

Goal

Develop innovative and integrated computational methods in seismic imaging and subsurface fluid flow modeling.

Advantages

More than \$ 1500 000/ year in Kaust research funds, tightly coupled visualization + super computer resources + reservoir modeling + seismic imaging.

Benefits

Yearly February Houston meeting, annual reports, access to the student interns, experts in fluid flow modeling, and seismic imaging. Software development in membership year to be distributed to sponsors in following April.

Membership

\$ 27 000 / year membership fee

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Center for Subsurface Imaging and Fluid Modeling (CSIM) Consortium

<http://csim.kaust.edu.sa/>

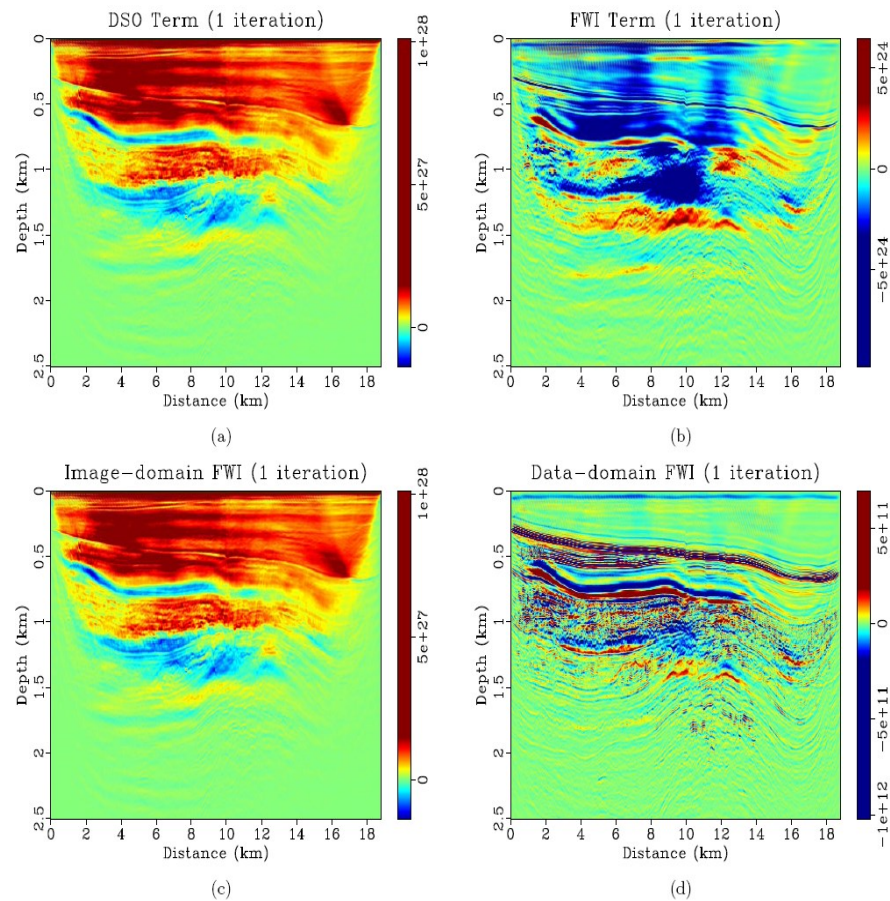
2013



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Inversion in Image Domain

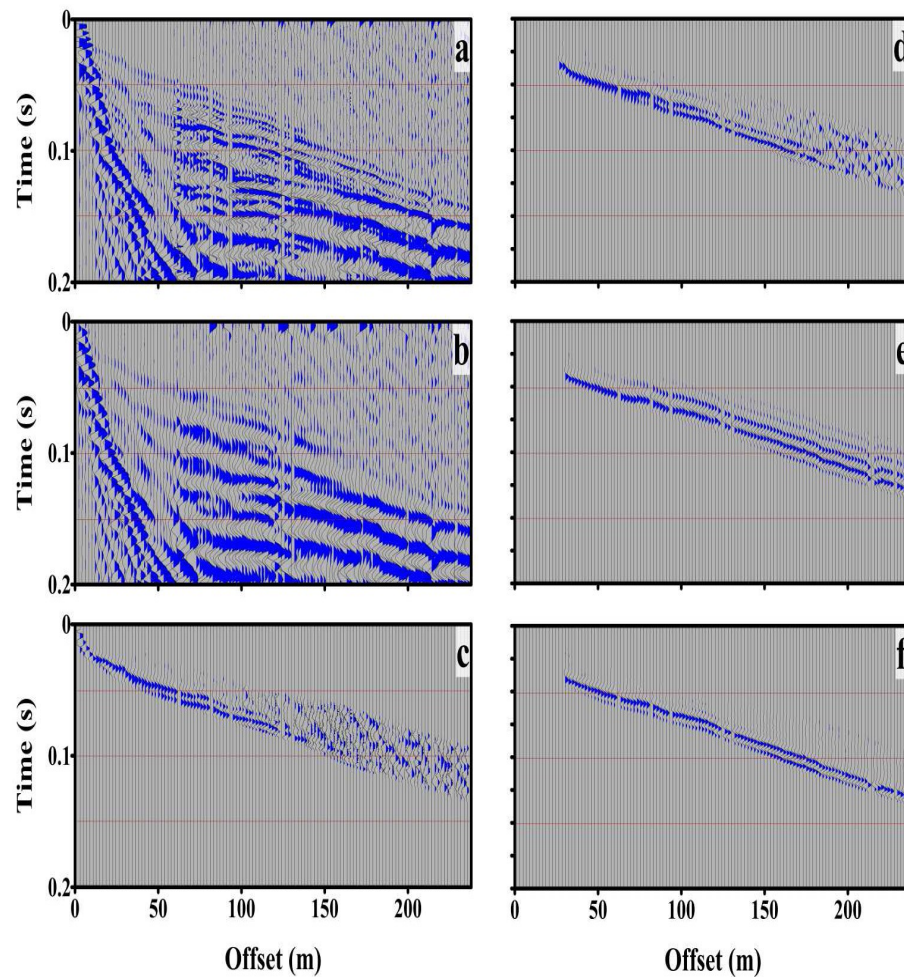


The gradient of image-domain FWI includes (a) DSO gradient and the (b) FWI gradient. The sum of these two terms is the (c) gradient of image-domain FWI. (d) is the gradient of conventional FWI. The gradient of image-domain FWI contains more low-wavenumber components of velocity than the gradient of conventional FWI.

Acquisition of seismic data at the Gulf of Aqaba

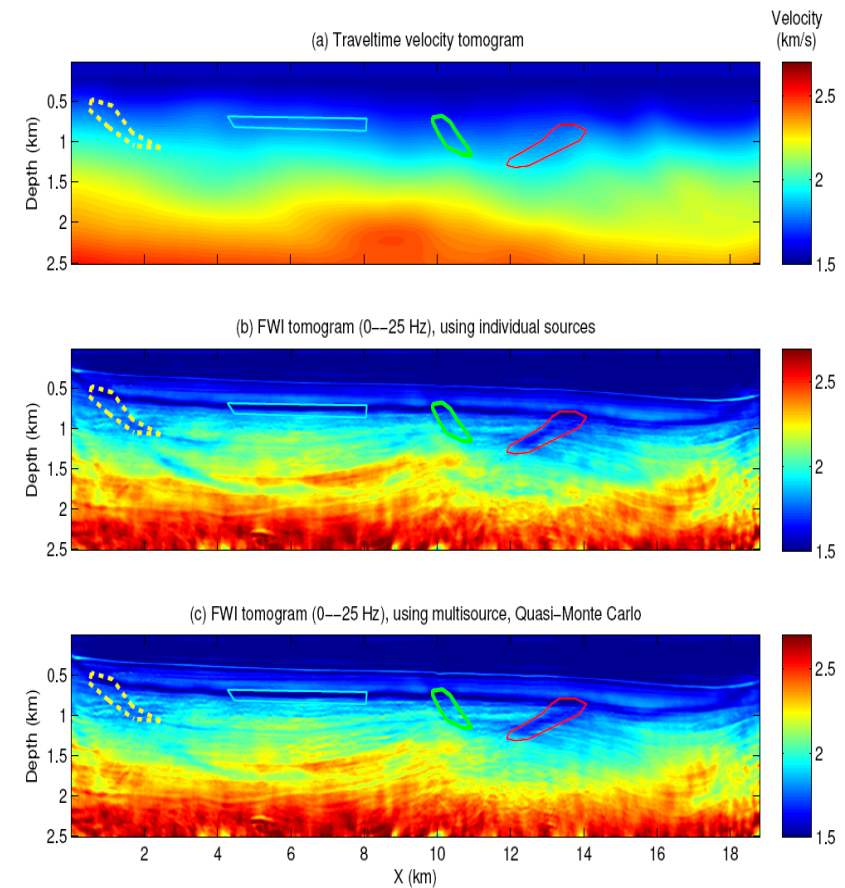


Iterative Super-Virtual Refraction Interferometry



a) Raw CSG. b) Same as a) after band-pass filtering. c) Same as b) except muting around the first arrivals. d) The traces after the first iteration of super-virtual refraction interferometry. e) The traces after the third iteration. f) Same as e) except a deconvolution filter is applied to the traces.

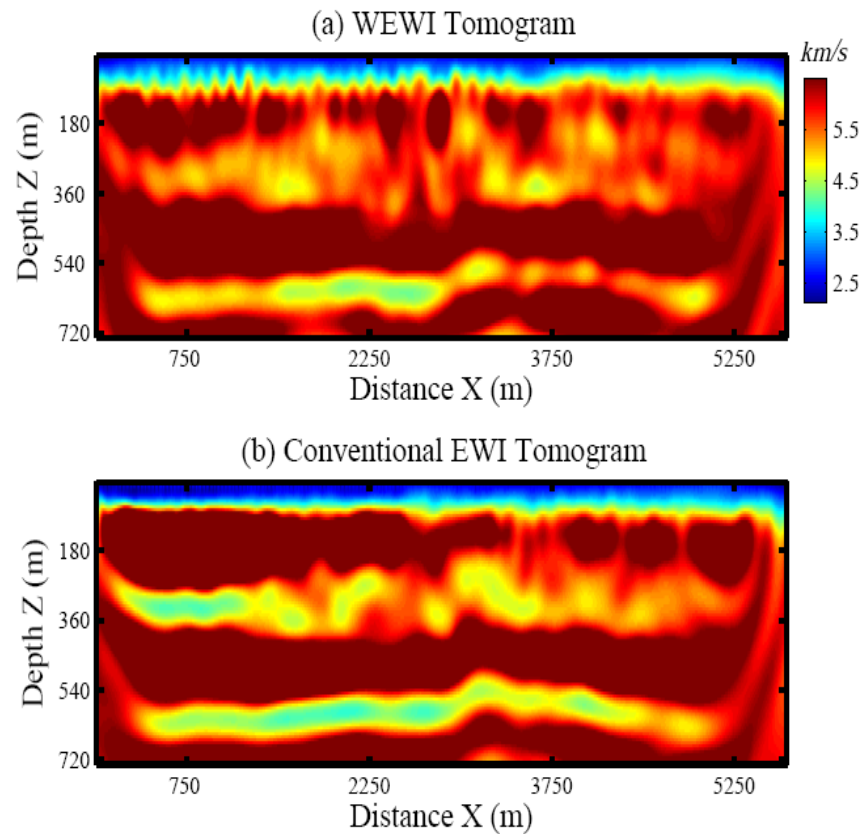
Multisource FWI with Frequency Selection



FWI results for the GOM dataset. (a) The initial velocity model. The velocity tomograms obtained from (b) standard FWI after 20 iteration steps, and (c) FWIMFS after 71 iteration steps. The encircled regions are low velocity anomalies in the FWI results.



Weighted Early-Arrival Waveform Inversion to Shallow Land Data

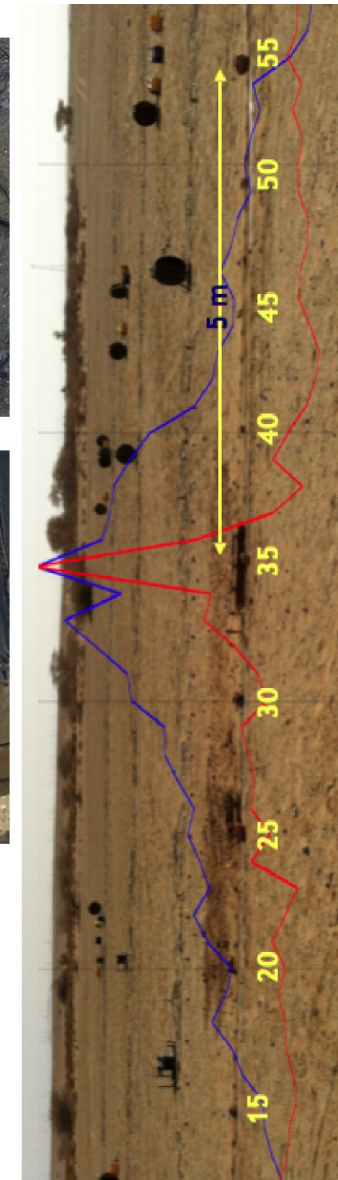


(a) The WEWI, and (b) the conventional EWI tomograms inverted from the early arrivals of CSGs #1 ~ #180

Field-data Verification of Near-field Super-resolution

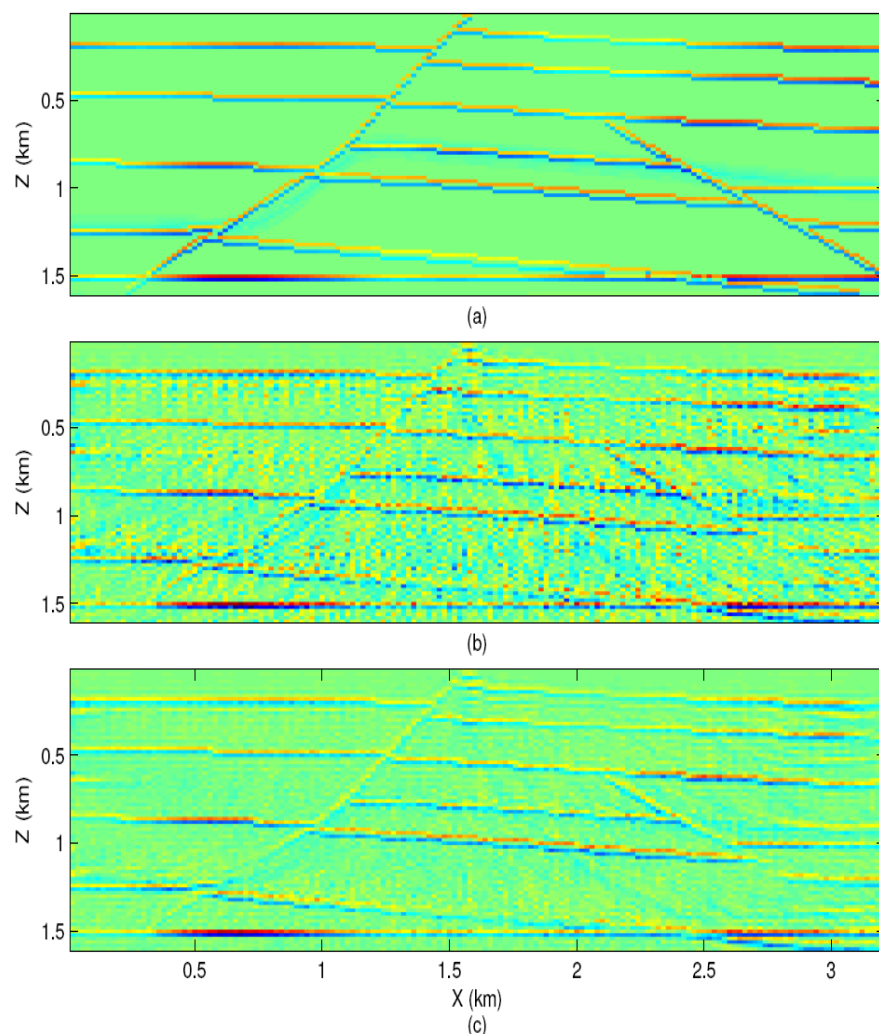


The plates used with seismic source: (a) The flat plate, and (b) The plate used to maximize source repeatability and minimize bouncing



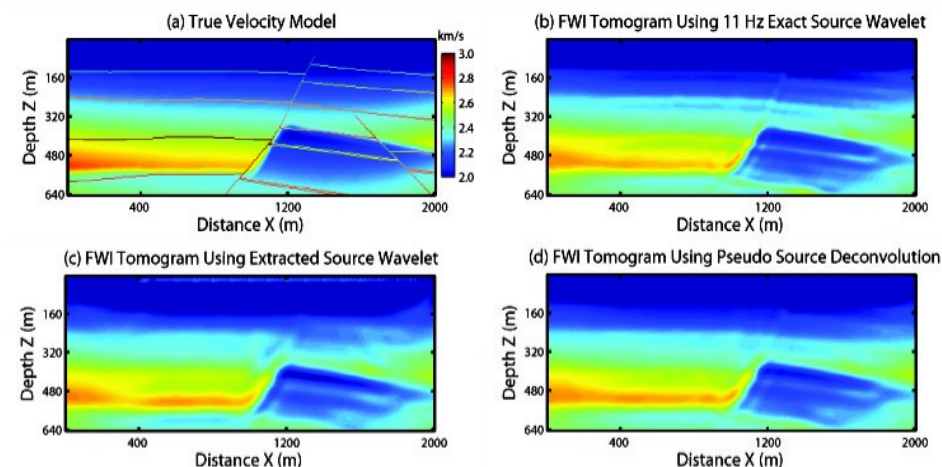
A composite showing the computed TRM profile on-top of a field photo along the profile. The scattered wave TRM-profile at shot location 35 (red curve), and the TRM-profile using the full-wavefield (blue curve)

A Misfit Function Ignoring Unpredictable Data



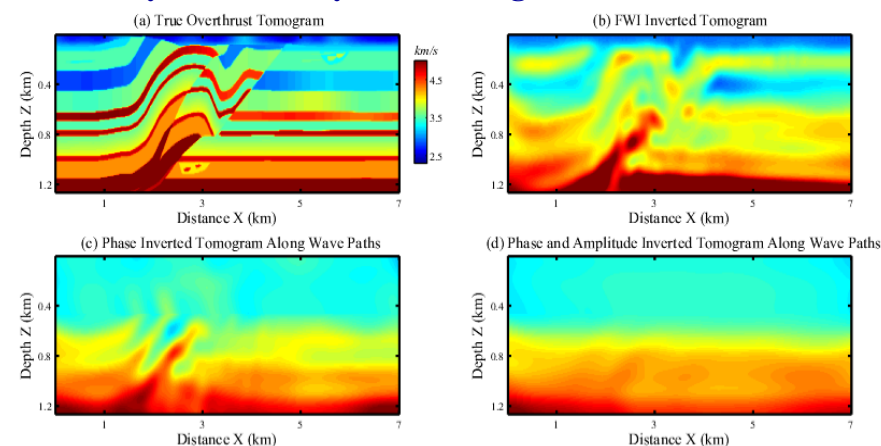
P-P reflectivity models, of (a) the actual model, and (b & c) inverted by LSM, in the (b) conventional and (c) using a misfit function that partly ignores the un-explainable arrivals in the data. Here, the input data consists of both PP and PS reflections, but the modeling can only model PP arrivals.

Deconvolution Misfit Function by Source Convolution



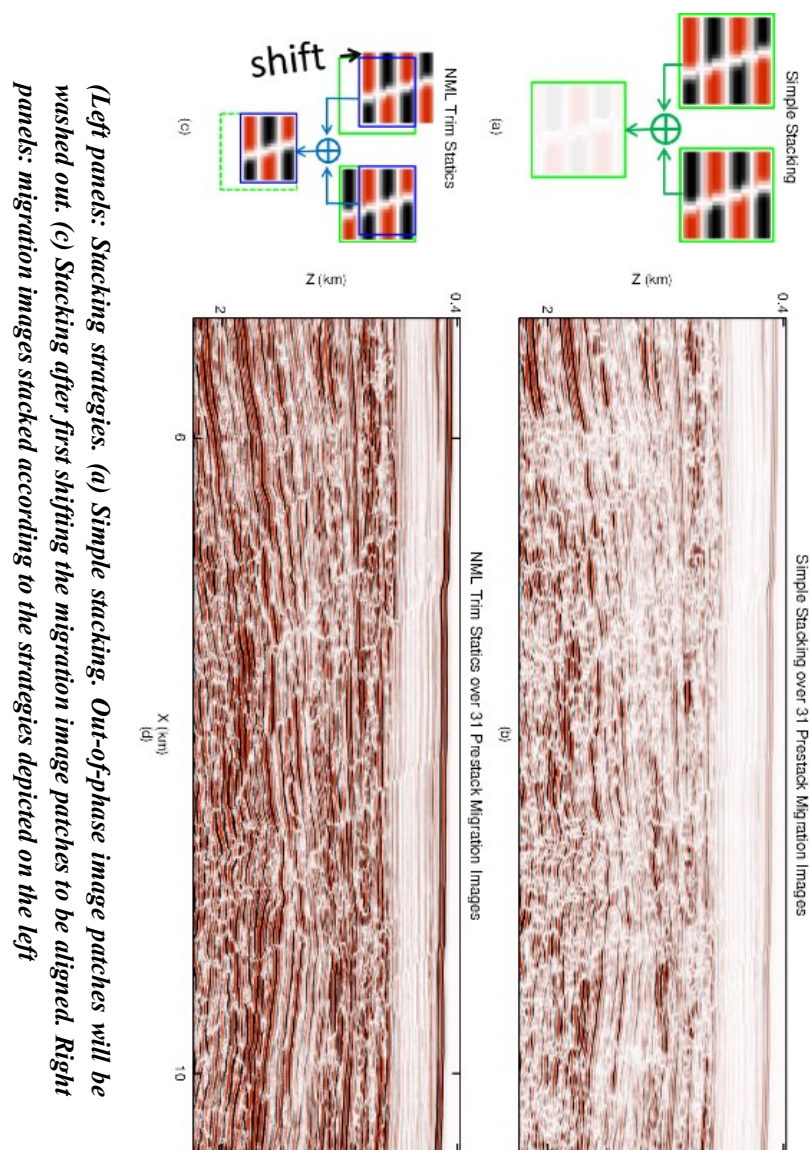
a) True velocity model, b) FWI tomogram with exact source wavelet, c) FWI tomogram with extracted source wavelet, and d) FWI tomogram with pseudo source deconvolution technique.

Velocity Inversion by Phase along Reflection Wave Paths

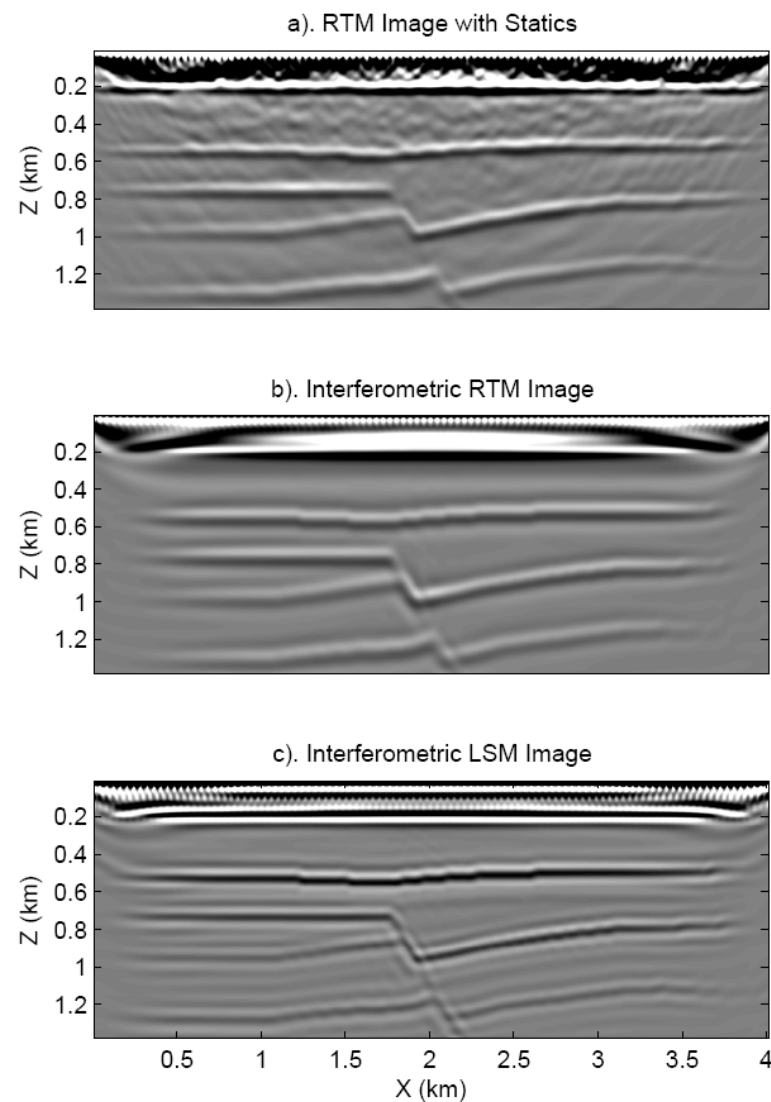


(a) The Overthrust model, (b) tomogram inverted by conventional FWI, (c) tomogram inverted along wave paths weighted by only phase residuals, and (d) the tomogram inverted along wave paths weighted by both both phase+amplitude residuals.

Non-local Means Filter for Trim Statics



Suppression of Statics by Interferometric LSM



a). RTM image of the data with statics. b). Interferometric RTM image. c). Interferometric LSM image after 20 iterations.