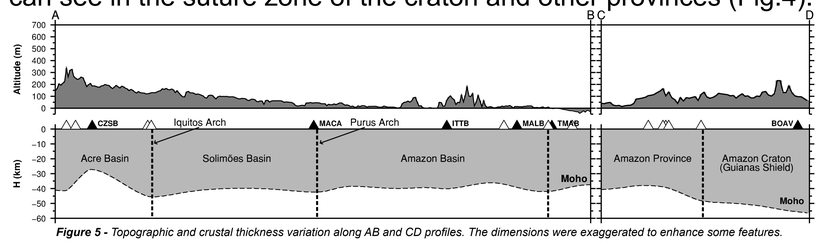


***Figure 5** - Topographic and crustal thickness variation along AB and CD profiles. The dimensions were exaggerated to enhance some features.*

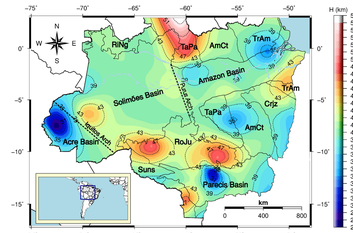


***Figure 6** - Crustal thickness interpolation map combining all the results for the Amazon Craton according to the its geochronological provinces: Carajás (Crjc), Amazônia Central (AmCt), Transamazonas (TrAm), Tapajós-Parima (TaPa), Rio Negro (RiNg), Rondônia- uruena (RoJu) e Sunsás topographic and crustal thickness variation along AB and CD profiles. The dimensions were exaggerated to enhance some features.(Suns).*

A central domain can be established in the Amazon Province (Fig. 5), with a crustal thickness ranging from 40 to 45 km, composed of the Solimões and Amazon basins. It also possible to see that Moho dips in the direction of the North of Amazon Craton (Fig. 5, profile CD).

The definition of basin boundaries by crustal thickness variation also coincides with the approximate location of the arches that separate them, such as the Purus Arch, between the Amazon and Solimões basins, and the Arch of Iquitos (Fig. 6).

Conclusions

1) The Amazon Craton is the region delimitated by an average crustal thickness usually greater than 39 km (Fig. 4, black dotted line).

2) The regions with H often over 43 km in the Amazonian Craton and Paraná Basin may be related to ancient cratonic blocks, which were part of the paleocontinents Amazon, São Francisco/Congo and Paranapanema. The latter, in turn, also has existence confirmed by geophysical data (Mantovani et al., 2005).

3) The limits of the Amazon Craton, in terms of crustal thickness, follows the pattern of seismicity distribution at its edges, which is related to a suture zone between the paleocontinents that collided in Brasiliano event.