Evaluation Of Herglotz-Wiechert Inversion Using P Wave Travel Times From Brazilian Seismic Network Stations

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Abstract

The Herglotz-Wiechert method, developed in 1910 by Gustav Herglotz and Emile Wiechert, is based on the analytical solution of the inversion of seismic travel times to determine variations of seismic velocity with depth. Here, we present a computational code in Python that implements this inversion methodology, and assess its performance through measurement and inversion of P-wave travel times for 11 earthquakes recorded at 81 seismic stations of the Brazilian Seismographic Network (RSB). The efficiency of the code is assessed through two numerical experiments with synthetic "data", resulting in inverted v(r) functions that accurately match the ak135 global model utilized to generate the synthetic "dataset". The results obtained from the inversion of real data showed that, for depths up to 1000 km, the inverted v(r) functions are similar to those predicted in global Earth models, while for depths between 1000 and 2000 km they present large deviations. Those deviations seem to be dependent on the interpolation strategy utilized to homogenize the integration steps along the T-Δ curves. We conclude that the methodology allows to successfully estimate the variation of P-wave velocity with depth within the continental lithosphere and upper mantle of Brazil.

Keywords: Herglotz-Wiechert Inversion; Upper mantle; Brazilian Seismographic Network.

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Abstract ID: dc78dd, *Contribution type:* Poster Presentation, *Session:* Tectonics & the Structure of the Crust and Upper Mantle, *Submitted by:* THABITA SOFIA GOMES (thabita.sof@hotmail.com).