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Spectral Inversion for Analysis of Seismo-Activity at Reykjanes Peninsula Oblique Rift, Iceland

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Reykjanes Peninsula Oblique Rift (RPOR), SW Iceland, is a segment of the complex boundary between the North America and Eurasia Plates. It forms a transition between the submerged Reykjanes Ridge, which is part of the mid-Atlantic ridge, and the onshore segments of the Icelandic plate boundary. It hosts a local seismic network REYKJANET for a decade and recently entered a new eruptive era after eight centuries of quiescence. Since spring 2020 when a notable uplift and earthquakes issued first serious warning of volcanic eruption there has been seven effusive eruptions between 2021 and 2024 lasting from months to hours. This study introduces a parametric spectral inversion tailored for the analysis of seismic data from the REKJANET network. Spectral inversion aims to separate of source, path, and site effects in the observed earthquake spectra. It constrains subsurface properties such as near surface velocity structure including local attenuation (kappa), regional attenuation characteristics (quality factors), and seismic source parameters (scalar seismic moment, corner frequency, stress drop). In the first step, the Fourier amplitude spectrum is calculated for each seismic waveform, capturing the frequency content and amplitude distribution of the seismic signals, analysis of signal-to-noise ratios for different components (radial and transversal), and different wave groups (P, S). In the second step, a parametric spectral inversion is performed assuming a specific form for both the source and path terms. The procedure is performed for the seismic activity (2013-2023) preceding the recent volcanic events, to constrain the site and attenuation terms, providing a framework for an analysis of the recent seismo-volcanic activity.