

EGU22-2580

<https://doi.org/10.5194/egusphere-egu22-2580>

EGU General Assembly 2022

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



Integrated seismic and borehole investigation of the deep weathering structure – case study of Santa Gracia Reserve, Chile

Rahmantara Trichandi^{1,2}, Klaus Bauer¹, Trond Ryberg¹, Klaus Bataille³, and Charlotte M. Krawczyk^{1,2}

¹GFZ Potsdam, Potsdam, Germany

²Technische Universität Berlin, Berlin, Germany

³University of Concepción, Concepción

Subsurface imaging of the critical zone, where regolith is produced from bedrock, plays a significant role in understanding the geological and biological interaction at depths. The depth where we can find the intact bedrock is also often referred to as the weathering front. In the scheme of the EarthShape project, we assess one of the hypotheses which link the advance of weathering front to different climate conditions. We present the seismic investigation result from Santa Gracia National Reserve, Chile, one of the main EarthShape sites, which is in a transitional area between the arid to the semi-arid climatic zone. We investigate the weathering profile of this area by acquiring a 500 m long near-surface seismic profile using weight drop sources and 3-component geophones. With the acquired data, we perform two different seismic imaging methods: 1) Body wave tomography, and 2) Multichannel Analysis of Surface Wave (MASW) with Bayesian inversion. Both methods allow us to image the P- and S-wave velocity of the subsurface down to 80 and 60 meters depth, respectively. In addition to the absolute velocity models, we also produce the vertical velocity gradient model, which also provides us with extra tools in interpreting the weathering structure. The resulting models were then validated by existing borehole data located in the middle of the profile. Using the 87 meters deep borehole information, we identified three major layers in the weathering profiles: saprolite, weathered bedrock, and bedrock. The layers were identified by the different seismic velocities, which represent different stages of weathering in the subsurface. Across the profile, the identified weathering front can be traced down to 30 meters depth and is relatively parallel to the surface topography. The interpreted weathering layers also correlate with existing geochemical analysis of the borehole coring and even another perspective in the multi-disciplinary interpretation of the weathering zone. Accordingly, seismic imaging of the critical zone using different methods allows us to improve the critical zone interpretation, either as a combined or independent approach in regions without borehole data available.