wide-azimuth angle gathers
for anisotropic wave-equation migration

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wide-azimuth angle gathers
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accurate wavefield imaging
wide-azimuth angle gathers

accurate wavefield imaging

efficient angle decomposition
accurate wavefield imaging

wavefield reconstruction

\[ \mathcal{L} [W_s (x, t)] = D_s (x_s, +t) \]
\[ \mathcal{L} [W_r (x, t)] = D_r (x_r, -t) \]
accurate wavefield imaging

wavefield reconstruction

\[ \mathcal{L} [W_s(x, t)] = D_s(x_s, +t) \]

\[ \mathcal{L} [W_r(x, t)] = D_r(x_r, -t) \]

conventional imaging condition

\[ R(x) = \sum_{\text{shots}} \sum_t W_s(x, t) W_r(x, t) \]
accurate wavefield imaging

wavefield reconstruction

\[
\mathcal{L} \left[ W_s (x, t) \right] = D_s (x_s, +t) \\
\mathcal{L} \left[ W_r (x, t) \right] = D_r (x_r, -t)
\]

extended imaging condition

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

loop over shots{
    build $W_s(x, t), W_r(x, t)$
    decompose $W_s(x, t), W_r(x, t)$
    select main wave paths
    apply imaging condition
}
**wavefield-domain decomposition**

loop over shots{  
  build $W_s(x, t), W_r(x, t)$  
  decompose $W_s(x, t), W_r(x, t)$  
  select main wave paths  
  apply imaging condition  
}

**image-domain decomposition**

loop over shots{  
  build $W_s(x, t), W_r(x, t)$  
  do nothing  
  apply imaging condition  
  decompose $R(x, \lambda, \tau)$  
}
efficient angle decomposition

1. use extended images
2.
3.
$R(x, \lambda, \tau)$

common-image gathers: wasteful, biased
\[ R \left( c, \lambda, \tau \right) \]

*common-image-point gathers: efficient, un-biased*
efficient angle decomposition

1. use extended images
2. use common-image-point gathers
3.
conventional IC interpretation
extended IC interpretation
extended IC interpretation
ISO: reflection geometry
TTI: reflection geometry

\[ \psi (\theta) \]
ISO: \( \psi (\theta) \)

\[ v_p = 3 \text{km/s} \]
TTI: $\psi(\theta)$

$v_p = 3\text{km/s}, \epsilon = +0.45, \delta = -0.29, \theta_a = 35^\circ, \phi_a = 90^\circ$
anisotropic decomposition

\[ R(\lambda, \tau) \xrightarrow{\psi(\theta), v_s(\theta, \psi), v_r(\theta, \psi)} R(\phi, \theta) \]

\[(\hat{q} \cdot \lambda) \sin(2\theta) = [v_s \cos(\theta + \psi) + v_r \cos(\theta - \psi)] \tau\]
anisotropic decomposition

\[
R(\lambda, \tau) \xrightarrow{\psi(\theta), v_s(\theta, \psi), v_r(\theta, \psi)} R(\phi, \theta)
\]

\[
(\hat{q} \cdot \lambda) \sin(2\theta) = [v_s \cos(\theta + \psi) + v_r \cos(\theta - \psi)] \tau
\]

\[
(\hat{n} \cdot \lambda) = 0
\]
efficient angle decomposition

1. use extended images
2. use common-image-point gathers
3. use reflector geometry
\[ v_p = 3\text{km/s} \]
\[ v_p = 3\text{km/s}, \epsilon = +0.45, \delta = -0.29, \theta_a = 35^\circ, \phi_a = 90^\circ \]
wide-azimuth angle gathers

accurate wavefield imaging

anisotropic RTM

efficient angle decomposition

extended CIPs