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Towards global anelastic adjoint tomography

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Attenuation is a key parameter to interpret the thermal variations and the water content in crust and mantle. During the construction of the first generation global adjoint tomography model GLAD-M15, and its successor GLAD-M25, elastic inversions have been performed by mainly using the phase information of the waveforms. Our goal is to construct elastic and anelastic structures simultaneously in adjoint inversions based on 3D wave simulations using both phase and amplitudes. To this end we first investigate the effect of attenuation on waveforms (both minor- and major-arc waves) using various 1D and 3D elastic/anelastic models which suggest the necessity of simultaneous elastic/anelastic inversions as attenuation cause significant physical dispersion particularly on surface waves. We prefer to apply correction to source parameters (scalar moment and origin time) rather than inverting them simultaneously with the elastic and anelastic models to reduce the trade-off between parameters. We initiate elastic/anelastic inversions using GLAD-M25 as the starting model and perform iterations with the dataset of 253 earthquakes used in the construction of GLAD-M15. The simulations are performed on Oak Ridge National Laboratory's Summit system. We initially focus on the upper-mantle attenuation demonstrating various misfit functions such as cross-correlation traveltime and amplitudes, instantaneous phase and envelopes as well as their double-difference variations. We will present our preliminary results and discuss the challenges and future directions in global inversions.