Reverse time migration
backscattering
noise or signal?

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conventional imaging condition

\[ W_s(x, t) \quad \rightarrow \quad W_r(x, t) \]
conventional imaging condition

\[ W_s(x, t) \xrightarrow{\text{shots}} W_r(x, t) \]

\[ R(x) = \sum_{\text{shots}} \sum_{t} W_s(x, t) W_r(x, t) \]
conventional imaging condition

\[ W_s = W_s^b + W_s^f \]

\[ W_r = W_r^b + W_r^f \]
conventional imaging condition

\[ W_s = W_s^b + W_s^f \]

\[ W_r = W_r^b + W_r^f \]
conventional imaging condition

\[ W_s = W_s^b + W_s^f \]

\[ W_r = W_r^b + W_r^f \]
conventional imaging condition

\[ R(x) = \sum_{\text{shots}} \sum_{t} W_s(x, t) W_r(x, t) \]
conventional imaging condition

\[ R = R^{ff} + R^{bb} + R^{fb} + R^{bf} \]
conventional imaging condition

\[ R = R^{ff} + R^{bb} + R^{fb} + R^{bf} \]
conventional imaging condition

\[ R = R^{ff} + R^{bb} + R^{fb} + R^{bf} \]

backscattering
$t = 0.0s$

$W_s$

$W_r$

$R(x)$
\[ W_s \]

\[ W_r \]

\[ R(x) \]
$t = 0.6s$

$W_s$

$W_r$

$R(x)$
$t = 1.2s$
$t = 1.4s$

$W_s$

$W_r$

$R(x)$
$t = 1.8s$

$W_s$

$W_r$

$R(x)$
$t = 2.0s$
$t = 2.2s$

$W_s$

$W_r$

$R(x)$
\[ R = R^{ff} + R^{bb} + R^{fb} + R^{bf} \]
\[ R = R_{ff} + R_{bb} + R_{fb} + R_{bf} \]
\[ R = R^{ff} + R^{bb} + R^{fb} + R^{bf} \]
\[ R = R^{ff} + R^{bb} + R^{fb} + R^{bf} \]
\[ R = R^{ff} + R^{bb} + R^{fb} + R^{bf} \]
extended imaging condition

\[ R(x, \lambda, \tau) = \sum_{\text{shots}} \sum_{t} W_s(x - \lambda, t - \tau) W_r(x + \lambda, t + \tau) \]

\[ \lambda: \text{ space lag} \]
\[ \tau: \text{ time lag} \]
\[ R = R^{ff} + R^{bb} + R^{fb} + R^{bf} \]
\[ R = R^{ff} + R^{bb} + R^{fb} + R^{bf} \]
\[ R = R^{ff} + R^{bb} + R^{fb} + R^{bf} \]
\[ R = R^{ff} + R^{bb} + R^{fb} + R^{bf} \]
\[ R = R^{ff} + R^{bb} + R^{fb} + R^{bf} \]
velocity sensitivity
$R(x)$

-12% velocity error
$R(x)$

-9% velocity error
$R(x)$

-6% velocity error
$R(x)$

-3% velocity error
$R(x)$

$+0\%$ velocity error
$R(x)$

$+3\%$ velocity error
$R(x)$

$+6\%$ velocity error
$R(x)$

$+9\%$ velocity error
$R(x)$

$+12\%$ velocity error
\( R(x) \)

\[ +15\% \text{ velocity error} \]
-15% velocity error
-15% velocity error
-15% velocity error
-12% velocity error
-9% velocity error
-6% velocity error
-3% velocity error
0% velocity error
$+3\% \text{ velocity error}$
$+6\% \text{ velocity error}$
$+9\%$ velocity error
$+12\%$ velocity error
$+15\%$ velocity error
\[ 2J_\tau = \|P(\tau)[R^{fb}(z, \tau) + R^{bf}(z, \tau)]\|^2 \]

\[ P(\tau) = |\tau| \]
\[ 2J_\lambda = \| P(\lambda_x)[R^{fb}(z, \lambda_x) + R^{bf}(z, \lambda_x)] \|^2, \]

\[ P(\lambda_x) = |\lambda_x| \]
$$2J_c = \| P(\lambda, \tau) \left[ R^{fb}(x, \lambda, \tau) + R^{bf}(x, \lambda, \tau) \right] \|^2$$
Sigsbee model example
conclusions

backscattering:
  is not noise
  is sensitive to velocity
conclusions

backscattering:
  is not noise
  is sensitive to velocity

salt geometry constraining?
extended image filtering