Geophysical Research Abstracts
Vol. 19, EGU2017-15385, 2017
EGU General Assembly 2017


# Workflows for Full Waveform Inversions

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Despite many theoretical advances and the increasing availability of high-performance computing clusters, full seismic waveform inversions still face considerable challenges regarding data and workflow management.
While the community has access to solvers which can harness modern heterogeneous computing architectures, the computational bottleneck has fallen to these often manpower-bounded issues that need to be overcome to facilitate further progress.

Modern inversions involve huge amounts of data and require a tight integration between numerical PDE solvers, data acquisition and processing systems, nonlinear optimization libraries, and job orchestration frameworks. To this end we created a set of libraries and applications revolving around Salvus (http://salvus.io), a novel software package designed to solve large-scale full waveform inverse problems.

This presentation focuses on solving passive source seismic full waveform inversions from local to global scales with Salvus. We discuss (i) design choices for the aforementioned components required for full waveform modeling and inversion, (ii) their implementation in the Salvus framework, and (iii) how it is all tied together by a usable workflow system.

We combine state-of-the-art algorithms ranging from high-order finite-element solutions of the wave equation to quasi-Newton optimization algorithms using trust-region methods that can handle inexact derivatives. All is steered by an automated interactive graph-based workflow framework capable of orchestrating all necessary pieces. This naturally facilitates the creation of new Earth models and hopefully sparks new scientific insights. Additionally, and even more importantly, it enhances reproducibility and reliability of the final results.