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Multi-frequency Bands Receiver Function Inversion by Using Occam's Inversion Algorithm

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Abstract

The work focuses on enhancing the inversion of receiver function (RF) data through the utilization of Occam's algorithm, coupled with multi-frequency bands receiver function constraints (MFO). The RF waveform is a valuable tool for revealing subsurface velocity structures. Inversion, aimed at determining these structures from observed data, encounters non-linearity and non-uniqueness challenges. Traditional deterministic inversion techniques often face difficulties in yielding definitive solutions due to these complexities. To address this, the study introduces Occam's algorithm to promote simpler model explanations, particularly with MFO as a constraint. The MFO approach employs data from multiple frequency bands, potentially refining the accuracy and precision of inversion outcomes.

This investigation contrasts the proposed MFO method with single-frequency band Occam's inversion (SFO) and Computer Program in Seismology V.3.30 (CPS330). Synthetic testing demonstrates that MFO yields superior accuracy and precision, decoupling solution models from discrepancies between true and initial models. However, local minima challenges in Occam's algorithm can impede recovering the absolute structure of the true model during initial stages.

Furthermore, when applied to observed receiver functions, MFO-derived inverted models align with the dominant velocity structure identified in previous studies. Nevertheless, the resultant average velocity model from MFO showcases slight discrepancies, contributing to a marginally thinner crustal thickness.

In summary, this work introduces an innovative approach to improve the accuracy and reliability of RF inversion by incorporating Occam's algorithm with multi-frequency bands receiver function constraints. The comparison with alternative methods demonstrates the efficacy of this approach in uncovering subsurface velocity structures, offering valuable insights into Earth's geological features.

Keywords: multi-frequency bands receiver function