

A modeling and migration study of fault shadows

by

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Outline

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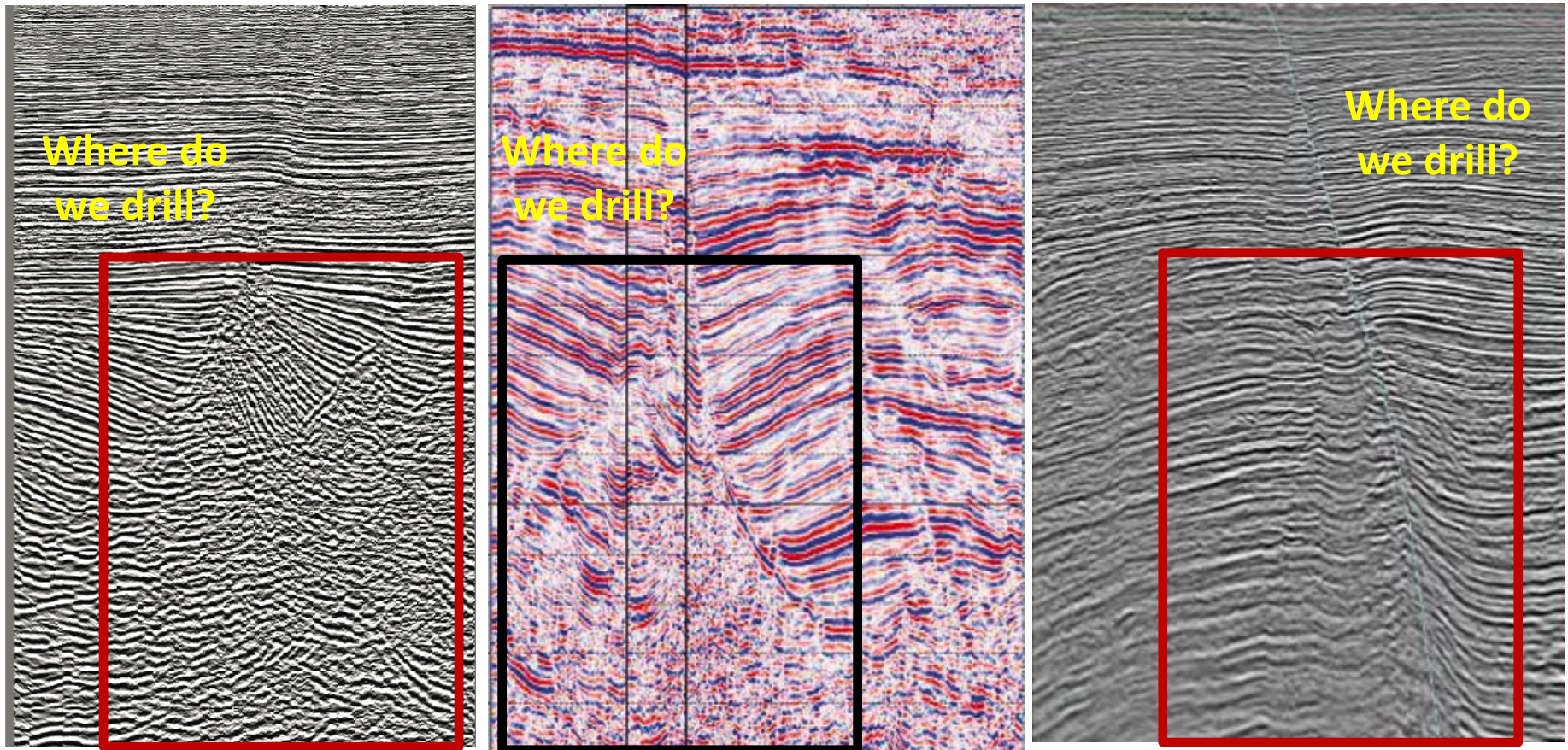
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Motivation



Need for deep prospectivity

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- **To investigate the cause of fault shadow in real dataset from a modeling point of view**
- **A steer for the next project phase with the aim of ultimately resolving fault shadows**

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Exploding
Reflector
section

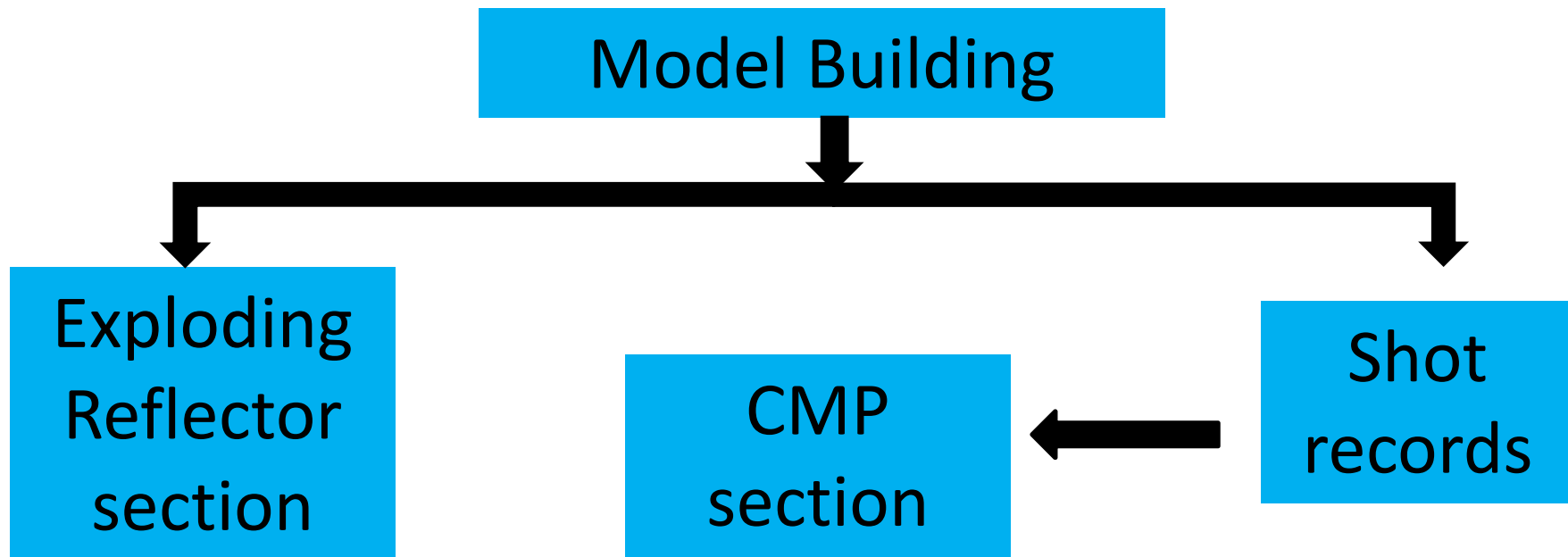
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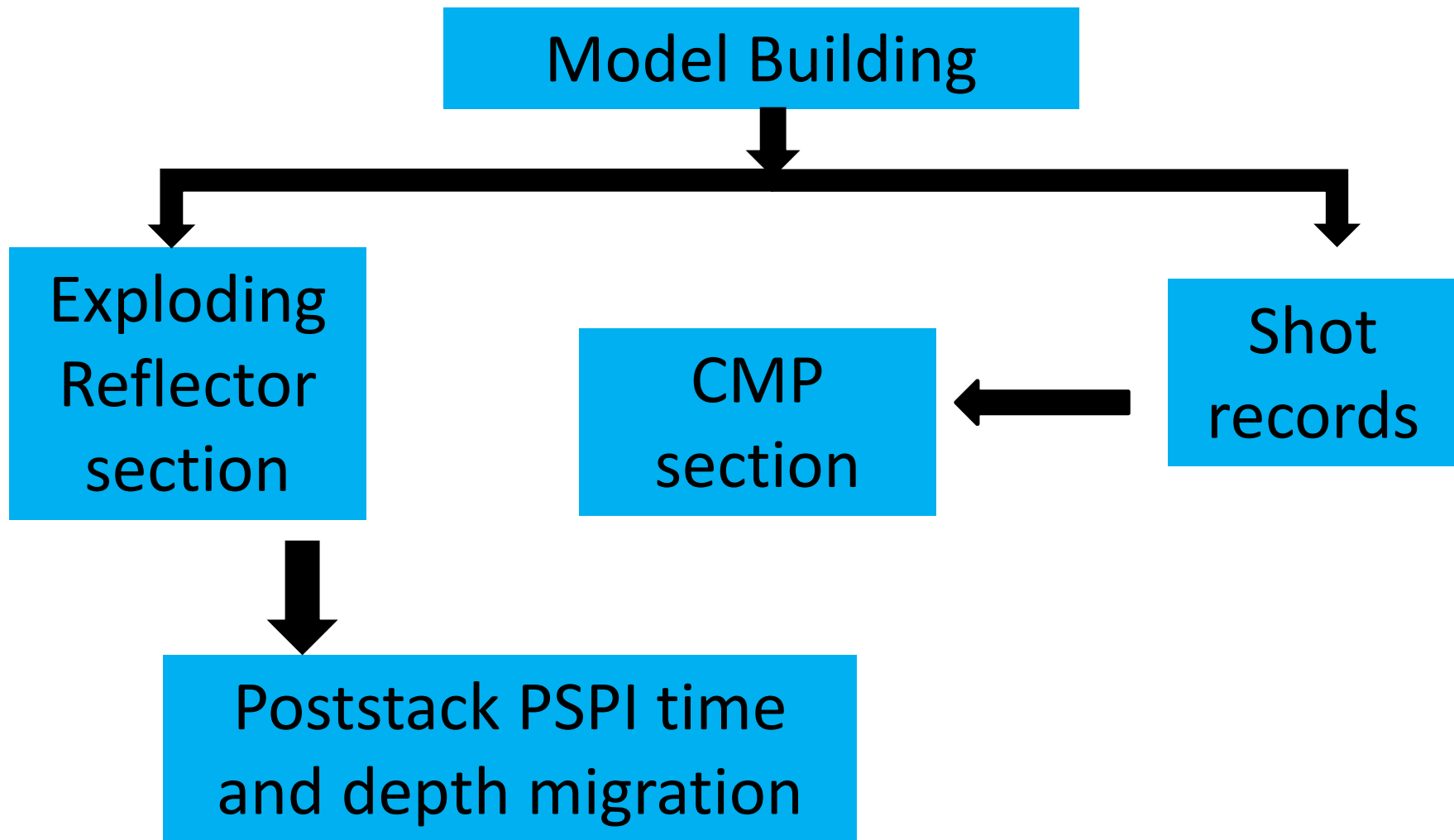
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Shot
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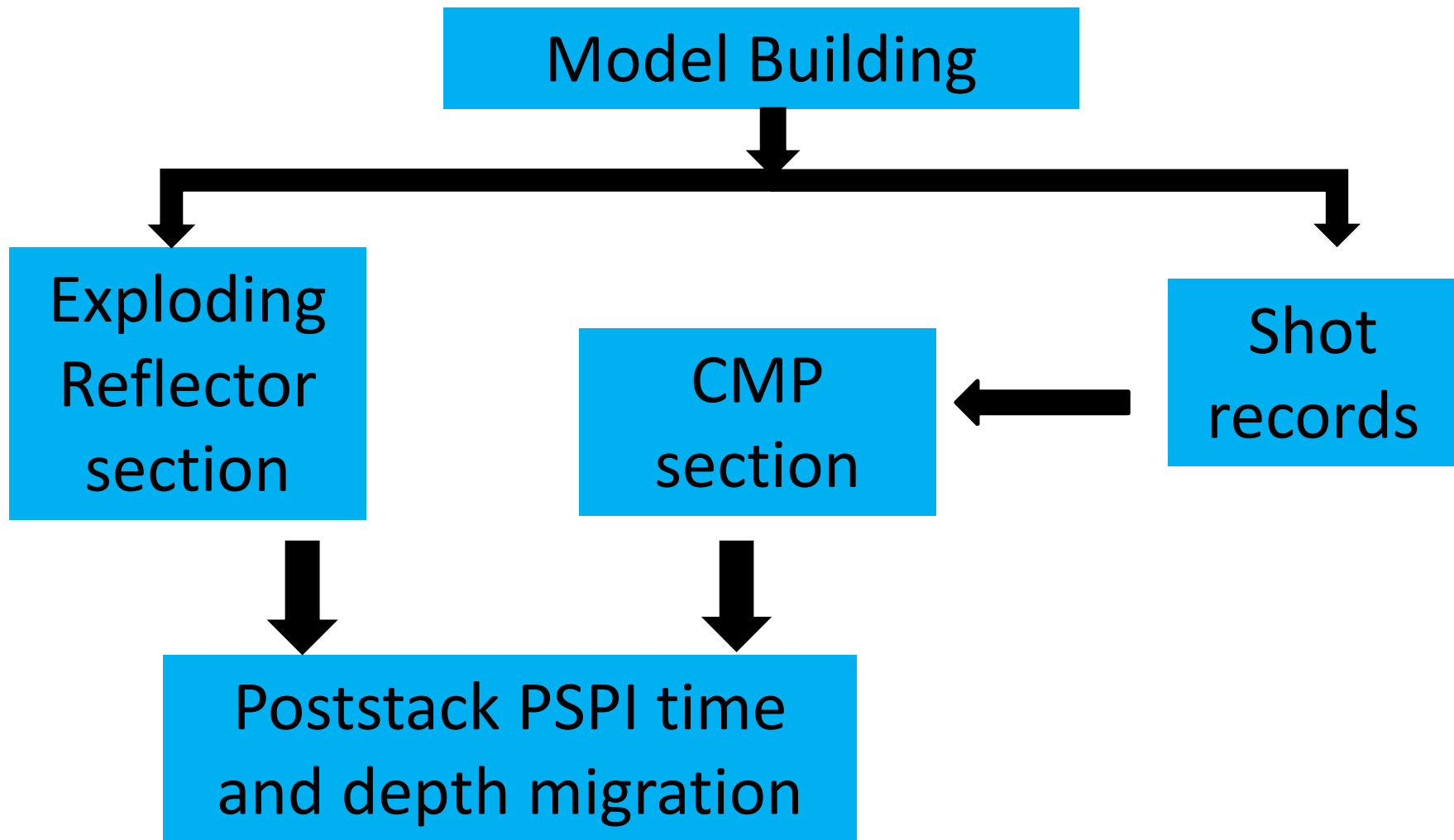
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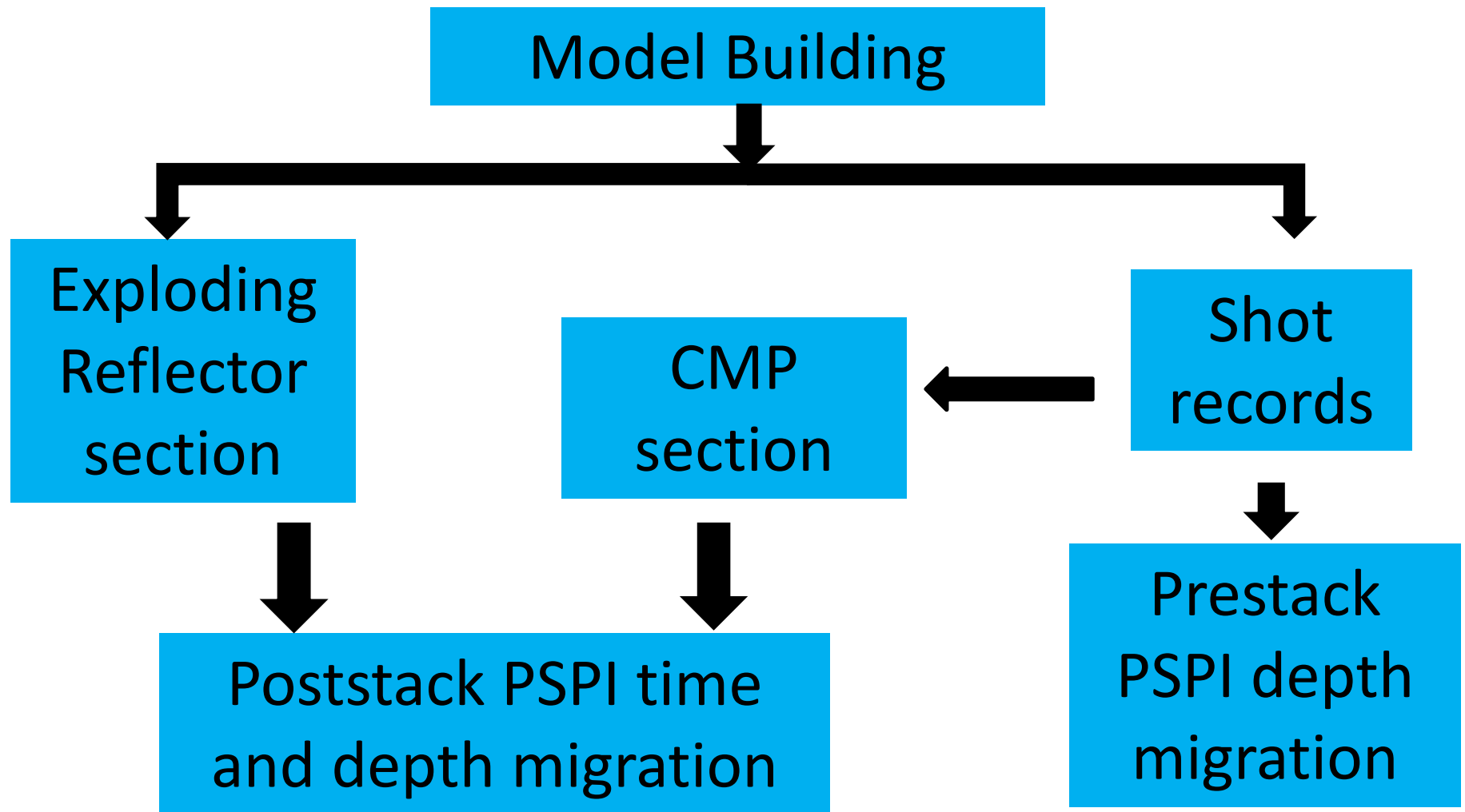
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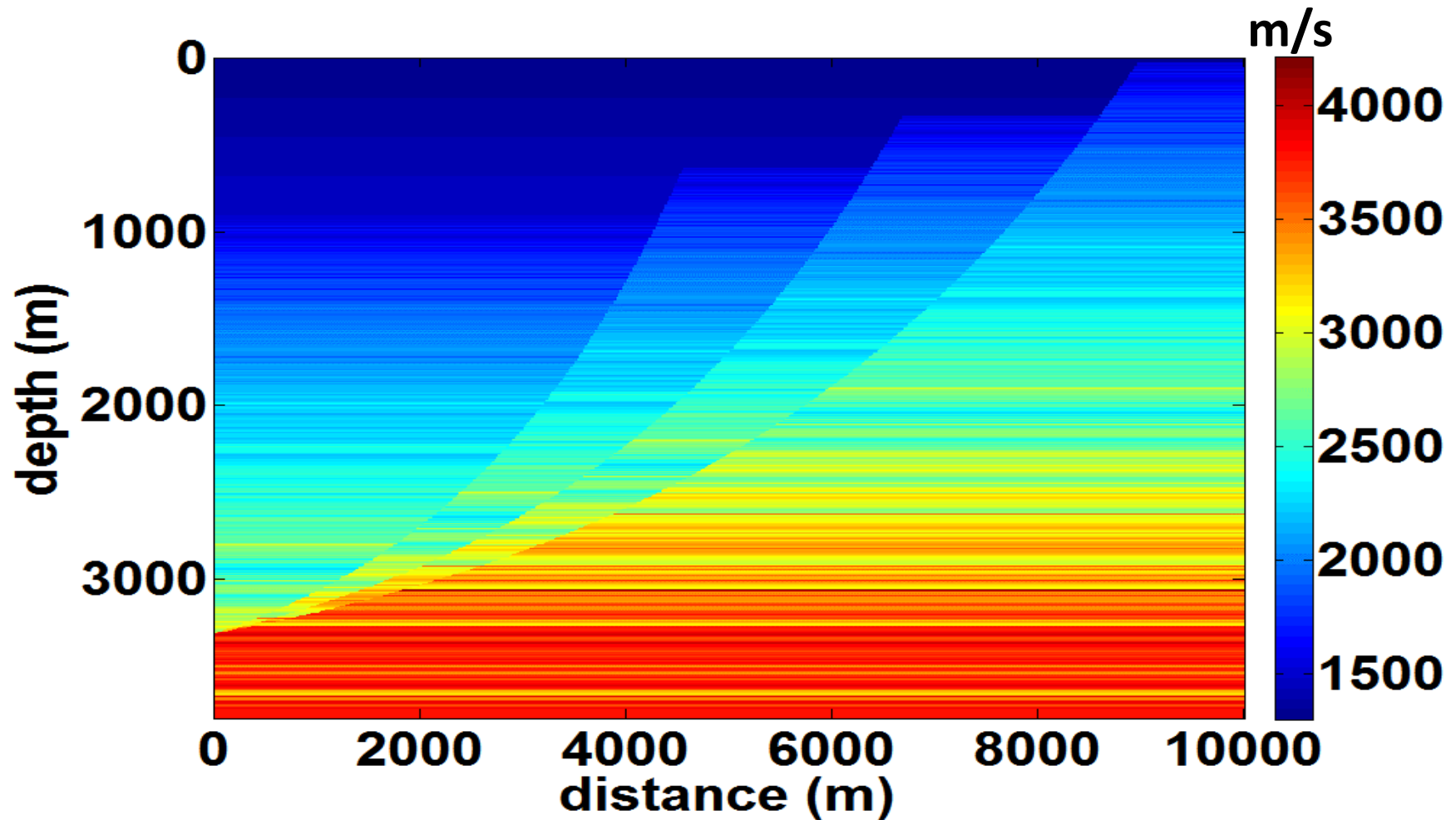


Methodology



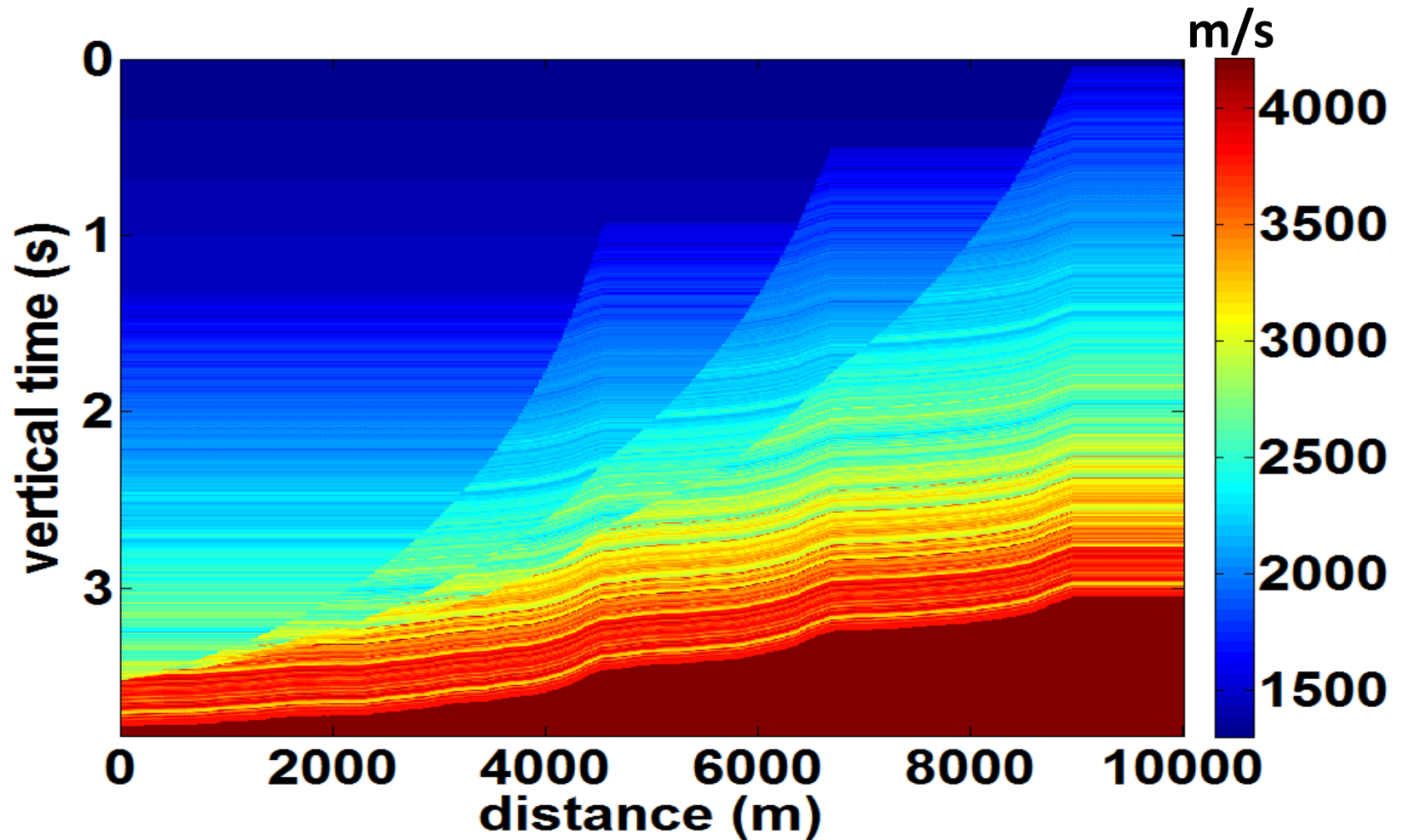
True velocity model in depth

well-log stratigraphy



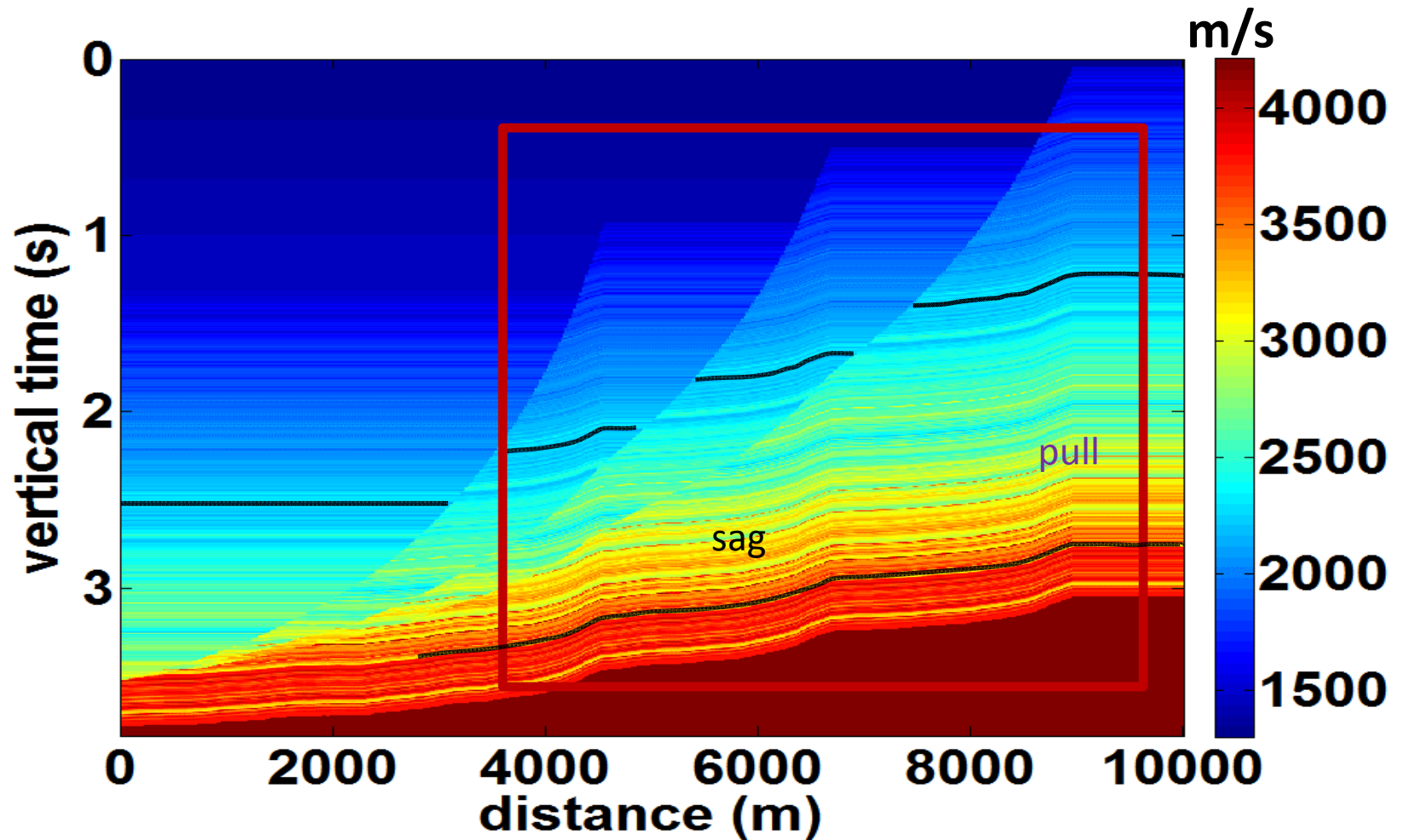
True velocity model in time

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True velocity model in time

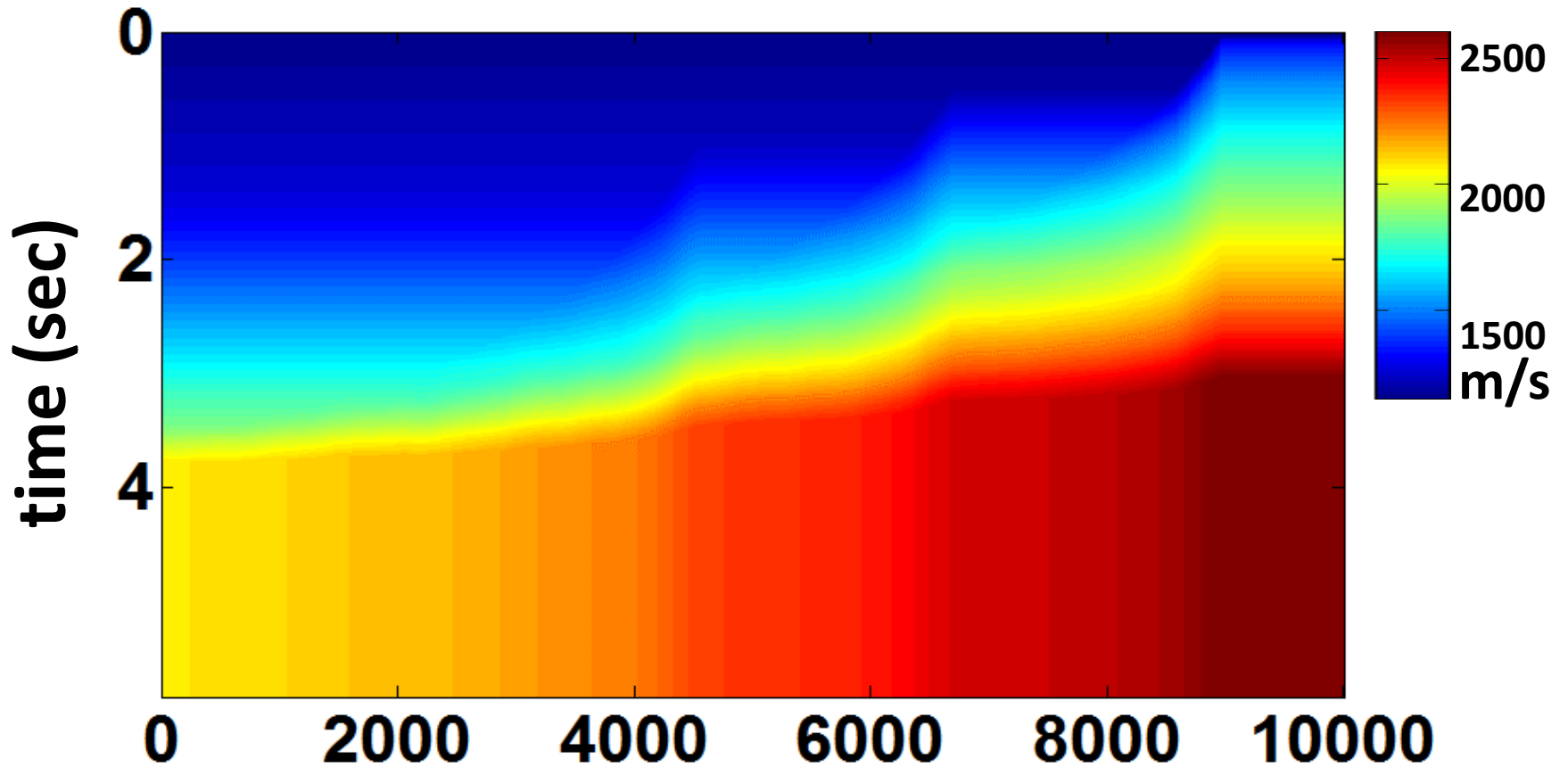
well-log stratigraphy



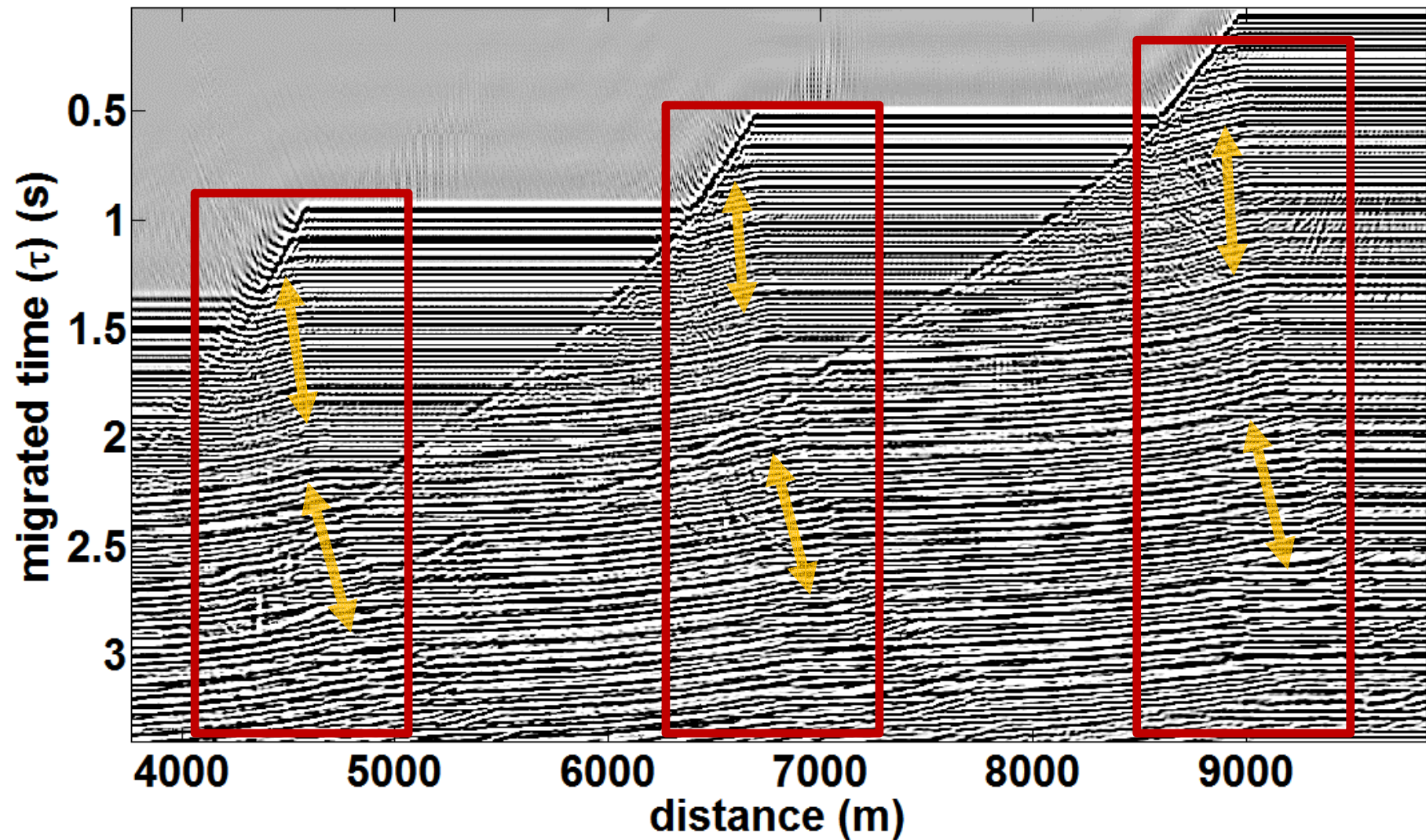
Post-stack time migration

RMS velocity

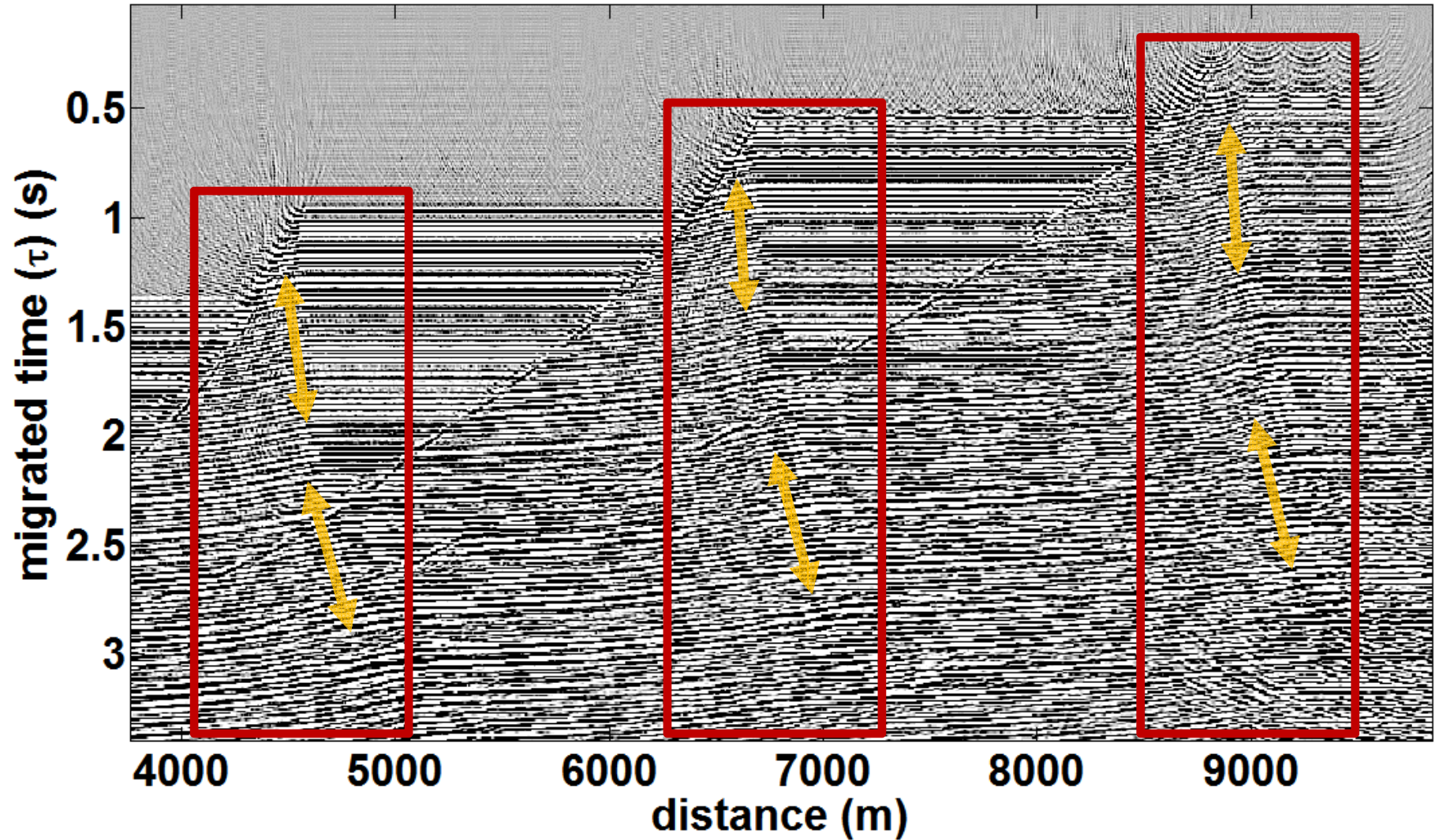
Normal-faulted geology



Exploding reflector post-STM



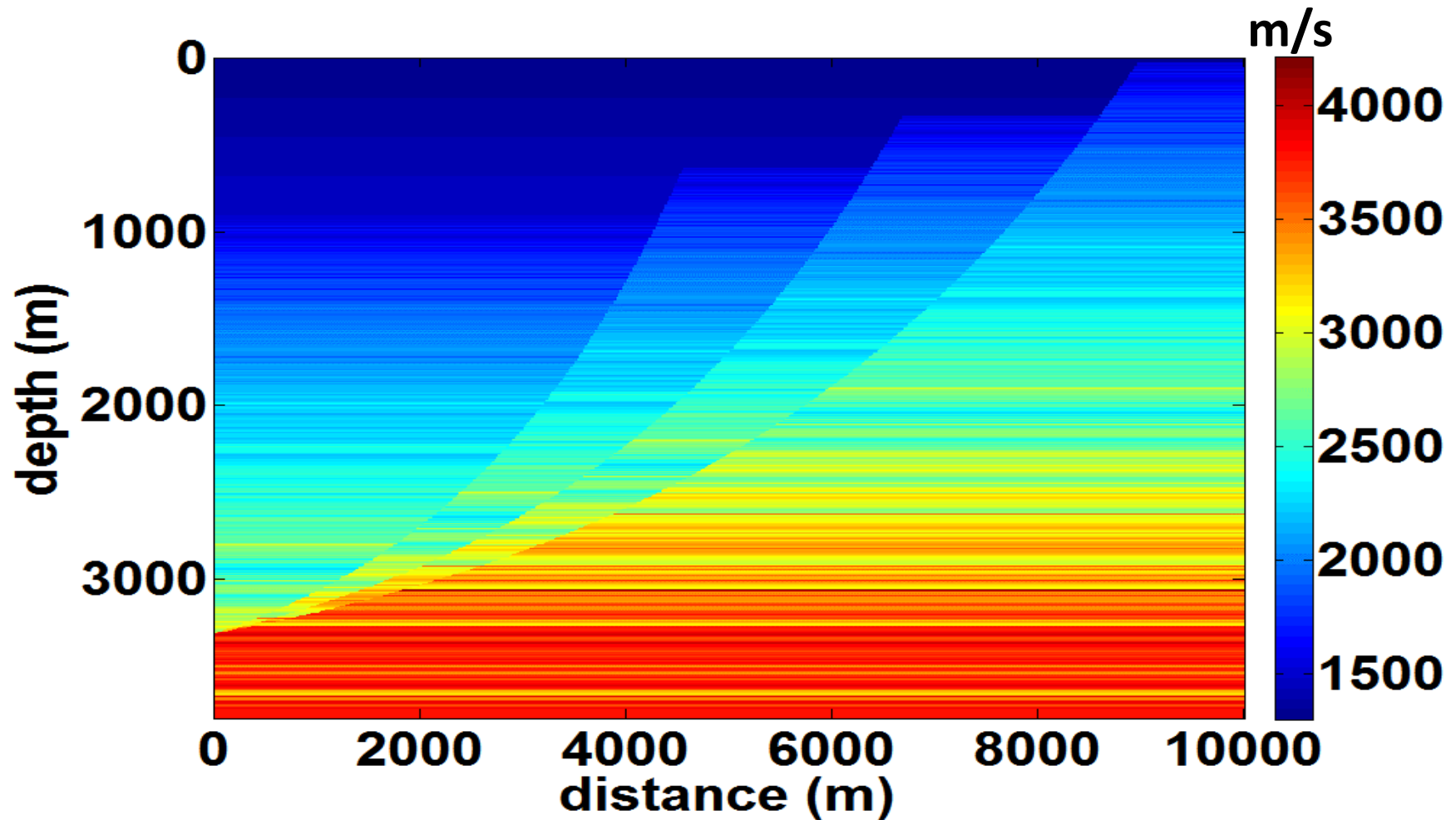
Common midpoint post-STM



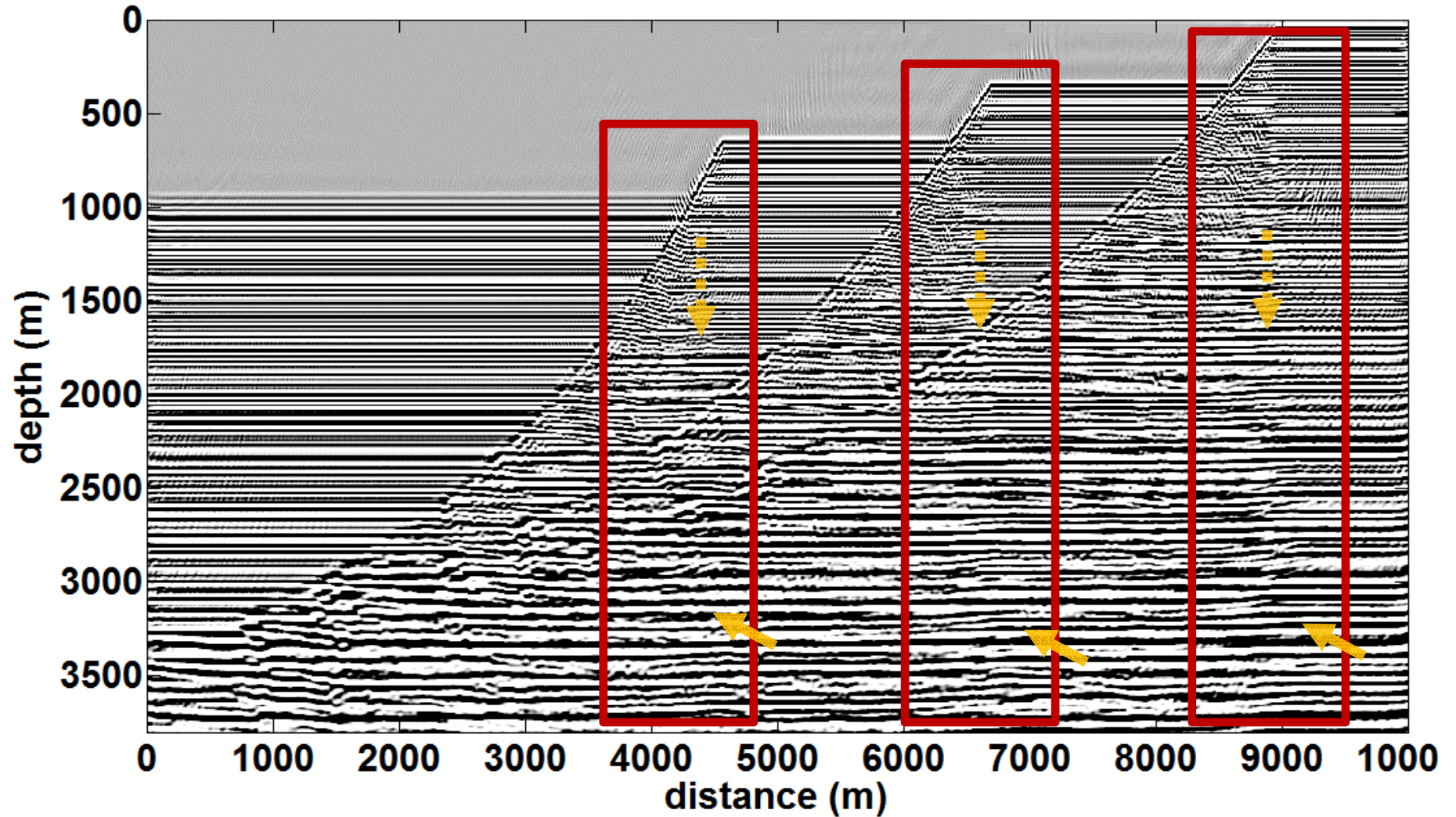
Post and pre-stack depth migration with true velocities

True velocity model in depth

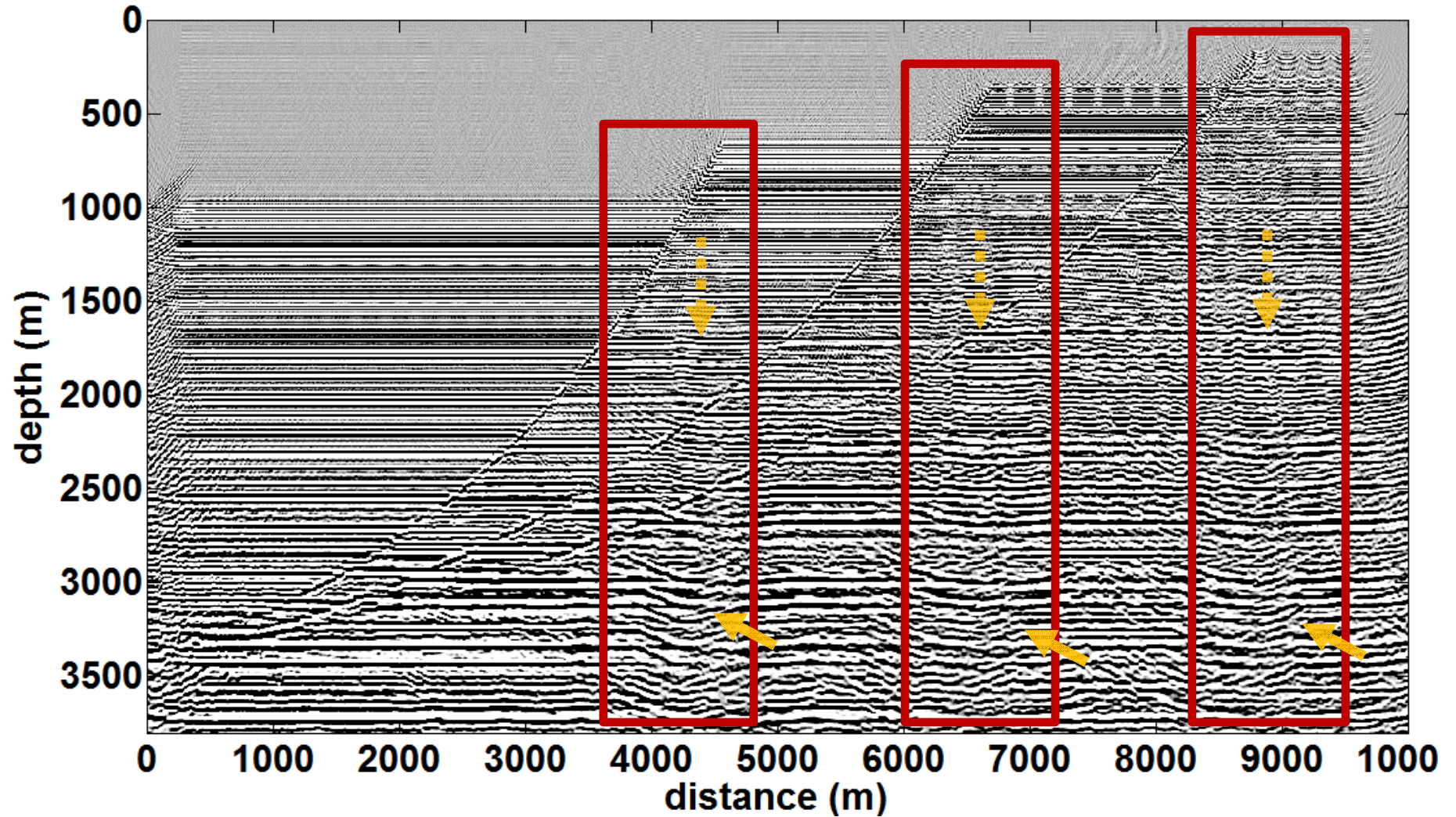
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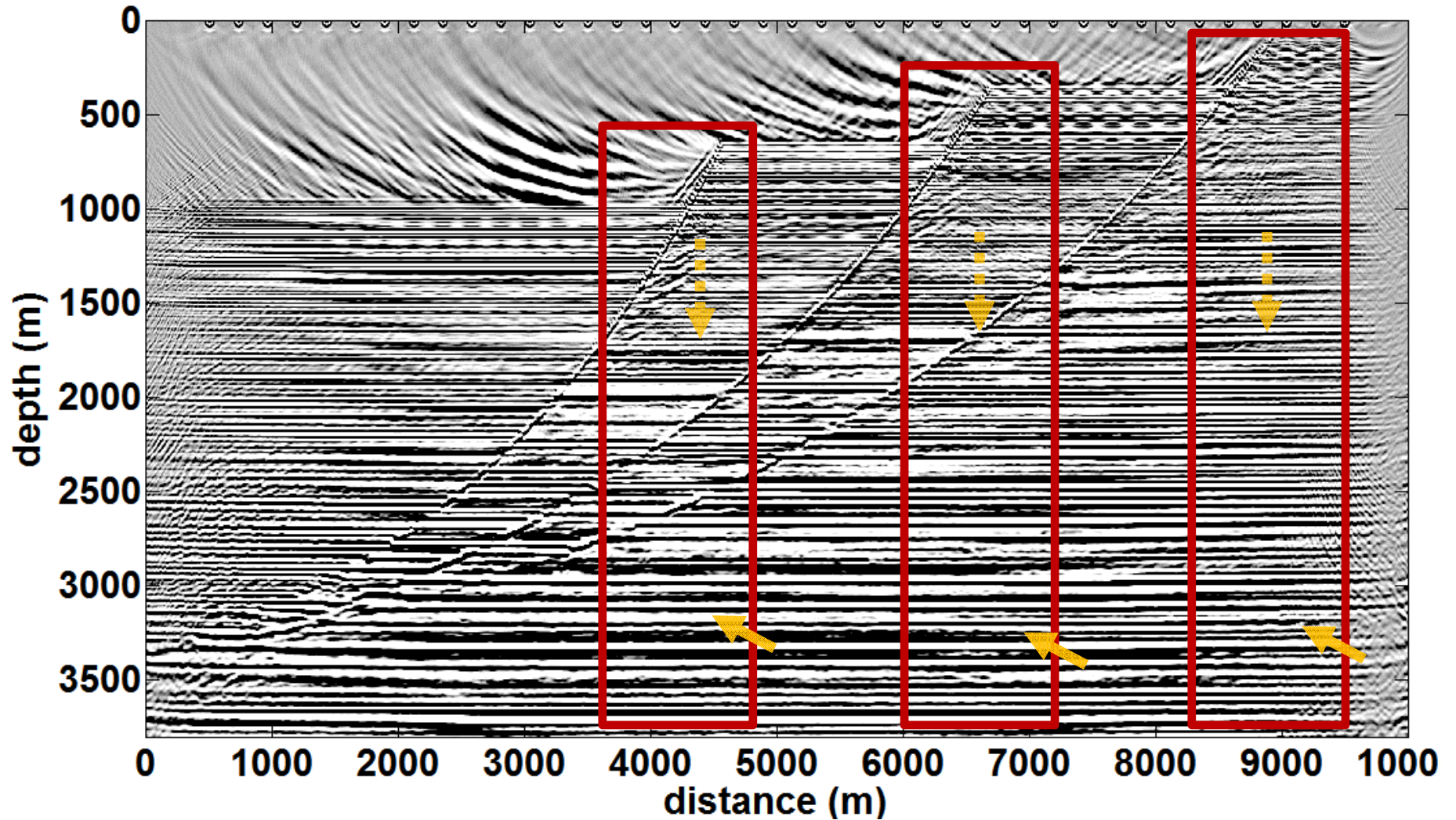
Exploding reflector post-SDM



Common midpoint post-SDM



Shot-domain pre-SDM

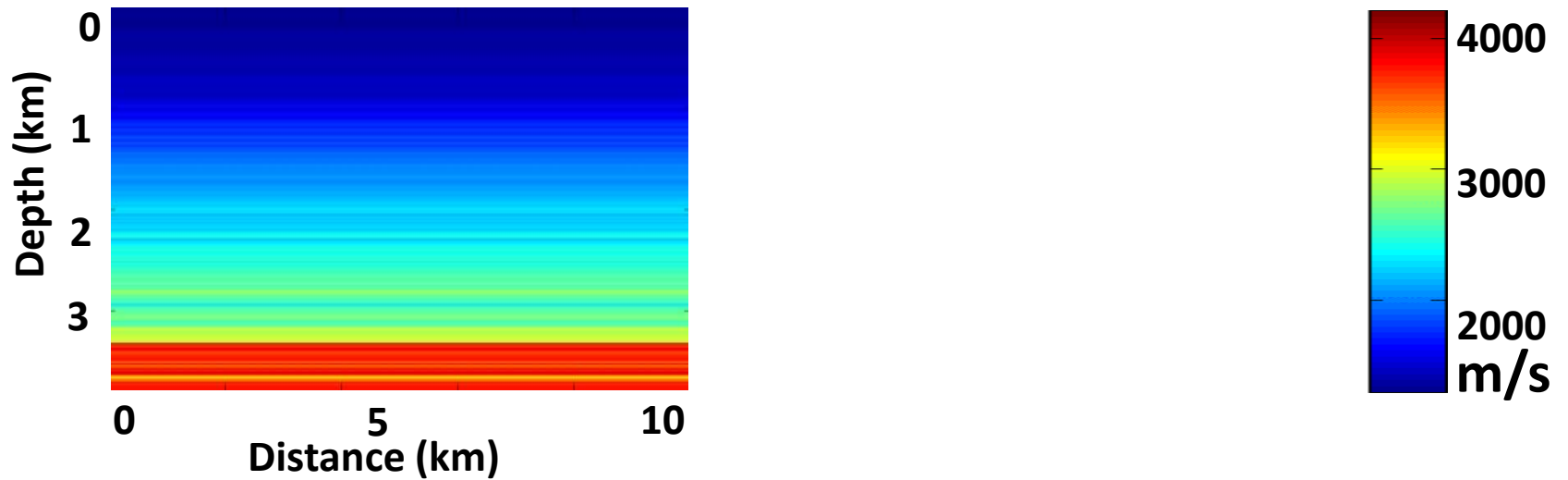


Approximate velocities from flat initial model

Fault-constrained velocities

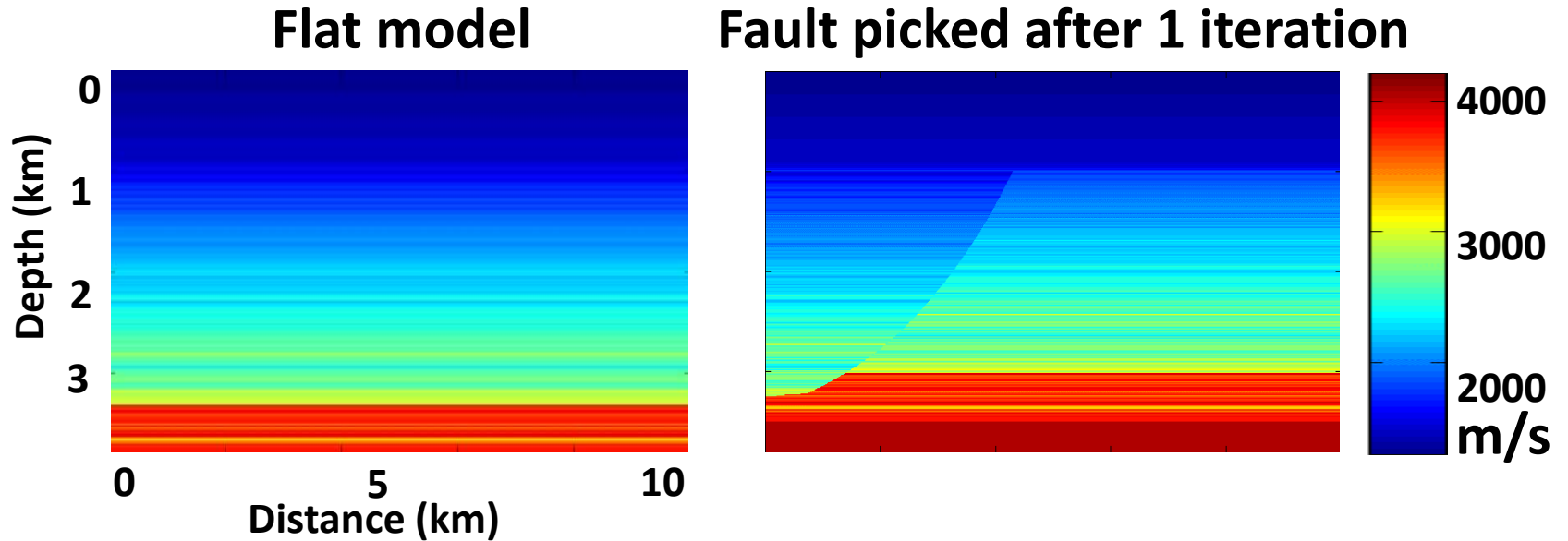
detailed stratigraphy

Flat model



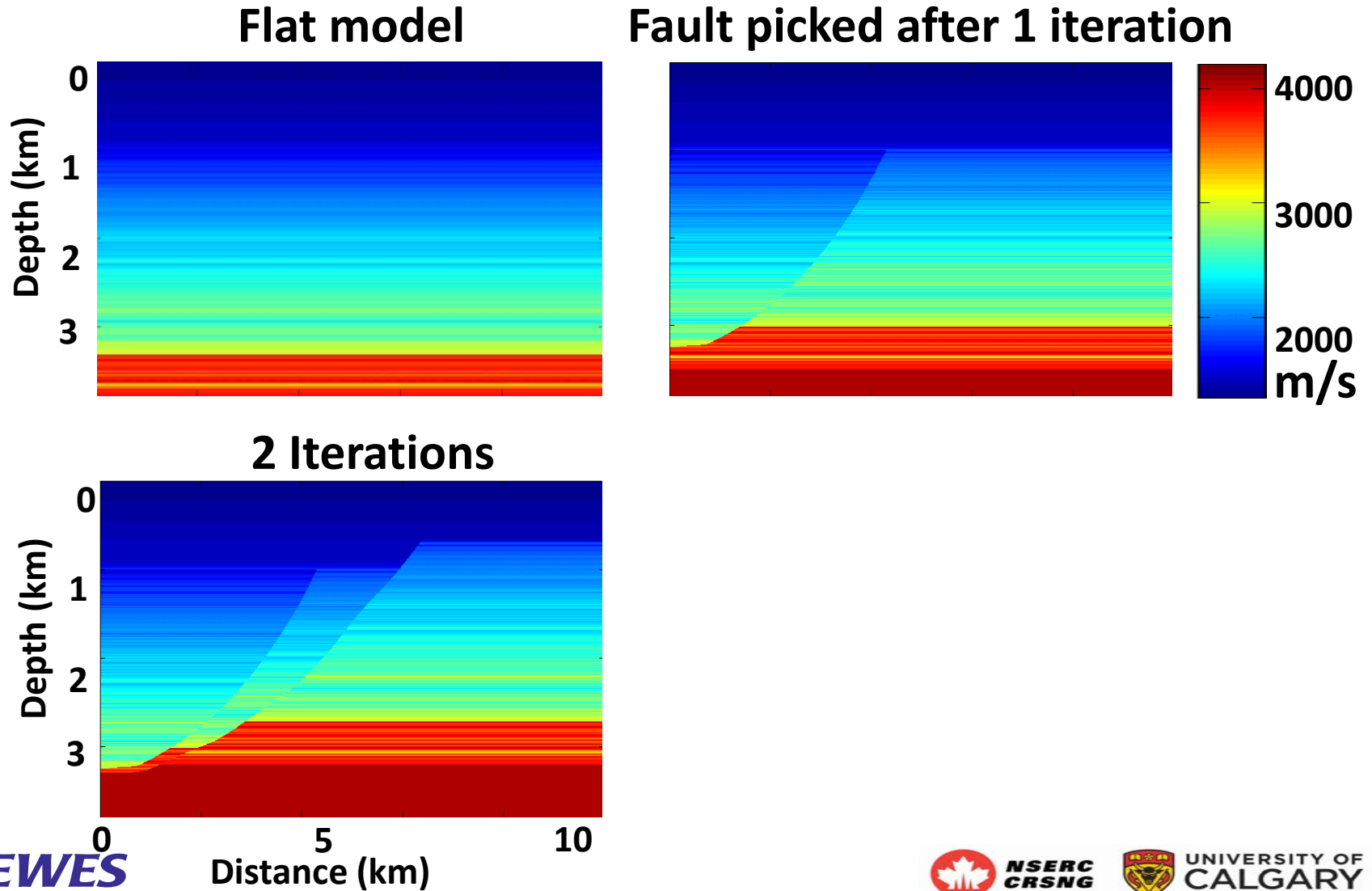
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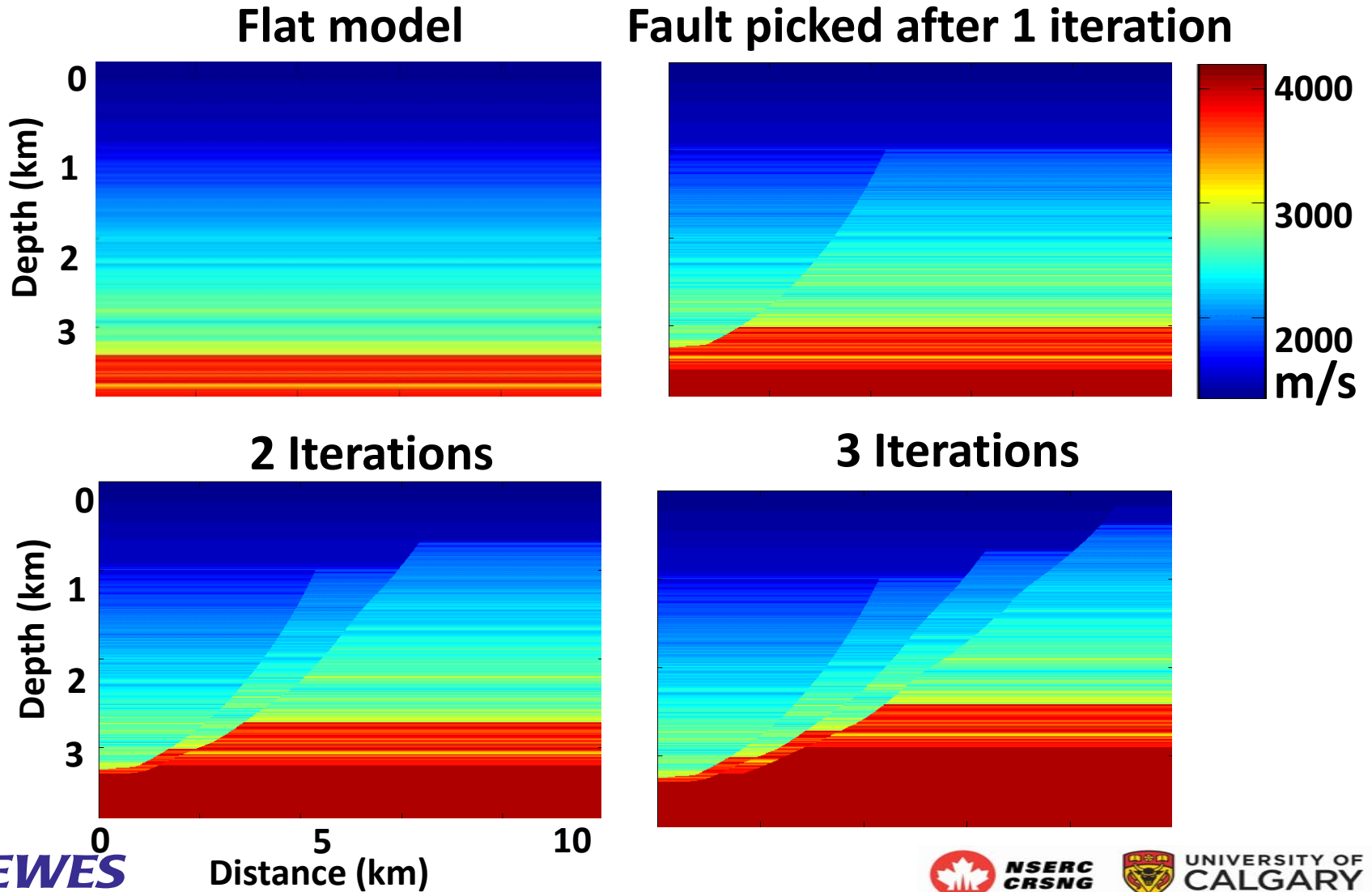
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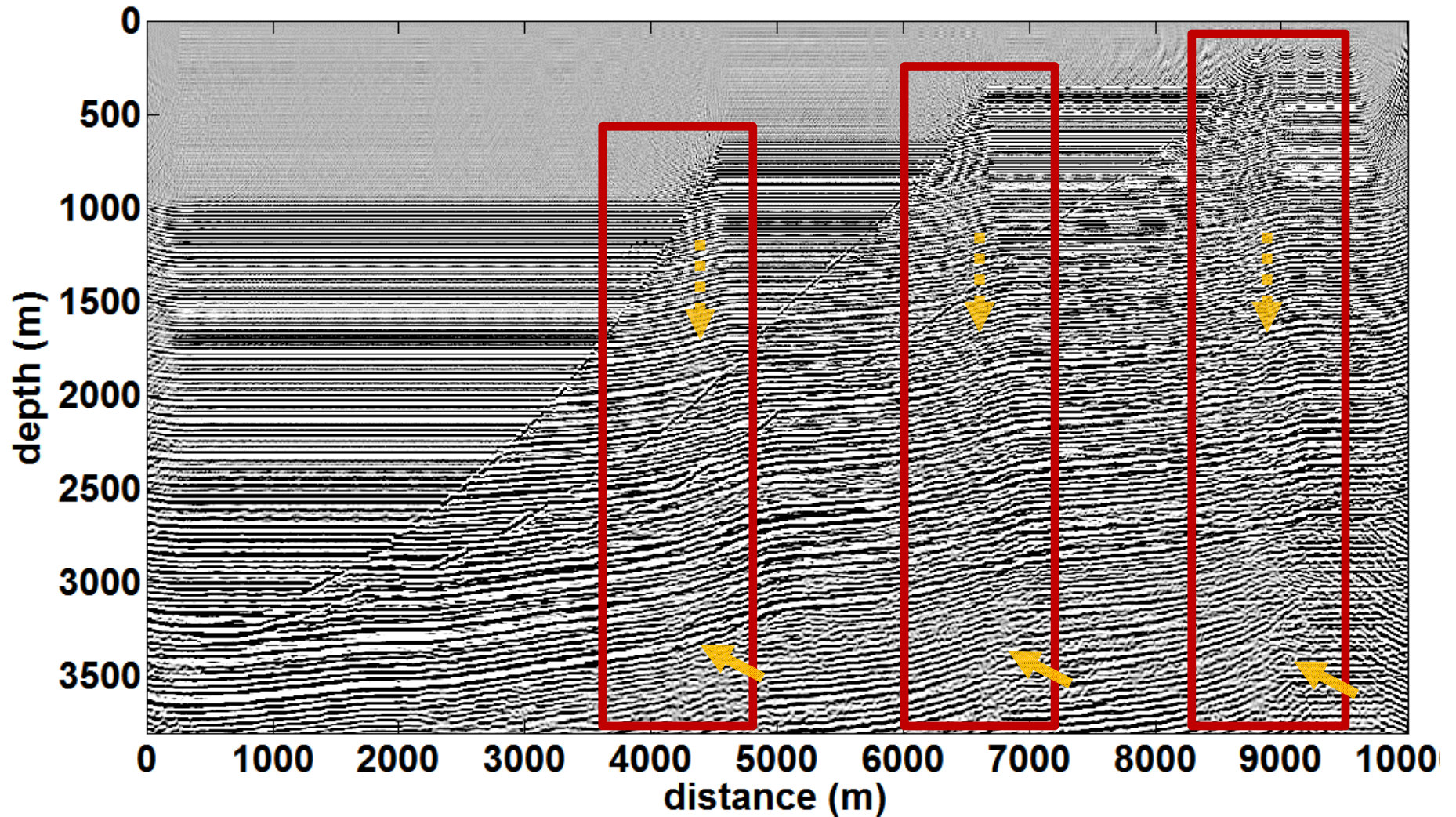
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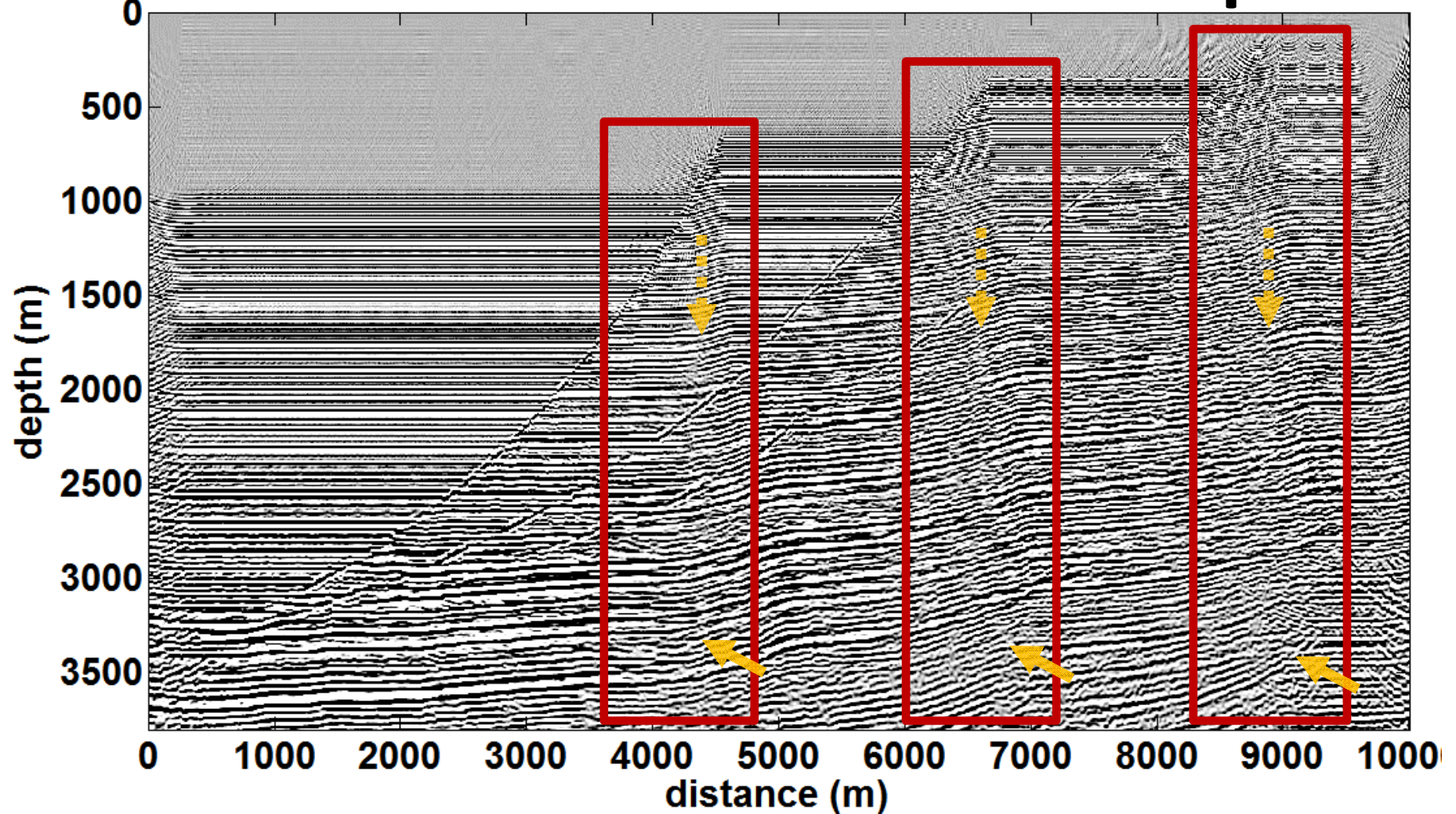


Iterated depth migration with approximate models

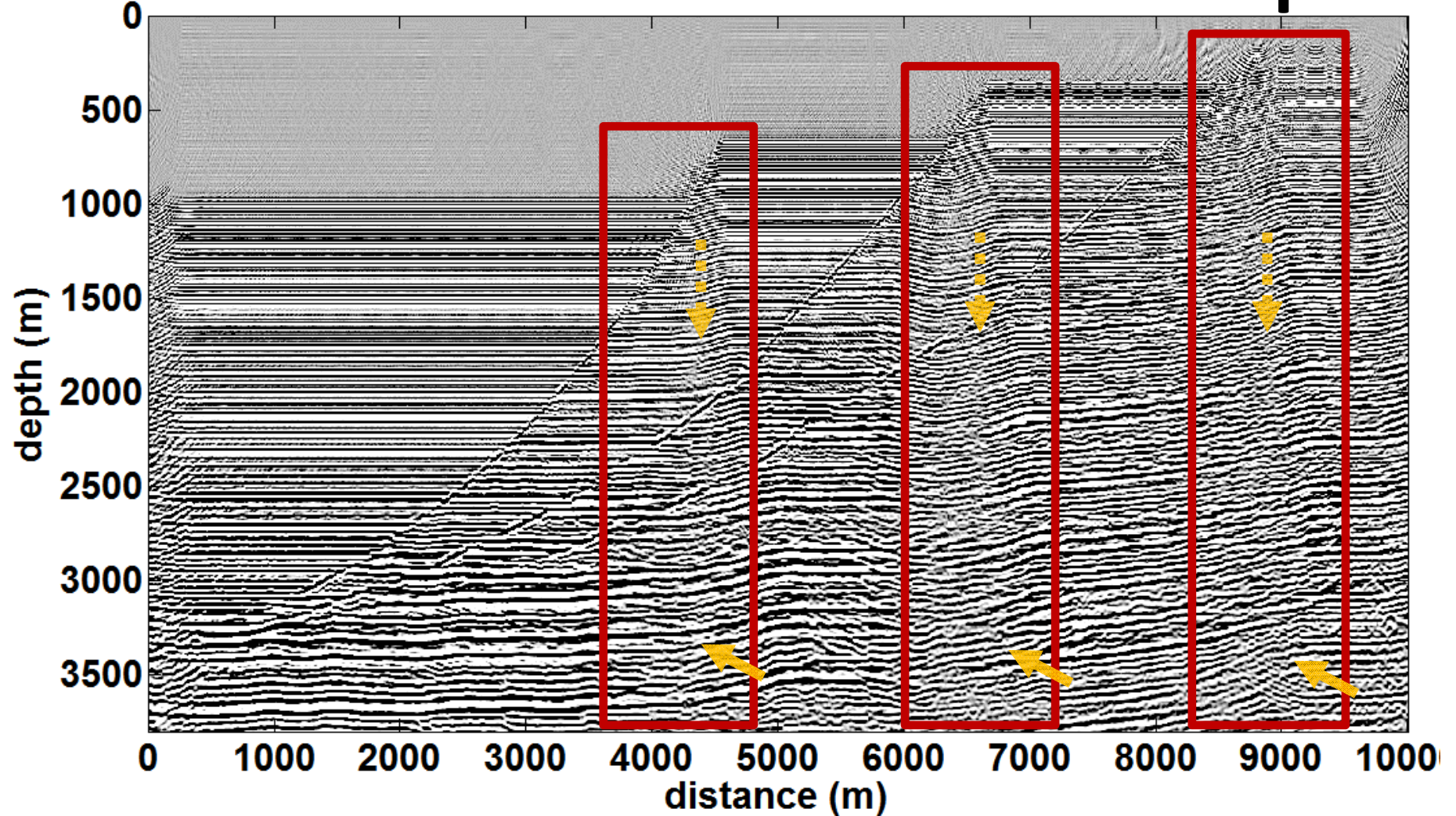
Post-SDM with flat model



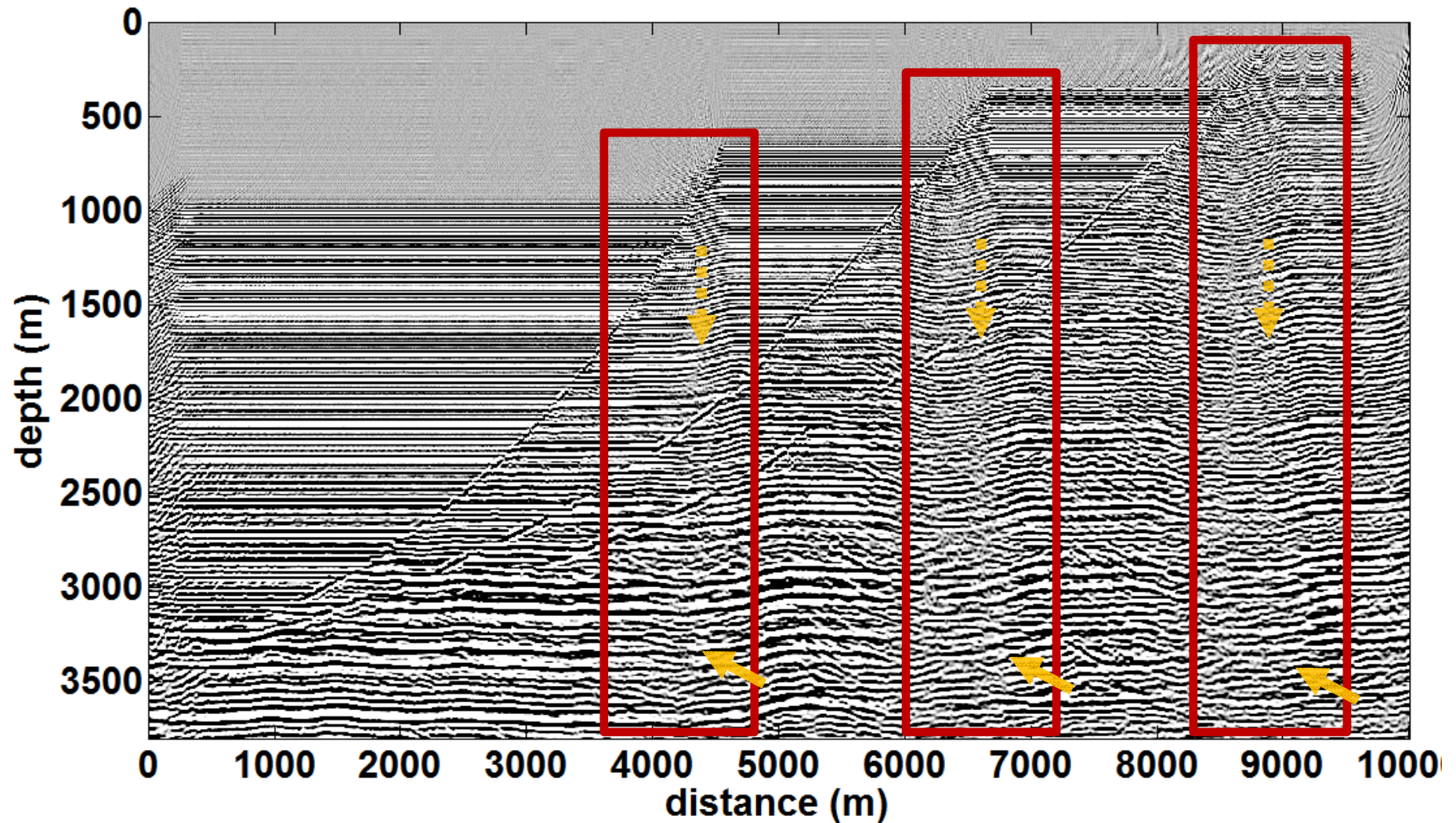
Iterative migration with fault constrained velocities from first pick



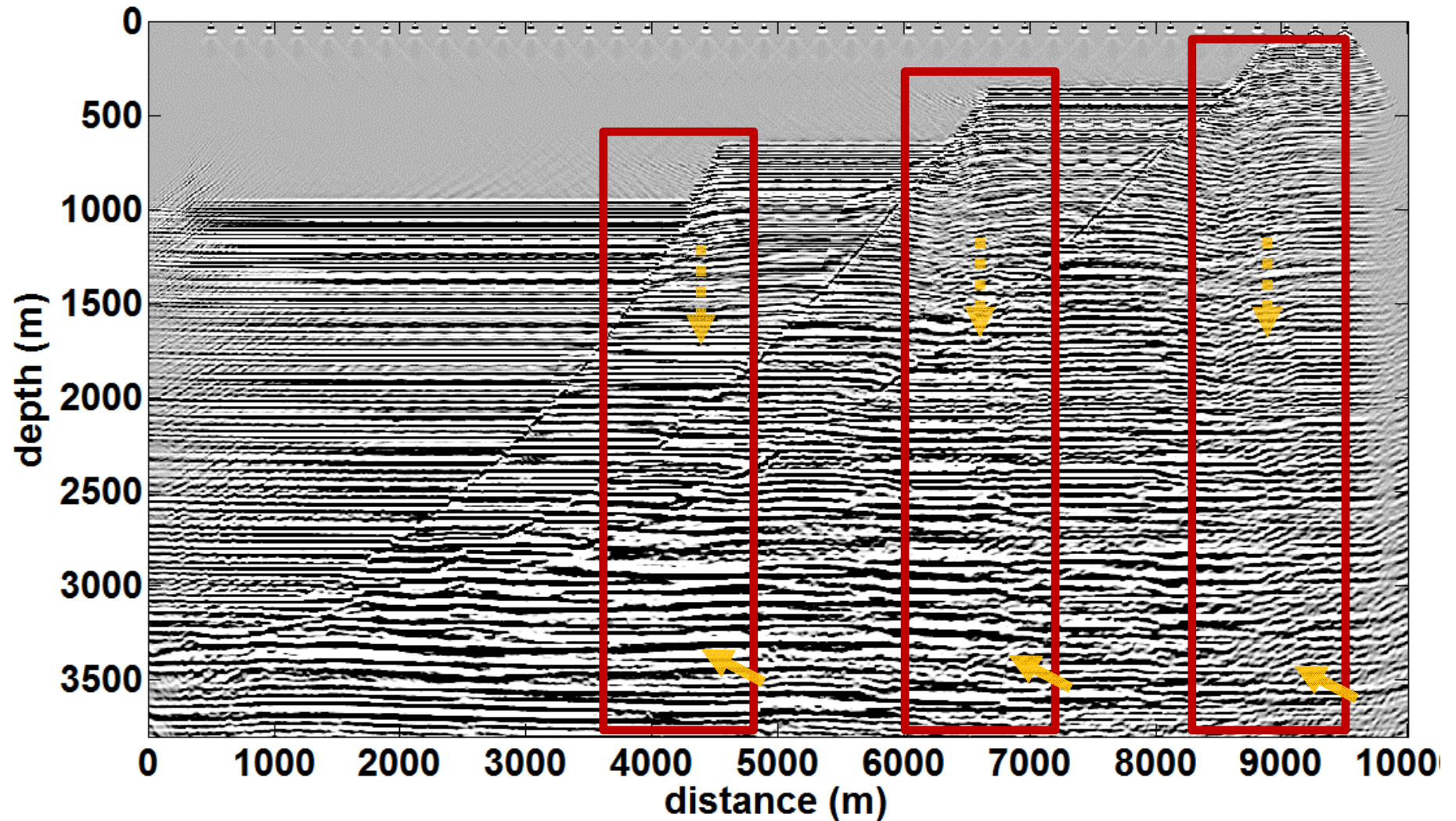
Iterative migration with fault constrained velocities from second pick



Iterative migration with fault constrained velocities from final pick



Prestack depth migration with third pick

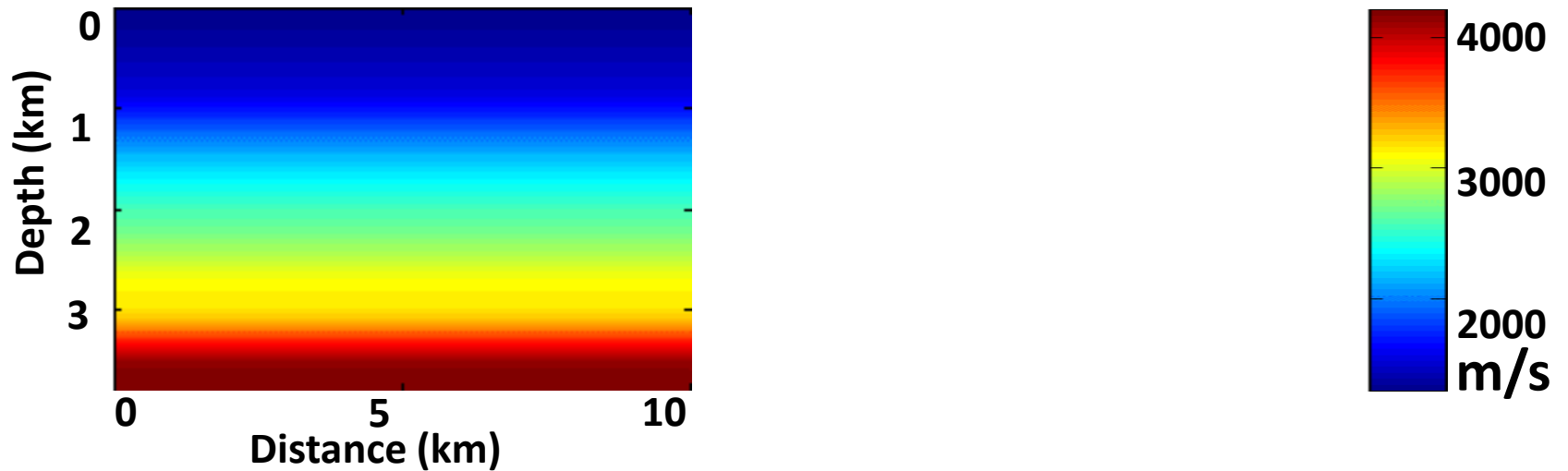


Approximate velocities from Gaussian smoothed flat initial model

Fault-constrained velocities

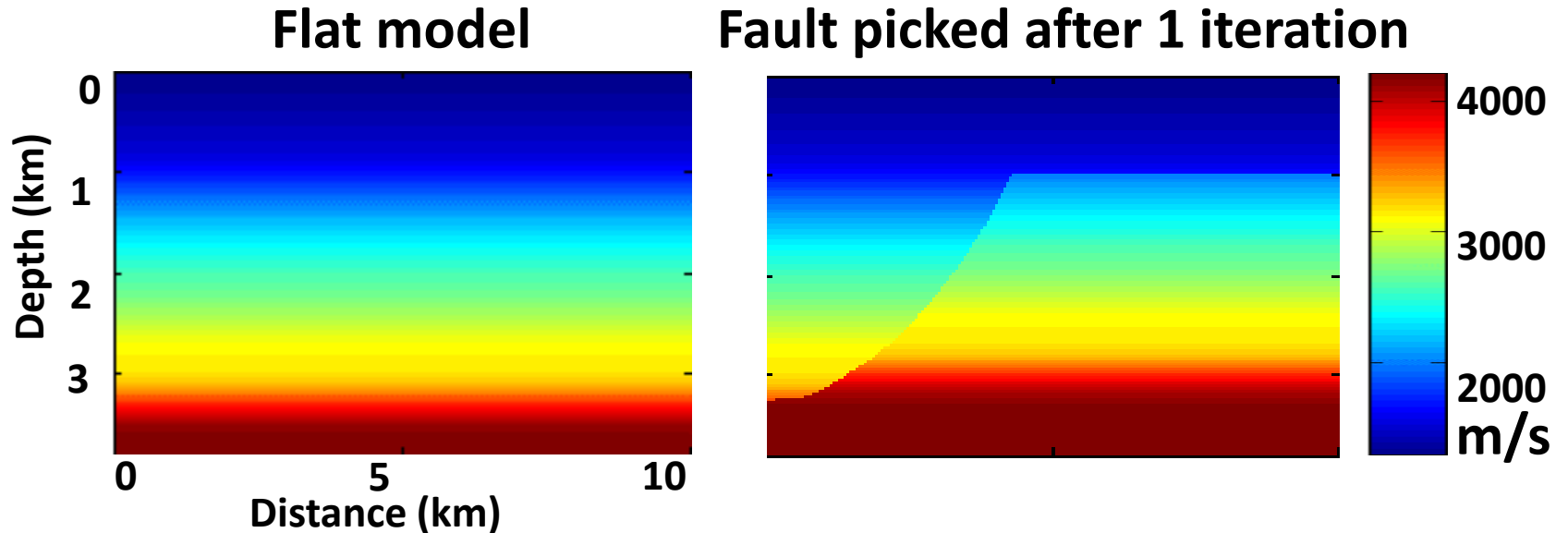
Gaussian-smoothed stratigraphy

Flat model



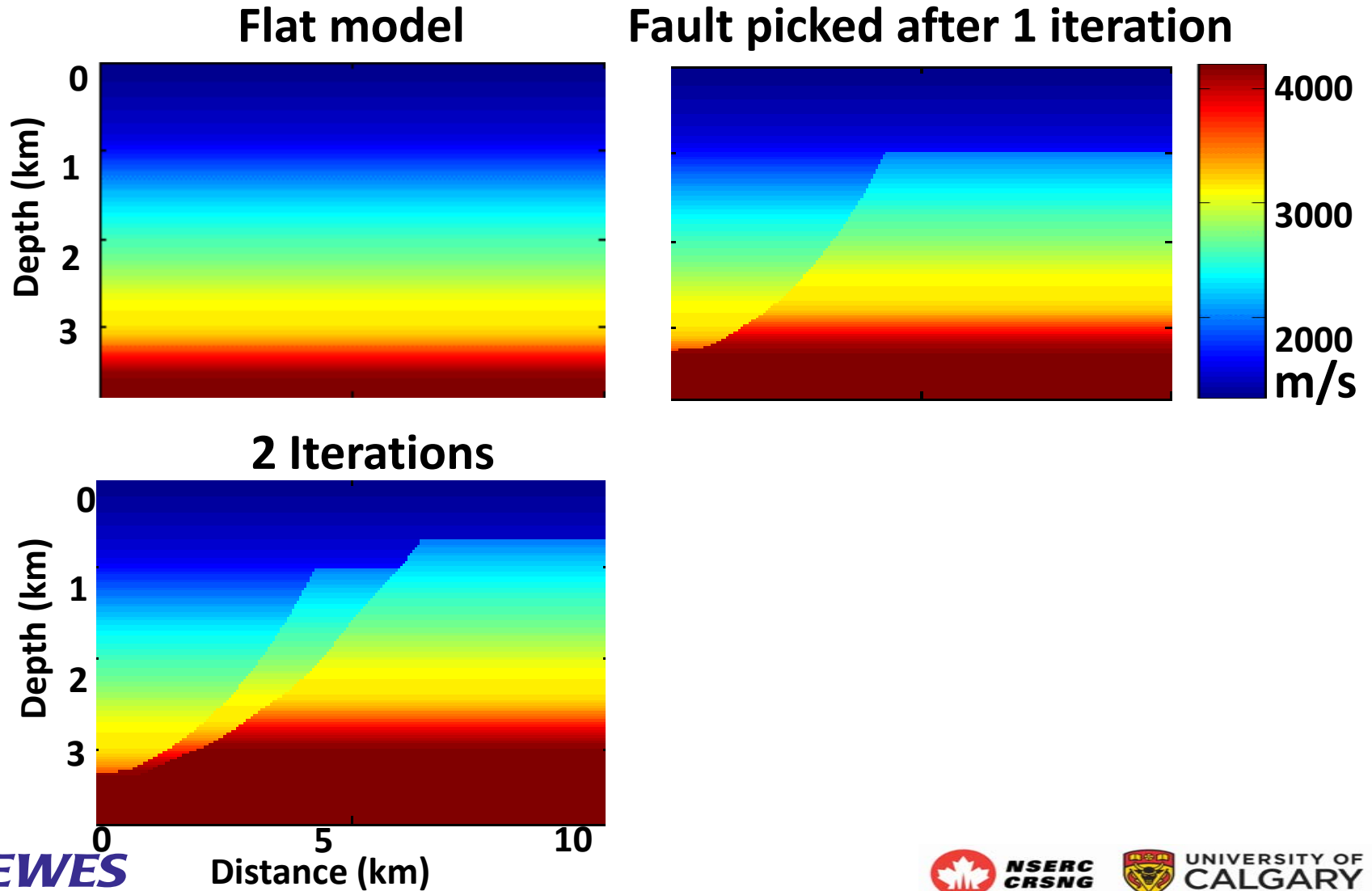
Fault-constrained velocities

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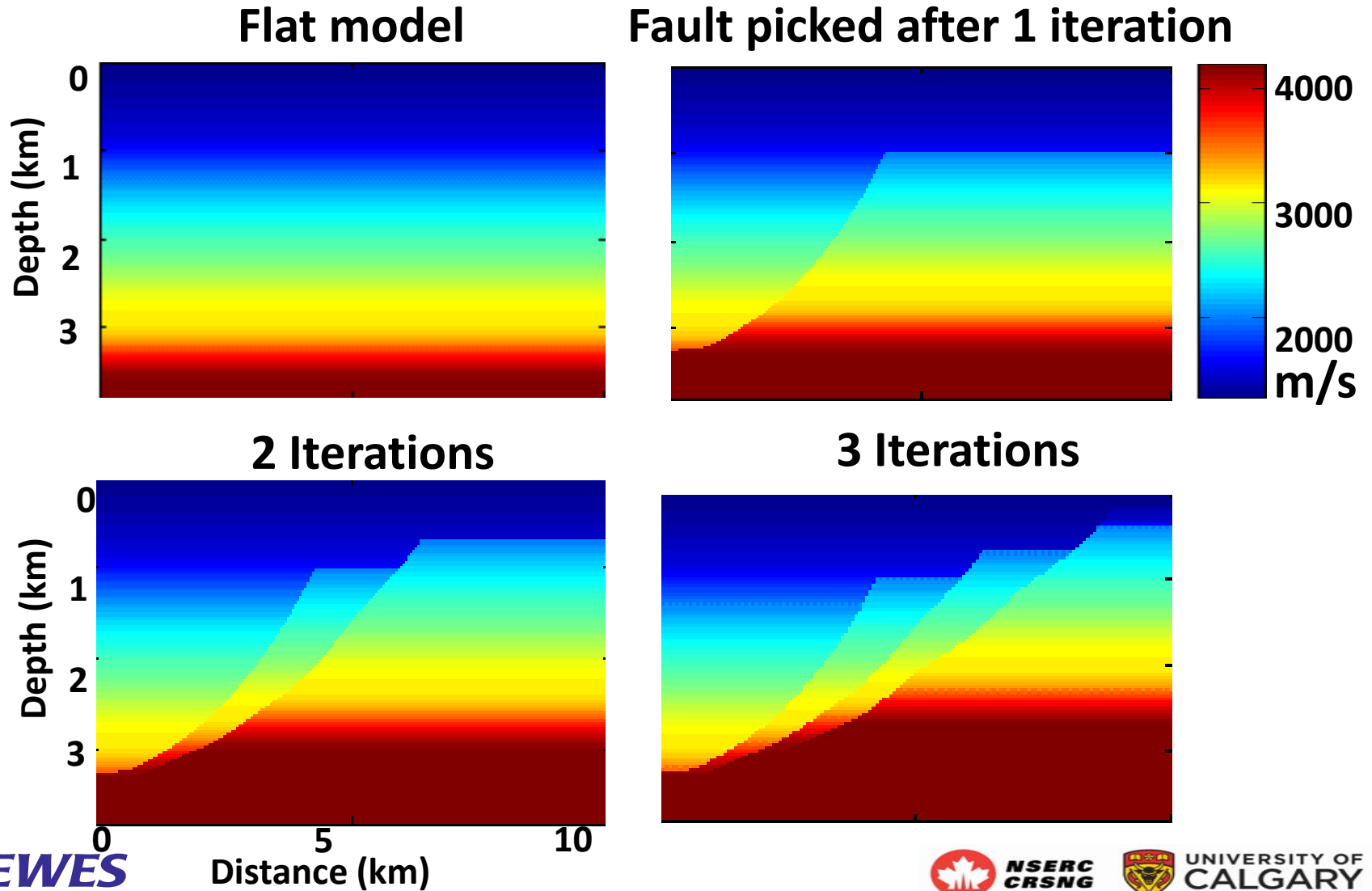
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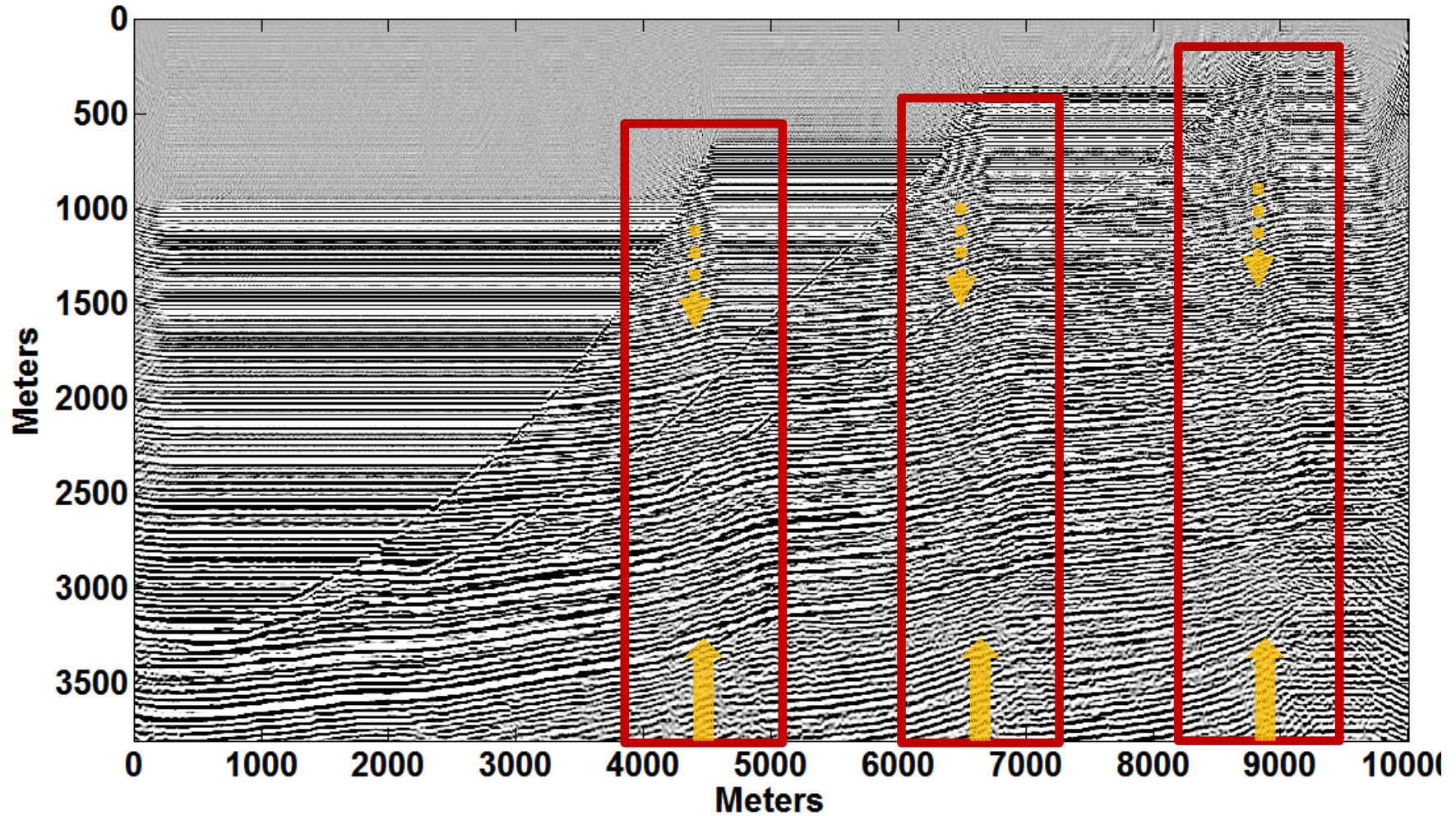
Fault-constrained velocities

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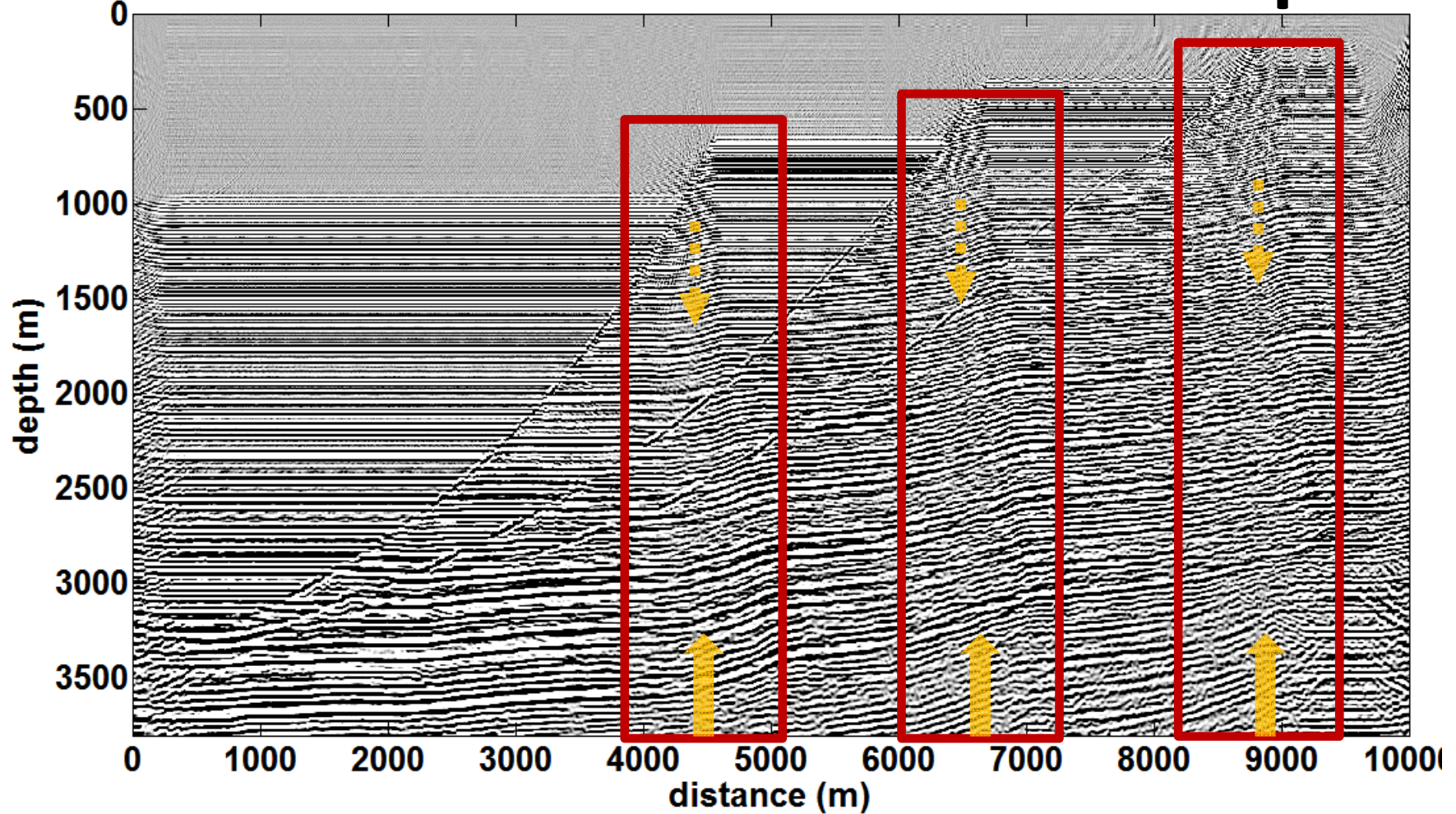


Iterated depth migration with gaussian-smoothed approximate models

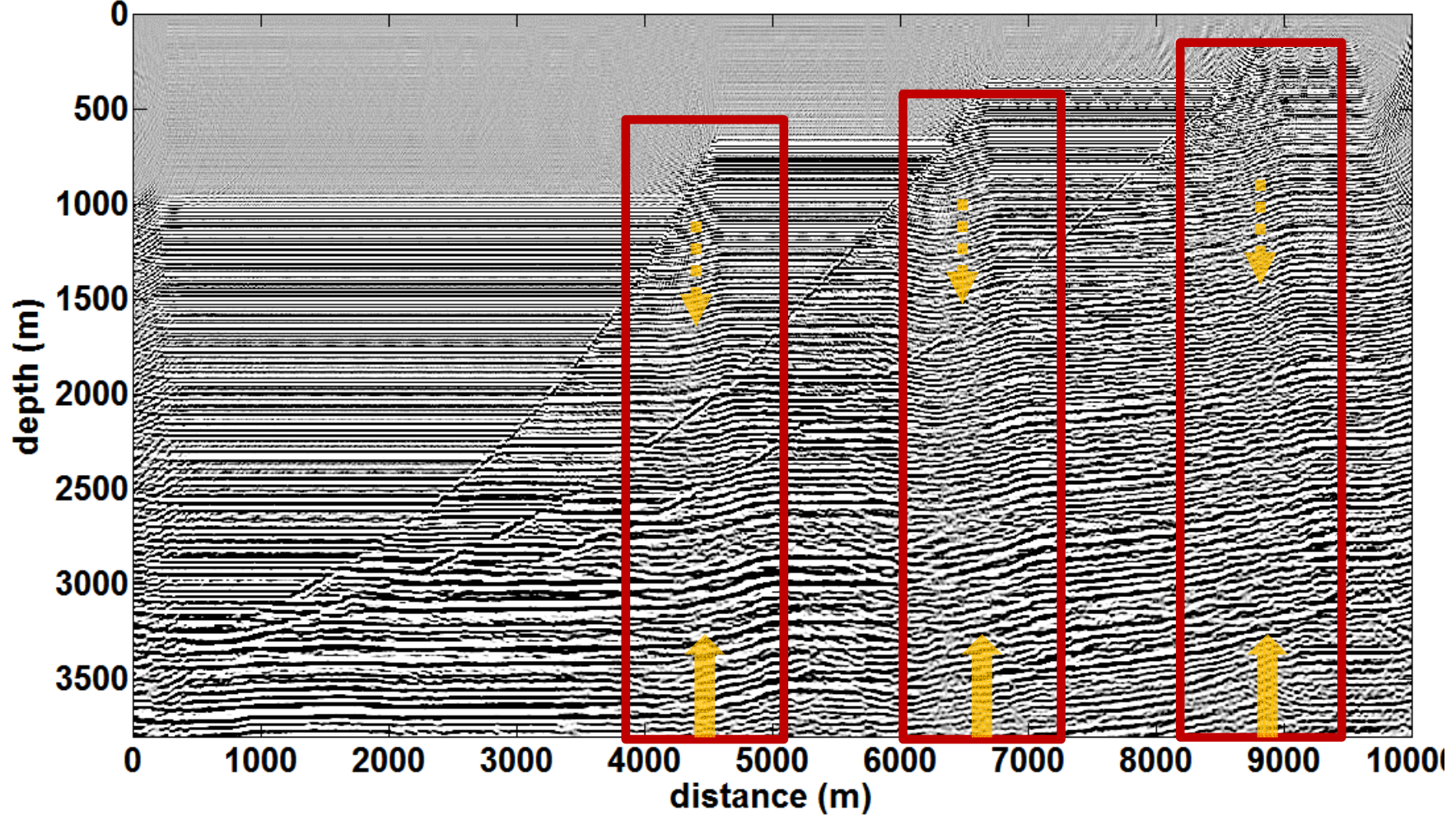
Post-SDM with Gaussian-smoothed flat model



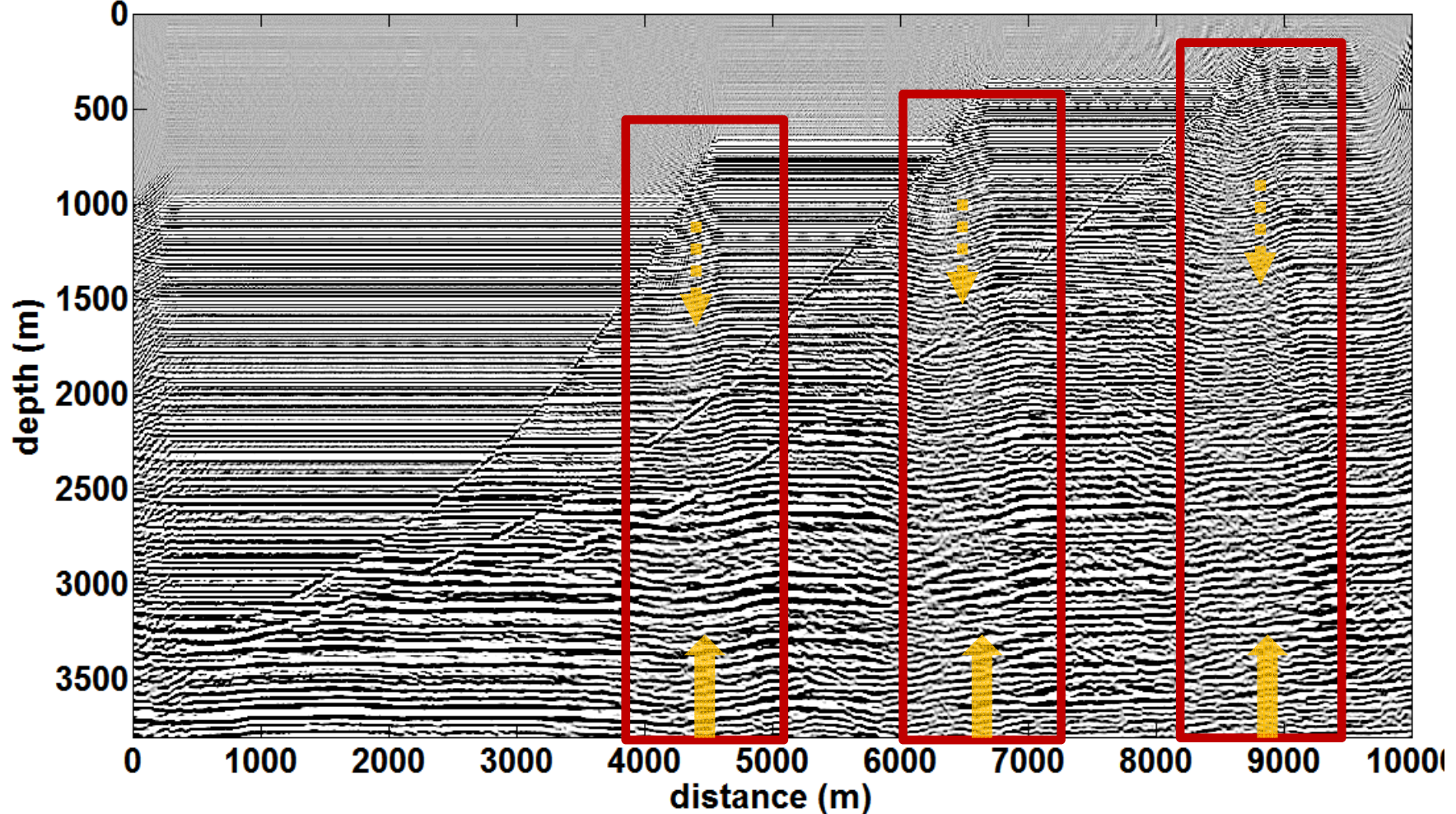
Iterative migration with fault constrained velocities from first pick



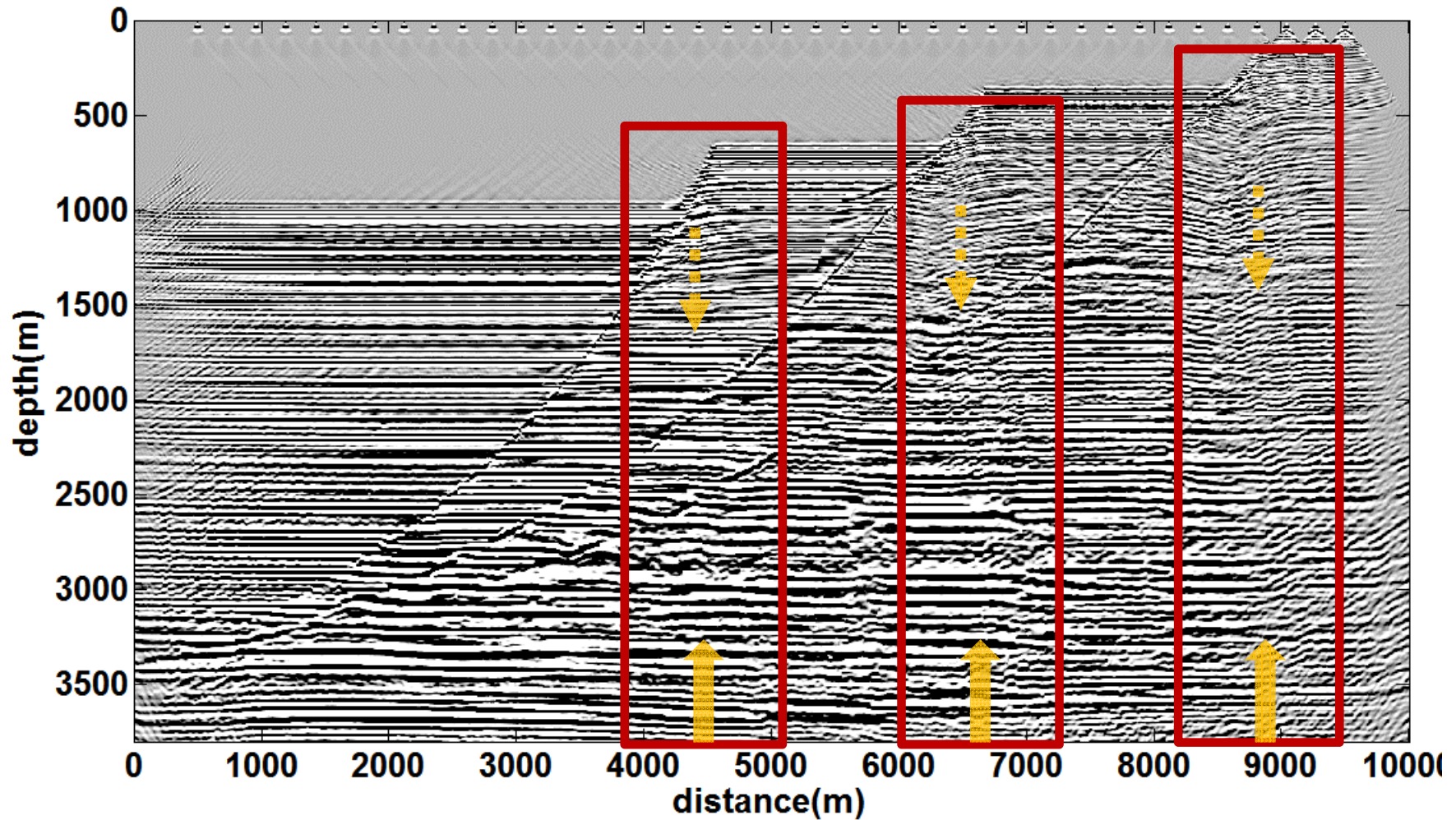
Iterative migration with fault constrained velocities from second pick



Iterative migration with fault constrained velocities from third pick



Prestack depth migration with third pick



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- **Primarily caused by strong velocity contrast across a fault.**
- **Non-hyperbolic reflections created by dipping fault forces poststack migrations to fail**
- **Time migration is in addition inherently limited by RMS.**

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- **Prestack depth migration is promising if the velocity is accurate.**
- **Lastly, fault shadow is a velocity and wave propagation problem and requires accurate understanding of the velocities as well as the structural geology and stratigraphy of the area**

Future Work

In the future, we will work on

- **a more realistic geologic model**
- **building effective migration velocity models**
- **and incorporate seismic attenuation and anisotropy.**

Acknowledgment

- **NSERC for the grant CRDPJ 379744-08**
- **CREWES Sponsor**
- **CREWES Staff**
- **Colleagues**

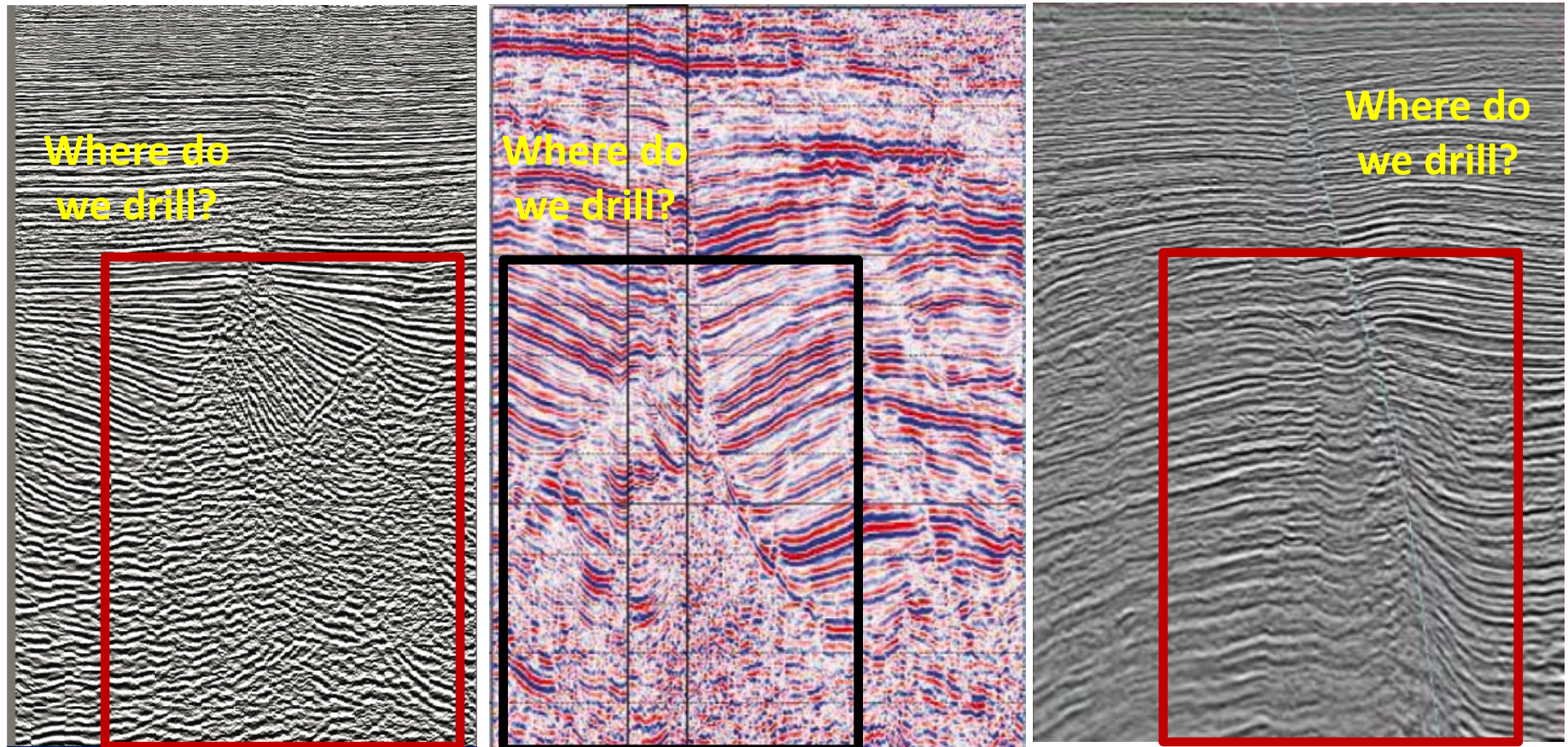
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Thank you
I will now take some questions

Appendix

Fault Shadows on typical real seismic datasets in SEG and CSEG publications



Kirckhoff depth migration of the South Texas (Bednar et.al. 2003)

Conventional PSDM of the Gulf of Guinea (aikulola et.al. 2010)

common offset poststack depth migration of the Permafrost of Siberia (Quigley et.al. 2012)