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Ambient noise tomography of the western Corinth Rift, Greece

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SUMMARY

Three years of continuous waveform data recorded at 22 stations from the Corinth Rift Laboratory and the Hellenic Unified Seismological Network are used to perform an ambient noise surface-wave tomography of the western Corinth Rift. All available vertical component time-series were cross-correlated to extract empirical Rayleigh-wave Green's functions. Group velocity dispersion curves were measured for each station-pair by applying frequency-time analysis and then inverted to build 2D group velocity maps between 1 and 6 s period. Finally, we locally inverted these velocity maps using a neighborhood algorithm to assess the 3D shear-velocity model of the shallow crustal structure of the western Corinth Rift. Across all studied periods the southern coast of the Corinth Gulf is generally imaged as a region of lower velocities compared to the northern coast. At periods up to 3 s, the spatial variation of the group velocities is correlated with the surface geology of the area. Lower velocities are observed in areas where mostly Plio-Quaternary syn-rift sediments are present, such as off-shore regions of the rift, the Mornos delta and the largest part of the southern coast. Higher velocities are observed in pre-rift basement structures which are dominated mostly by carbonates. At periods above 3 s, where Rayleigh-waves begin to sense deeper structures below the sediments within the underlying basement, our study highlights the presence of a distinct zone of lower velocities across the southern part of the rift with an elongation in the WNW-ESE direction. The interpretation of this low velocity includes two arguments, the present-day active tectonic regime and the possible involvement of fluids circulation processes at depth within a highly fractured upper crust in the vicinity of the major faults zones. In general, the results demonstrate good agreement with the major geological and tectonic features of the area, as well as with previous local earthquake tomography studies and support the assumption of fluid circulations at depth. This work intends to be the base for further investigations towards the study of the Corinth Rift structure using long-time series of ambient noise data.

Keywords: Seismic tomography; Interferometry; Crustal structure; Corinth