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Source-free seismic imaging with reciprocity-gap misfit criterion.

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We consider the quantitative inverse problem of recovering sub-surface Earth's parameters from measurements obtained near surface. The reconstruction procedure uses the iterative minimization of a misfit criterion that evaluates the discrepancy between the observed and simulated signals, following the principles of Full Waveform Inversion. In the context of passive imaging, the position and characterization of the source signature are unknown, hence increasing the difficulty of inversion. In this work, we propose a new misfit criterion based upon reciprocity formulas, and that allows for source-free inversion, such that no information regarding the probing sources is required, making it an interesting candidate for ambient noise imaging. Our misfit criterion relies on the deployment of new sensing devices such as dual-sensors and distributed acoustic sensing technology, that offer the perspective of measuring different wave fields. It is the combination of these wave fields that makes the essence of our Full Reciprocity-gap Waveform Inversion method, [1, 2], with two and three-dimensional reconstructions of acoustic and elastic media.

[1] F. Faucher, G. Alessandrini, H. Barucq, M. V. de Hoop, R. Gaburro and E. Sincich. Full Reciprocity-Gap Waveform Inversion, enabling sparse-source acquisition, *Geophysics*, 85 (6), 2020, <http://dx.doi.org/10.1190/geo2019-0527.1>.

[2] F. Faucher, M. V. de Hoop and O. Scherzer. Reciprocity-gap misfit functional for Distributed Acoustic Sensing, combining data from active and passive sources , *Geophysics*, 86 (2), 2021, <https://doi.org/10.1190/geo2020-0305.1>.