

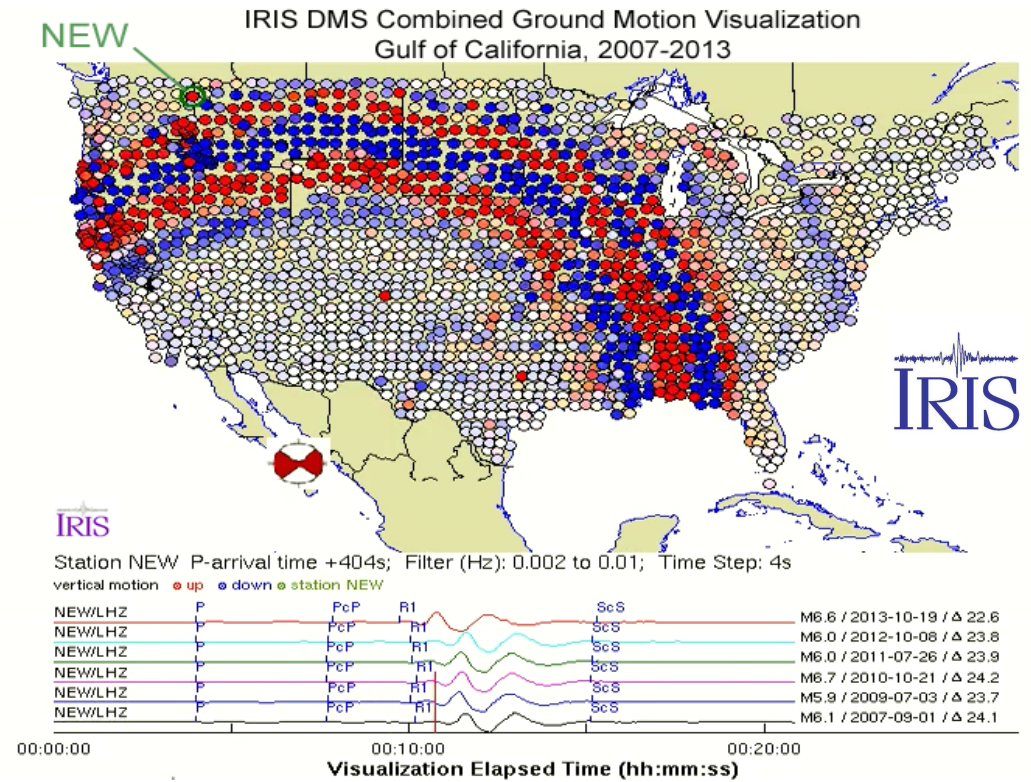
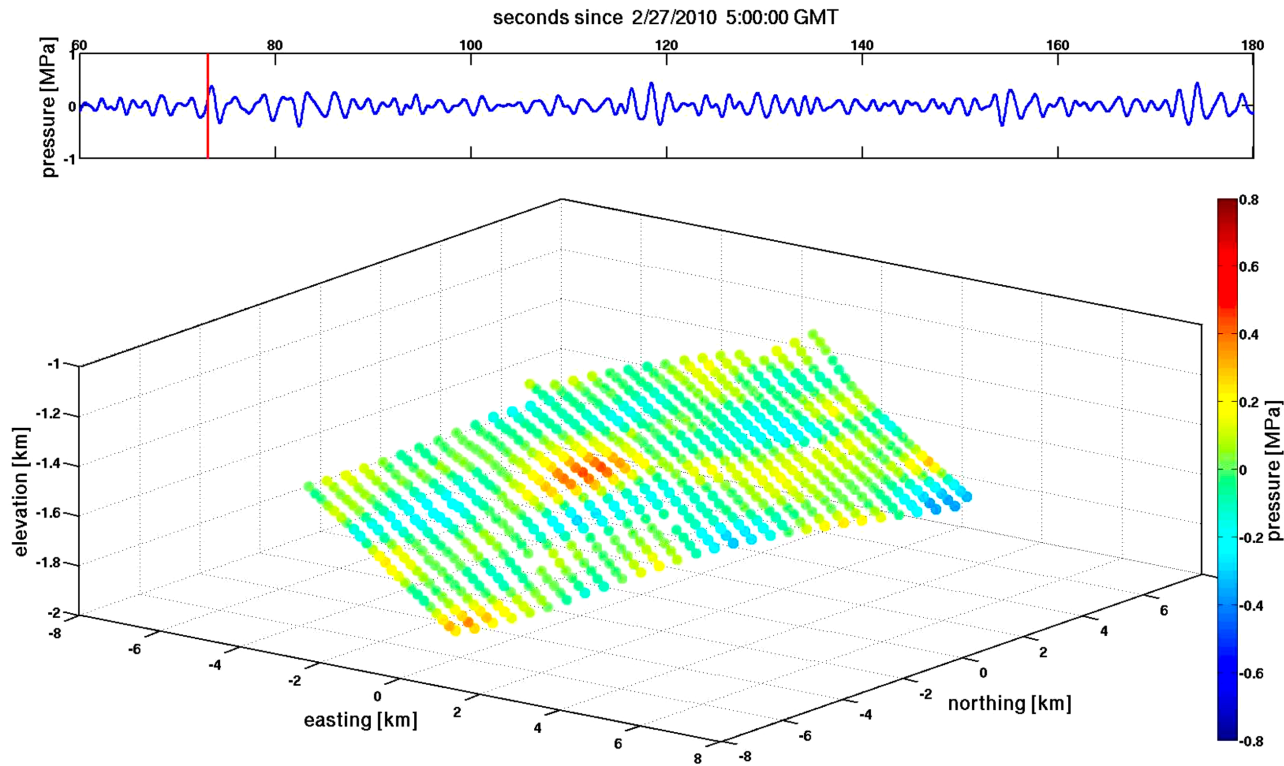
Wavefield Reconstruction Inversion for Ambient Seismic Noise

Sjoerd A.L. de Ridder, James R. Maddison, Ali Shaiban, and Andrew Curtis

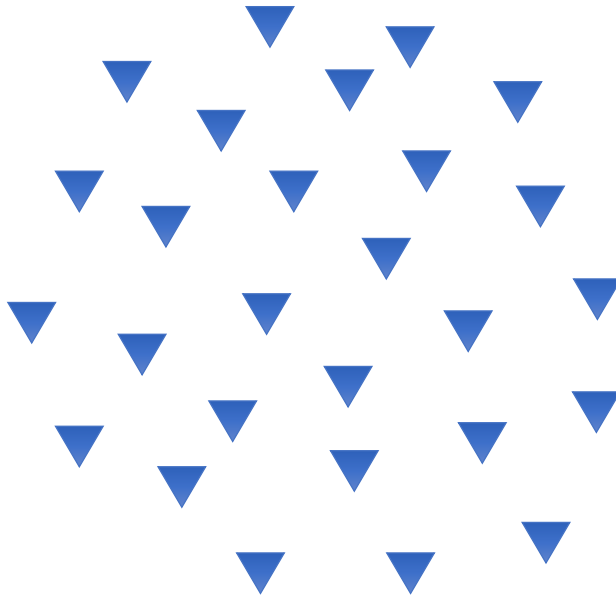
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Full Wavefield Recordings

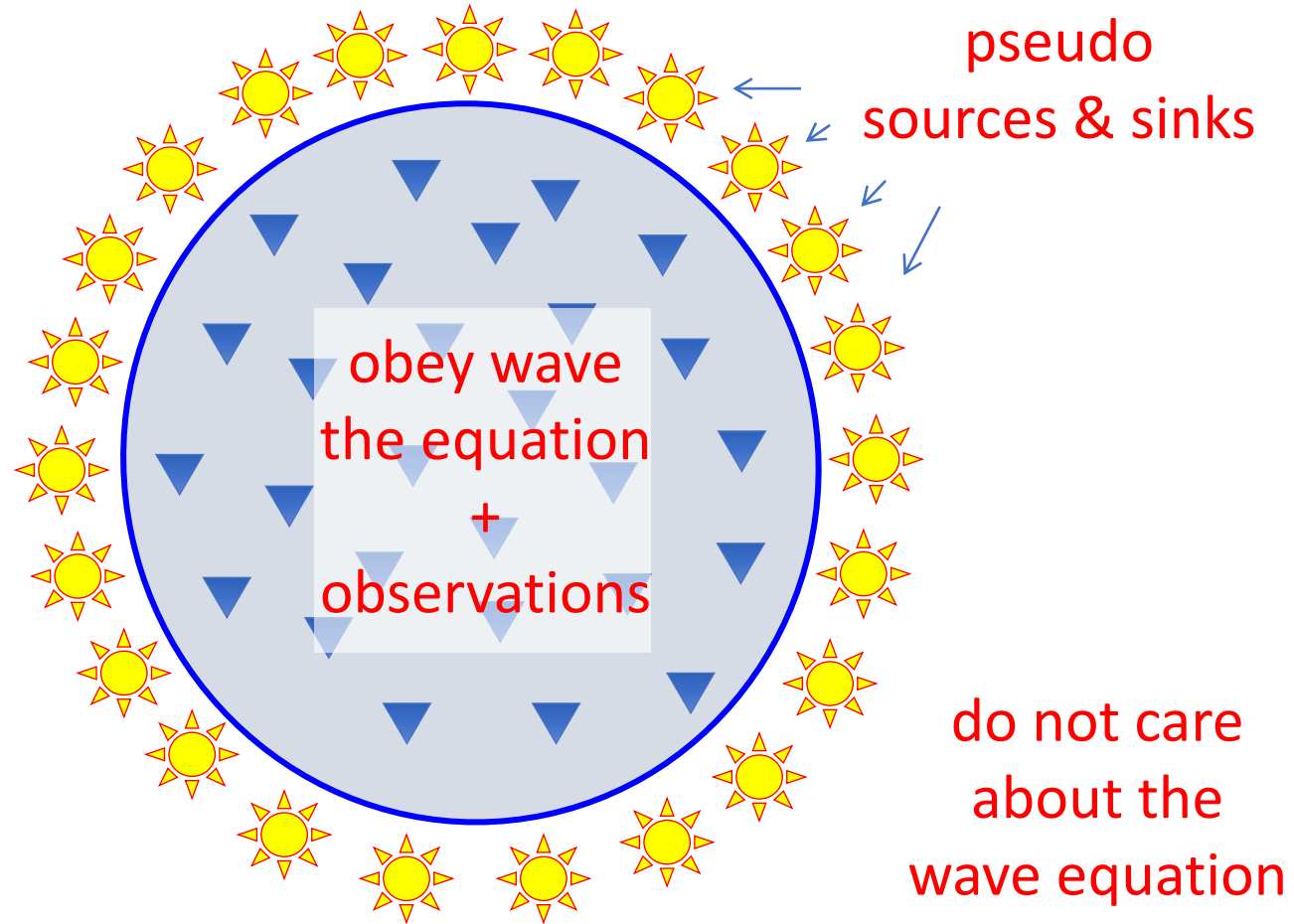


wave field only
known at
recordings and
subject to noise



velocity
unknown

do not care
about the
wave equation



Wave Equation

Wave Equation

$$c^2 \nabla^2 u - \partial_t^2 u = 0$$

Wave Equation

Wave Equation

$$c^2 \nabla^2 u - \partial_t^2 u = 0$$

Discrete Linear in Wave Field

$$\left[\text{diag}\{\mathbf{m}\} \mathbf{L} - \mathbf{D}_{tt} \right] \mathbf{u} = 0$$

Discrete Linear in Velocity

$$\left[\text{diag}\{\mathbf{L} \mathbf{u}\} \right] \mathbf{m} - \mathbf{D}_{tt} \mathbf{u} = 0$$

Wave Equation

Wave Equation

$$c^2 \nabla^2 u - \partial_t^2 u = 0$$

Discrete Linear in Wave Field

$$\left[\text{diag}\{\mathbf{m}\} \mathbf{L} - \mathbf{D}_{tt} \right] \mathbf{u} = 0$$

Discrete Linear in Velocity

$$\left[\text{diag}\{\mathbf{L} \mathbf{u}\} \right] \mathbf{m} - \mathbf{D}_{tt} \mathbf{u} = 0$$

Wavefield Reconstruction Inversion

Wave Equation

$$c^2 \nabla^2 u - \partial_t^2 u = 0$$

Discrete Linear in Wave Field

$$\left[\text{diag}\{\mathbf{m}\} \mathbf{L} - \mathbf{D}_{tt} \right] \mathbf{u} = 0$$

Discrete Linear in Velocity

$$\left[\text{diag}\{\mathbf{L} \mathbf{u}\} \right] \mathbf{m} - \mathbf{D}_{tt} \mathbf{u} = 0$$

Wave Equation Inversion

Wave Equation

$$c^2 \nabla^2 u - \partial_t^2 u = 0$$

Discrete Linear in Wave Field

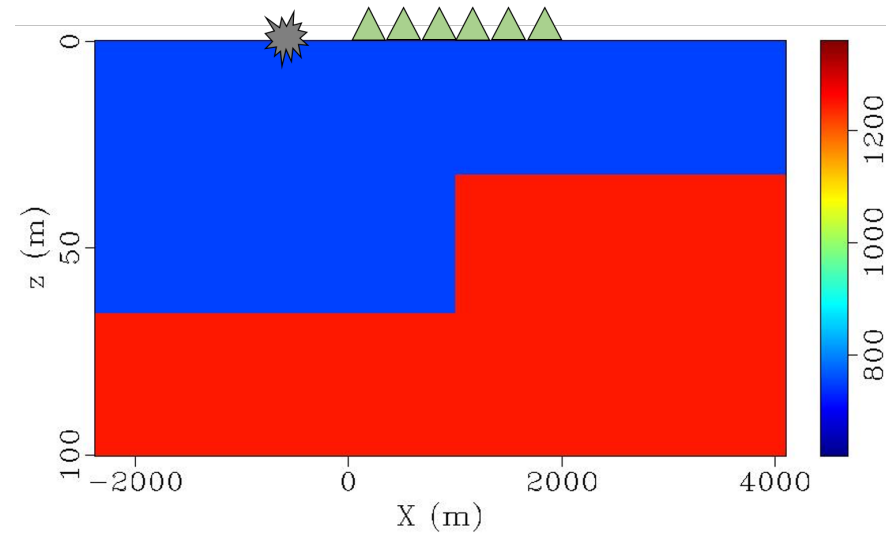
$$\left[\text{diag}\{\mathbf{m}\} \mathbf{L} - \mathbf{D}_{tt} \right] \mathbf{u} = 0$$

Discrete Linear in Velocity

$$\left[\text{diag}\{\mathbf{L} \mathbf{u}\} \right] \mathbf{m} - \mathbf{D}_{tt} \mathbf{u} = 0$$

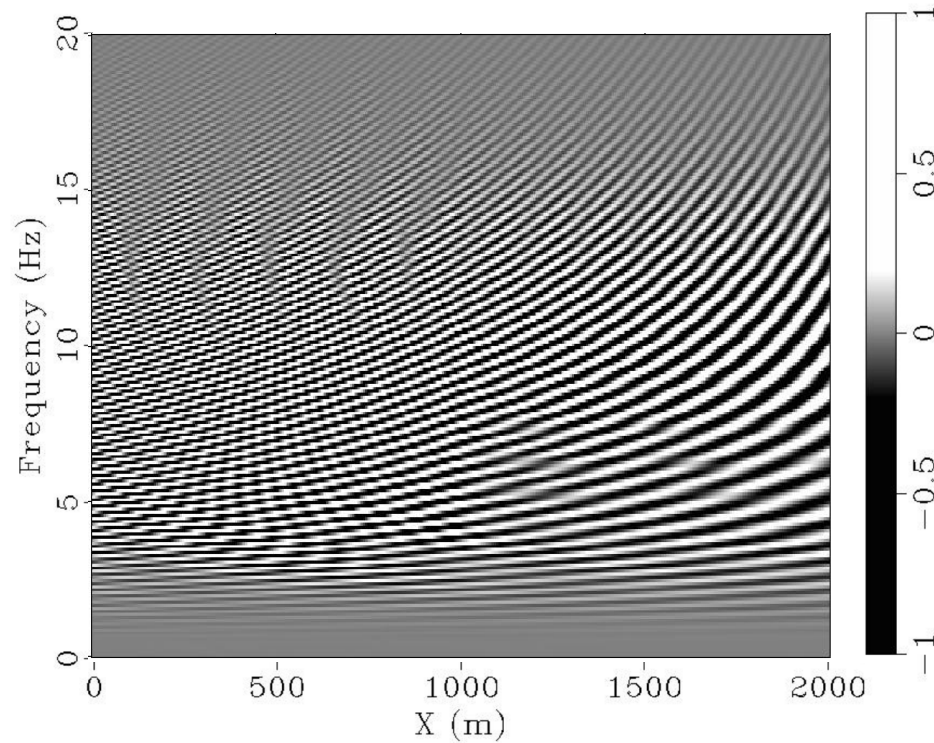
Step Function Model

Poisson Solid Medium
 $V_w = 92\% V_s$



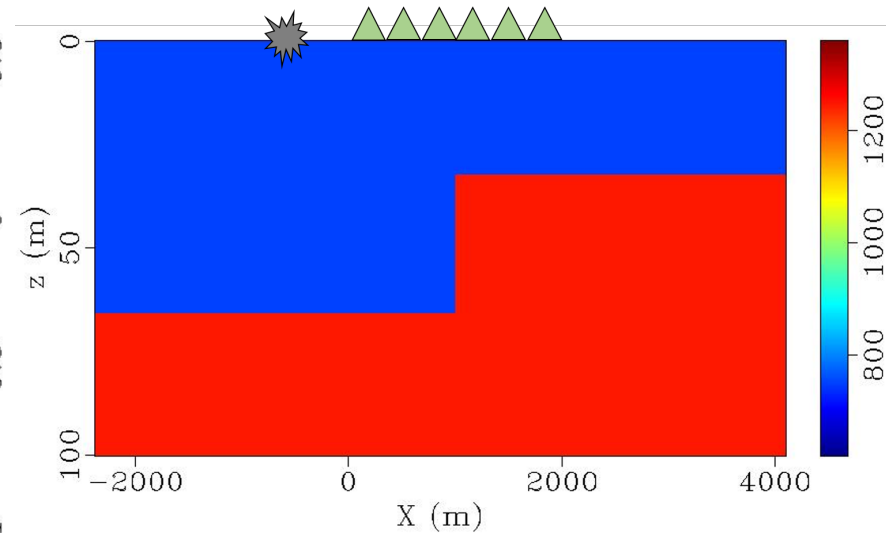
True Wavefield (unknown)

Fully Elastic Modelling

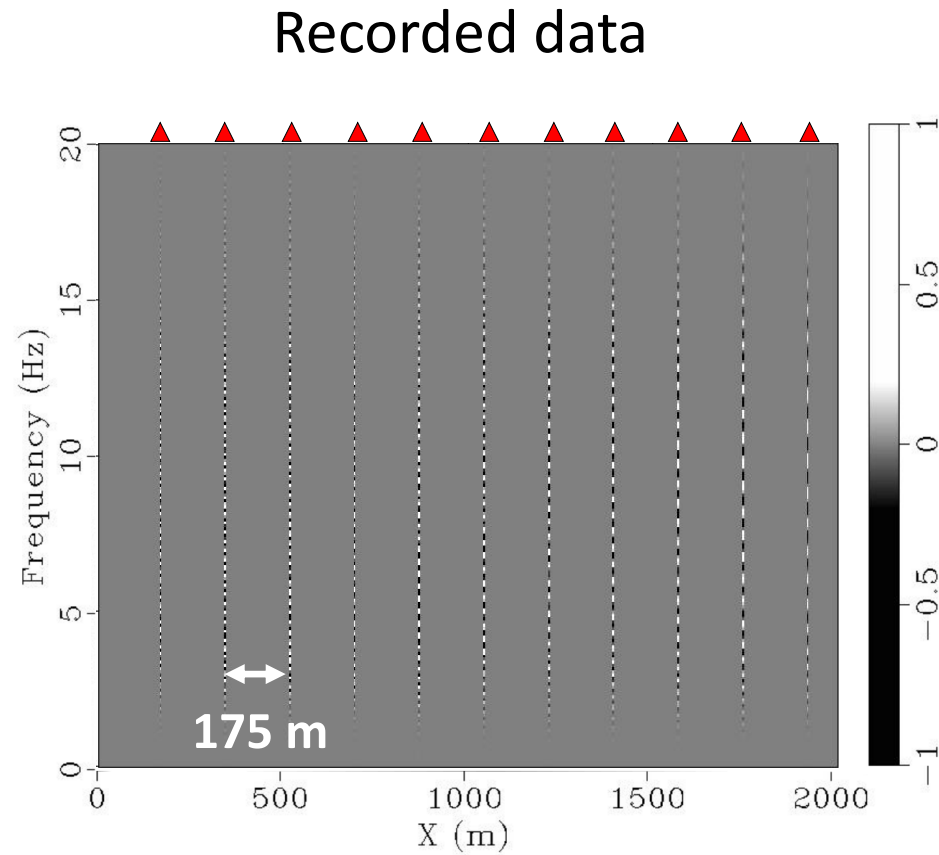


Poisson Solid Medium

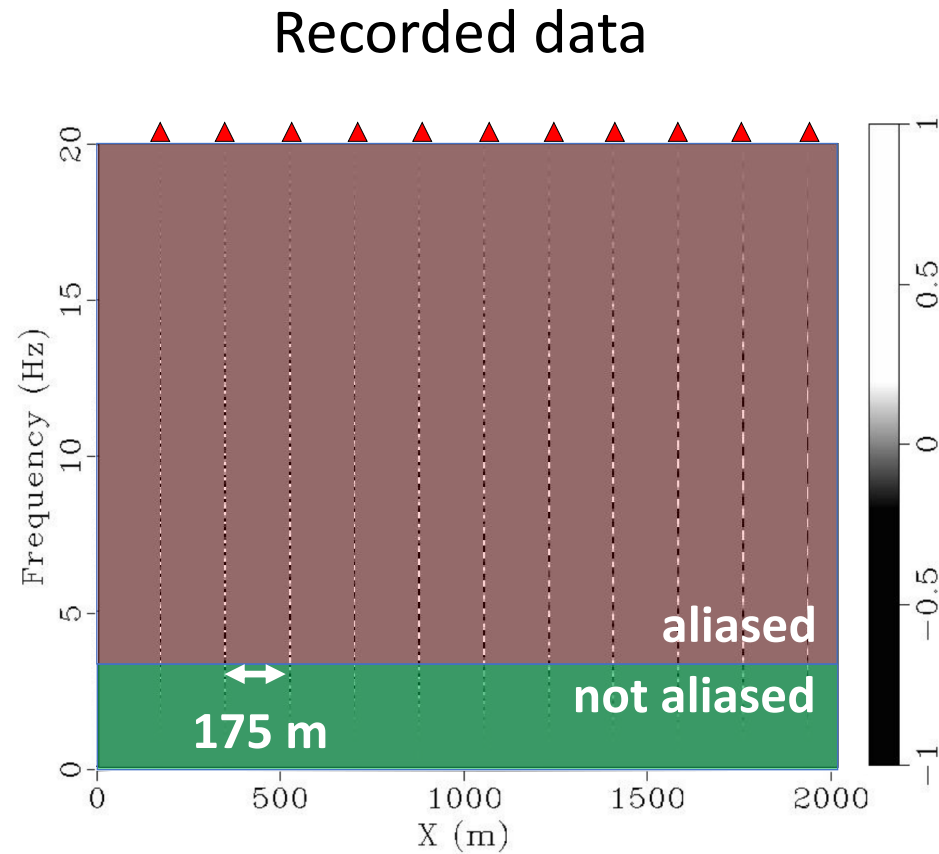
$$V_w = 92\% V_s$$



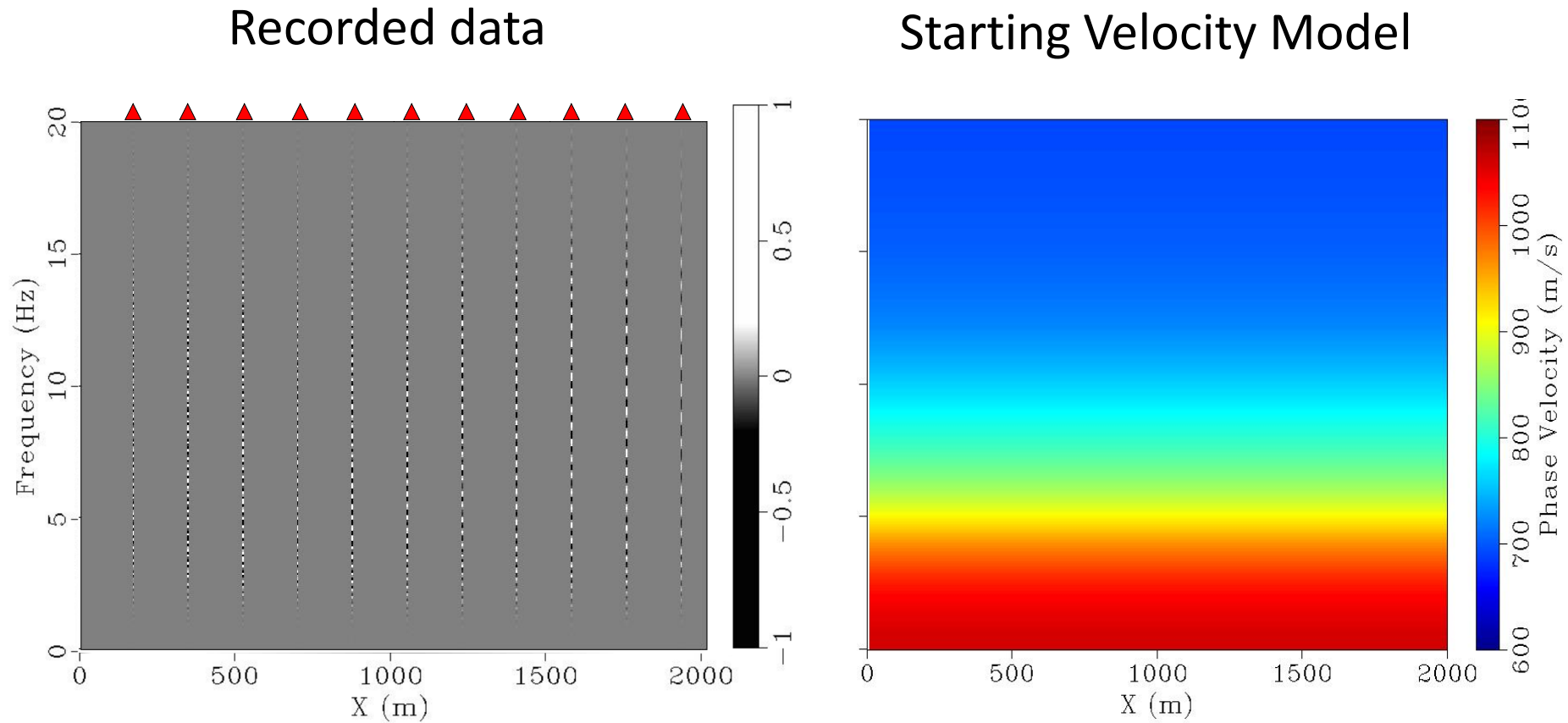
Sampled Wavefield (known)



Sampled Wavefield (known)

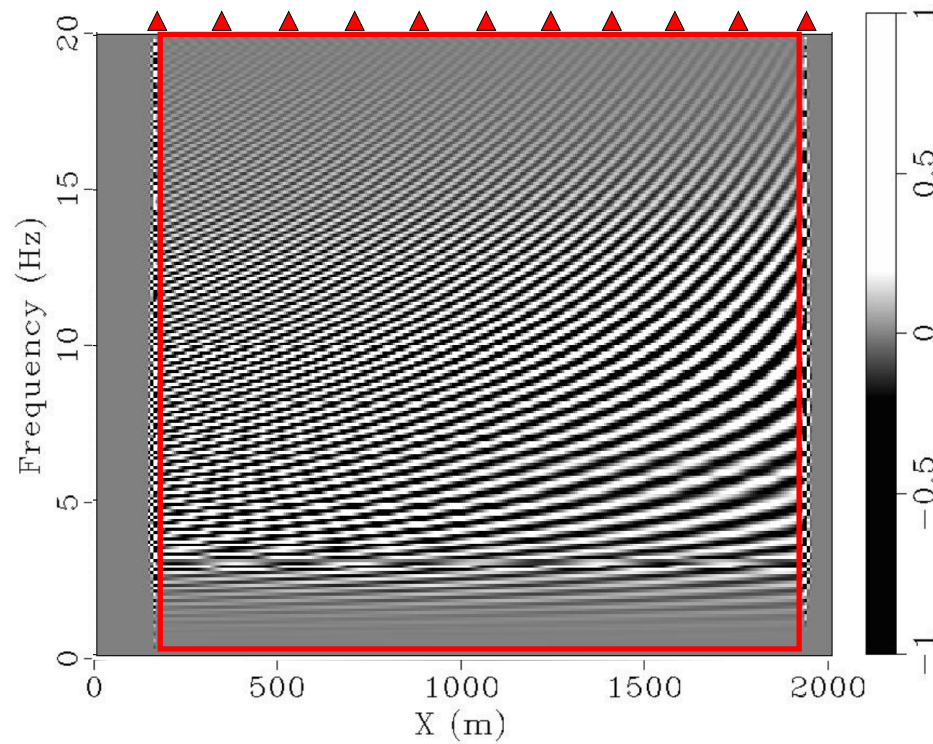


Sampled Wavefield (known)

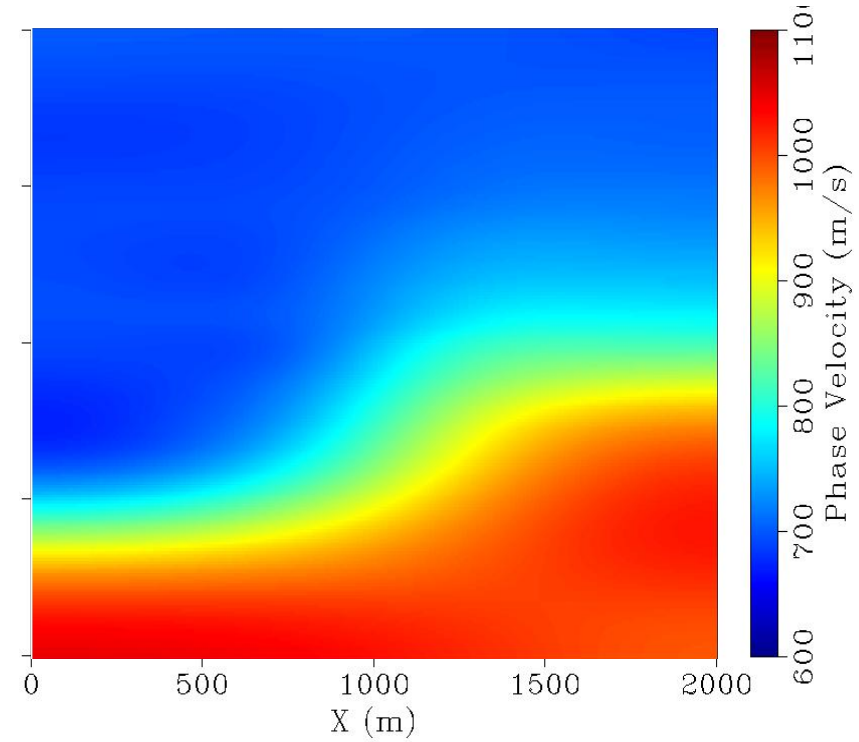


Retrieved after 45 iterations

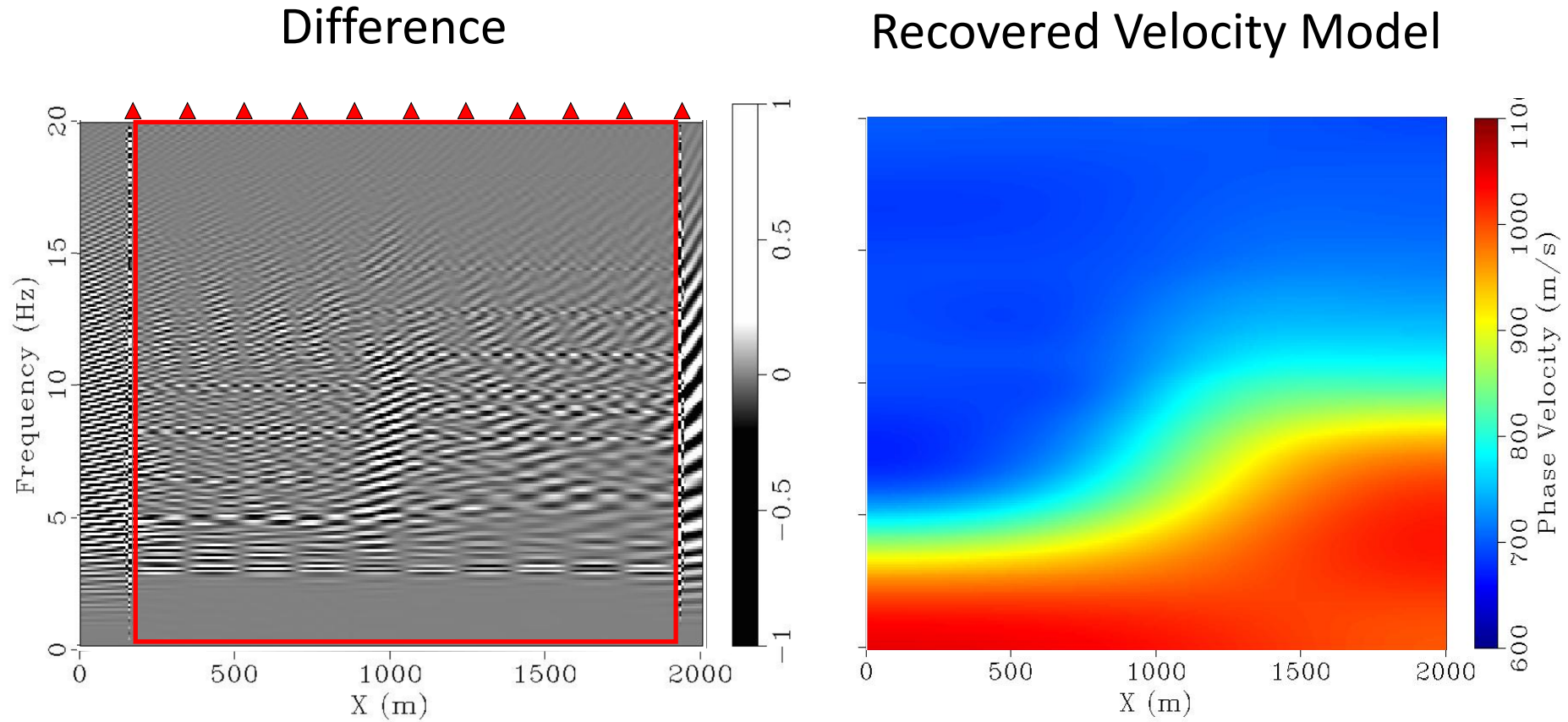
Recovered Wavefield



Recovered Velocity Model

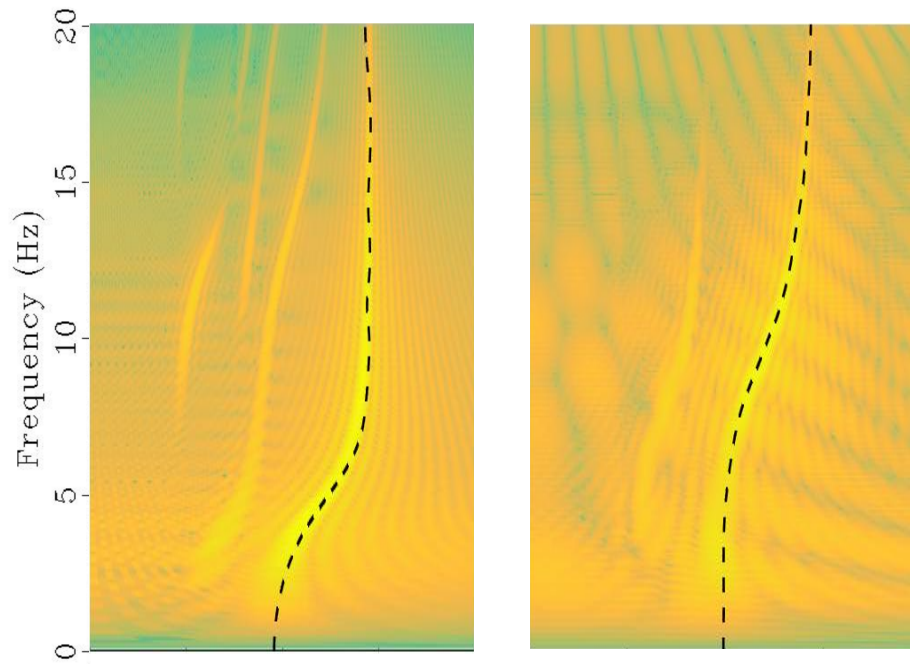


Retrieved after 45 iterations

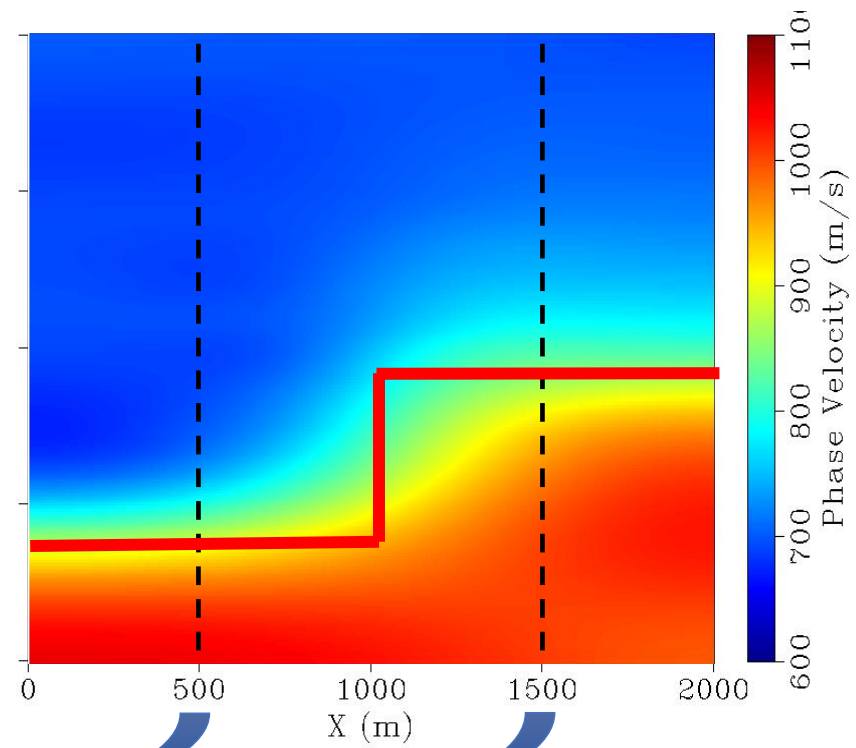


Dispersion Match

True Dispersion Images



Recovered Velocity Model



Stay Well, Safe & Sane

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