Validation of a recently proposed method for coda wave inversion: a comparison between real and synthetic data

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Seismograms and the information that they provide are of crucial importance for understanding the nature of seismic sources and the media through which the waves travel. These waves, in particular coda waves, contain details about the half-space through which they propagate, important for both industry and research purposes. Coda waves make up the tail of seismograms and are typically ignored regarding them as noise as a consequence of unmodelled physics. However, these types of waves are extremely important because they contain information about scattering attenuation which deals with how energy is redistributed when seismic waves interact with heterogeneities within the propagation medium. Understanding this physical phenomenon is fundamental in seismic hazard analysis as well as in the study of rock properties. In addition, they also contain information about intrinsic attenuation which may be used, with other physical measurements, for characterizing important rock properties such as fluid saturation, lithology, permeability or porosity, making attenuation estimation valuable for different areas such as mining or geothermal exploration. Here we apply an inversion linear process, proposed in 2014 by Fielitz and Wegler based on the radiative transfer theory (RTT), to both real and synthetic data to recover parameters related to scattering and attenuation. We show the challenges in the application of this method to a database of hundreds of earthquakes recorded in southwestern Iceland from 2010 to 2011, and how we partly overcome these challenges. We also show how closely we recover the parameters from the synthetic data created by researchers at the MIT Earth Resources Laboratory and the proper changes required to apply the inversion process.

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