EGU24-16682, updated on 06 Oct 2024
https://doi.org/10.5194/egusphere-egu24-16682
EGU General Assembly 2024

Determination of the shallow S-wave velocity structure and sedimentary thickness offshore central Chile using distributed acoustic sensing.

Clara Vernet, Trabattoni Alister, Diane Rivet, and Marie Baillet
Université Côte d'Azur, Observatoire de la Côte d'Azur, CNRS, IRD, Geoazur, Valbonne, France

Distributed acoustic sensing (DAS) provides an attractive solution for ocean-bottom seismological instrumentation by providing a dense and long-distance measurement of the deformation of the ground along offshore submarine fiber-optic cables. This study reports analyses made on records acquired with a network located along the Chilean margin. We focus onto the analysis of the structure of the shallow crust, in particular, the sedimentary layer of the overlying crust, whose lateral variations suggest strong contrasts of the sedimentary recharge of the slab.

The POST experiment was carried out from October 27 to December 3, 2021 on a fiber-optic cable connecting the city of Concón (100km northwest of Santiago) to La Serena. Using strain-rate recordings for twenty local and regional earthquakes, we estimated both the thickness and shear wave velocity of sediments. We used jointly (1) travel time delays between the direct P-wave and converted Ps at the bedrock/sediment interface that were estimated from manual picks and (2) coda wave interferometry. This later was done by identifying the phase velocities of the fundamental Rayleigh wave mode on frequency-wavenumber (FK) diagrams over 2km linear arrays along the fiber in the 0.3 to 7Hz frequency band. Each dispersive curve and travel time delays between the direct and converted wave were then jointly inverted to create a 2D S-wave velocity (Vs) structure of the sedimentary layer under the fiber.

Our results show significant differences in thickness and in Vs along the cable. Two basins are observed, including the Valparaiso Forearc Basin separated by the Punta Salinas Ridge and another basin limited by a thin sedimentary layer with Vs of a few hundred m/s. In the extreme northern part of the cable, a thin layer of unconsolidated Quaternary sediments is on top of a deeper compacted sediments with faster Vs. The developed methodology comforts the potential of DAS for subsurface imaging purposes. Moreover, accurate modeling of the subsurface could be used to correct the location of earthquakes on the \iber sensors.