

PRELIMINARY RESULTS OF AMBIENT NOISE SEISMIC TOMOGRAPHY IN THE BORBOREMA PROVINCE

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ABSTRACT

Preliminary results of the application of ambient noise seismic tomography method in NE of Brazil are presented in this paper. The goal is to investigate the geological structure of the crust of the Borborema Province from maps of the distribution of group velocities of Rayleigh waves in the region. The method is based on obtaining the empirical Green function between a pair of stations, from the cross correlation between the simultaneously ambient noise records to both stations. The dispersion curves obtained in the process provide information about the velocity of the medium, and a two-dimensional velocity map for a seismic array can be obtained from the tomographic inversion of times obtained for each period. We used data from 16 stations distributed in the east and north of the Province (Figure 01), with up to seven stations operating simultaneously. Velocity maps were obtained for periods of 10, 15 and 20 seconds, with 36, 36 and 29 paths, respectively (Figures 02, 03 and 04). Although not provide information related to the depth, the periods maps provide important information about the crustal structures. Important high-velocity anomaly was observed in the northeastern part of the Borborema Province. This anomaly correlates well with the core position of the Archean-Paleoproterozoic São José do Campestre Massif. This seismic behavior is expected for oldest and most stable regions. The limits of the anomaly coincides reasonably with the Portalegre shear zone in the west, and Patos in the south, mainly in the map of 20 seconds, coinciding with the limits proposed for the tectonic domain Rio Grande do Norte. In the maps of 10 and 15 seconds, which represents shallower structures, this anomaly is smaller, and at west it appears low velocity anomaly, which should be related to sedimentary rocks of the Potiguar Basin. Transverse Zone is marked by a transition from low to high velocity from north to south, with the southern sub-province characterized by low velocities. Strong low velocity anomaly can be seen in the map of 20 seconds between the Portalegre and Senador Pompeu shear zones, in the northern portion of the Province. This anomaly coincides with the Trend Cariri-Potiguar, and must be related to the process of rifting occurred in the region during the Cretaceous, which could have caused thinning of the crust. In general, areas of lithosphere are marked by low seismic velocity anomalies. The maps of 10 to 15 seconds in the same region are observed abnormalities high velocities, which indicates the difference between the seismic shallower and deeper or problems on the inversion procedure. The maps of 20 seconds may reflect a greater influence in the region of the upper mantle as a consequence of lithospheric thinning caused by Rift Potiguar. Some regions have not been interpreted (eg. Pedro II Lineament) due to low path coverage. The next stage of work will include new data to increase coverage of the routes, and get maps of S wave velocity with depth.

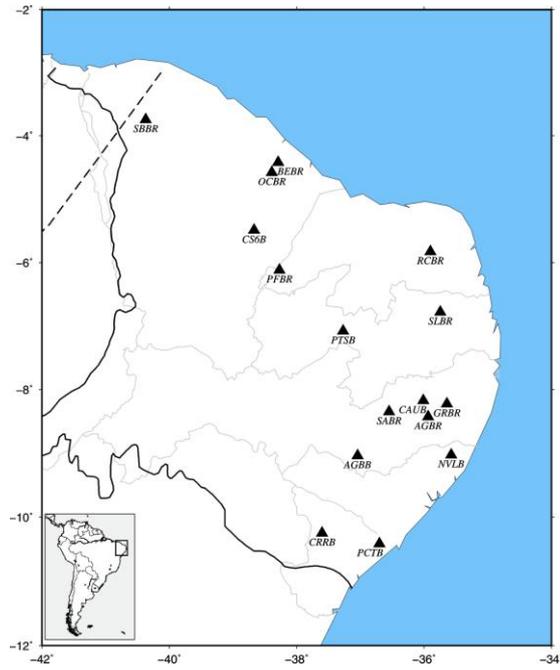


Figure 1: Study area with station distribution. Solid black lines are the limits of Borborema Province with São Francisco Craton (south) and Parnaíba Basin (West). Dashed black line is Transbrasiliano Lineament. Solid gray line is political boundaries.

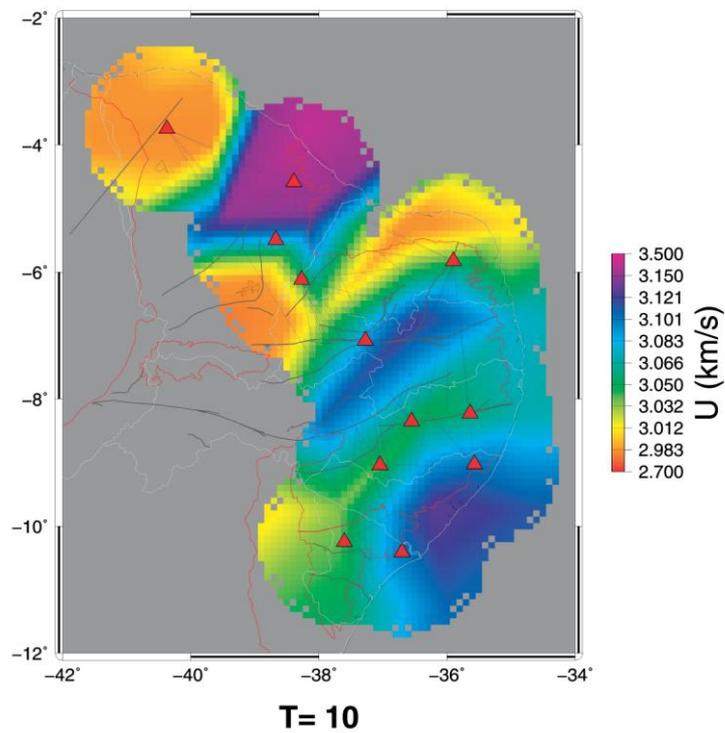


Figure 2: Map of the group velocity distribution for the period of 10 seconds. Red triangles are the stations.

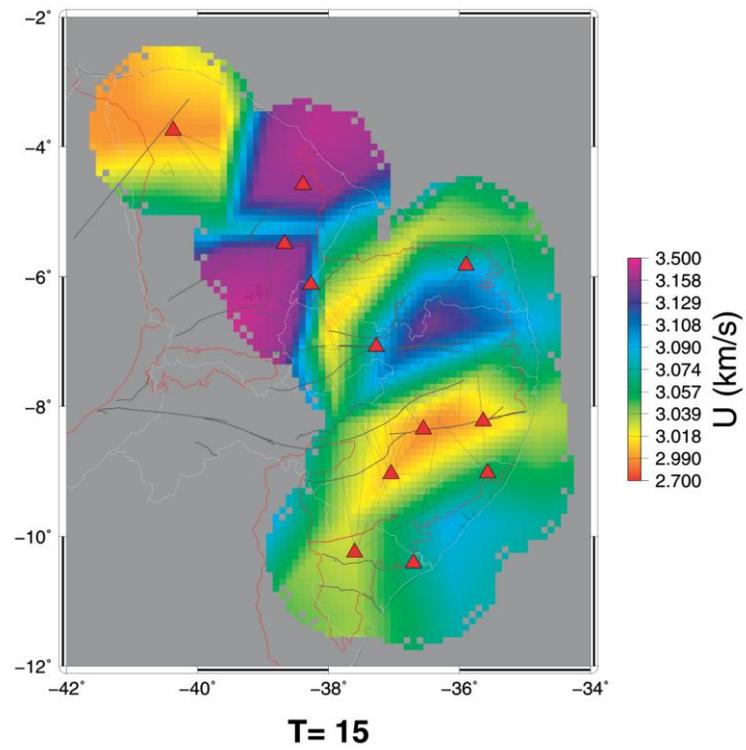


Figure 3: Map of the group velocity distribution for the period of 15 seconds. Red triangles are the stations.

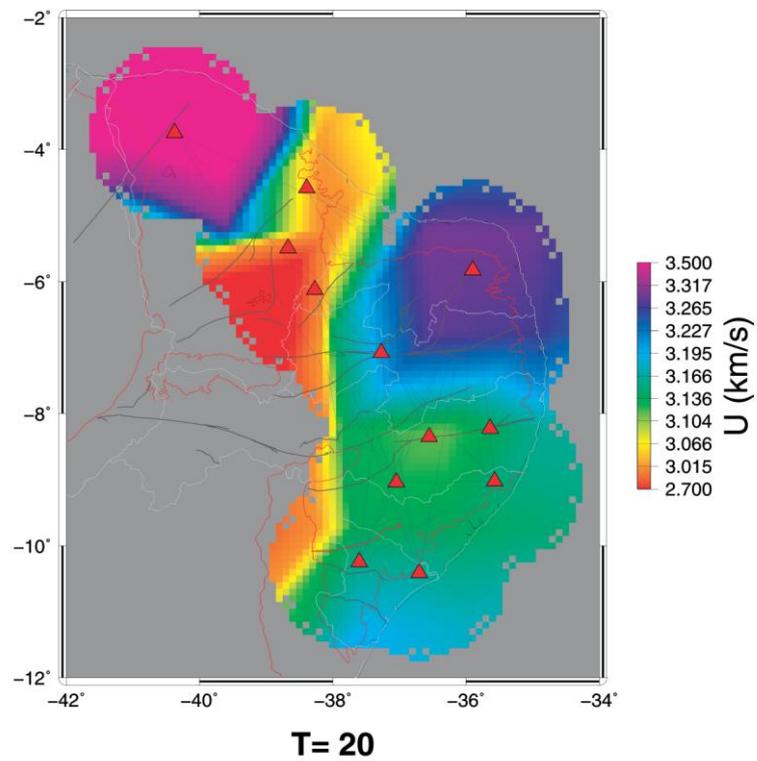


Figure 4: Map of the group velocity distribution for the period of 20 seconds. Red triangles are the stations.