

MATLAB EOM

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NSERC

Outline:

- What is EOM
- EOM MATLAB
- Commercials



Recent interest in EOM

More interest in time migration

Velocity analysis in structured areas

Converted wave applications

Development of EOM in MATLAB environment

What is EOM?

Equivalent **O**ffset **M**igration

Prestack migration: **time** or depth

Converted wave prestack migration

Accurate velocity analysis

Ability to see what goes into the migration

Fast

What is EOM?

Assumes colocated source and receiver...

SP R MP S

h_s

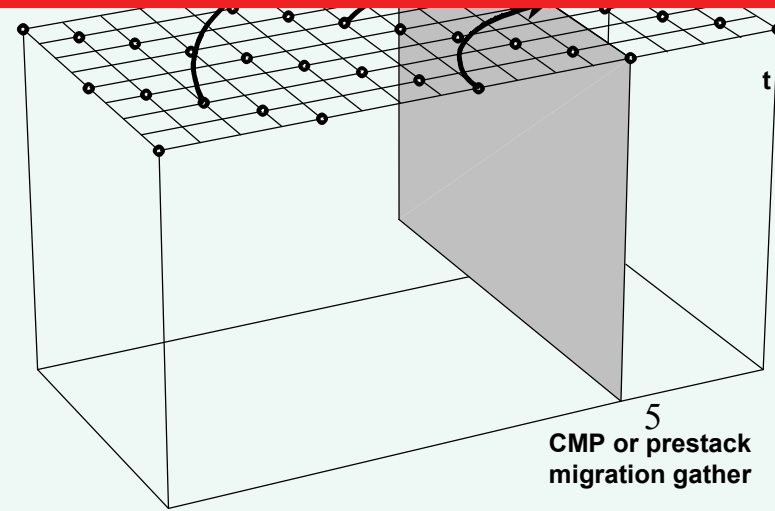
Saturday

to or z

SP R MP S

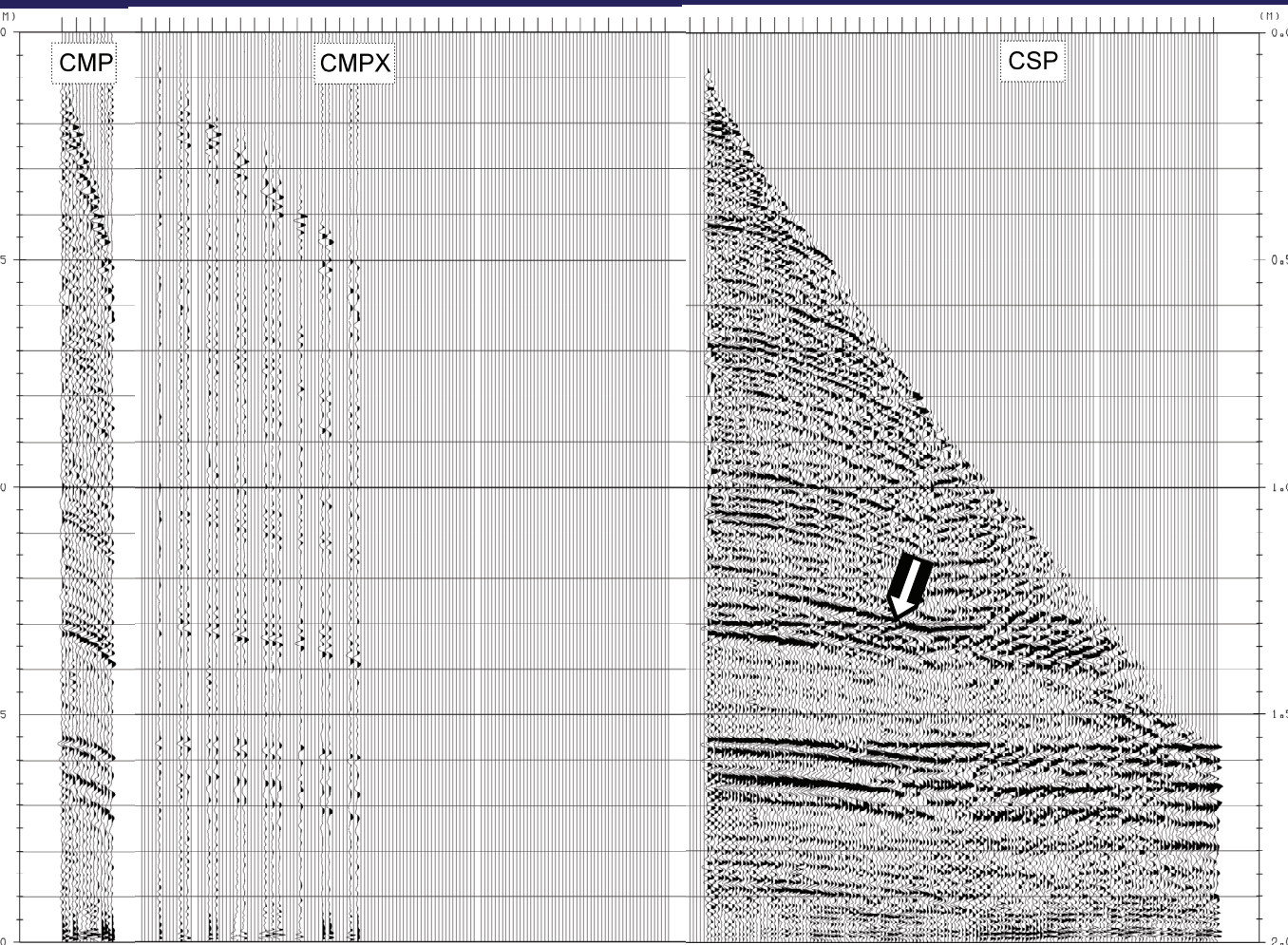
Scatter point
to or z

$$T = \left[\left(\frac{T_0}{2} + t_s \right)^2 + \frac{h_s^2}{V_{srs}^2 (T_0 + t_s)} \right]^{1/2} + \left[\left(\frac{T_0}{2} + t_r \right)^2 + \frac{h_r^2}{V_{rec}^2 (T_0 + t_r)} \right]^{1/2}$$



What is EOM?

Prestack migration gathers



High fold

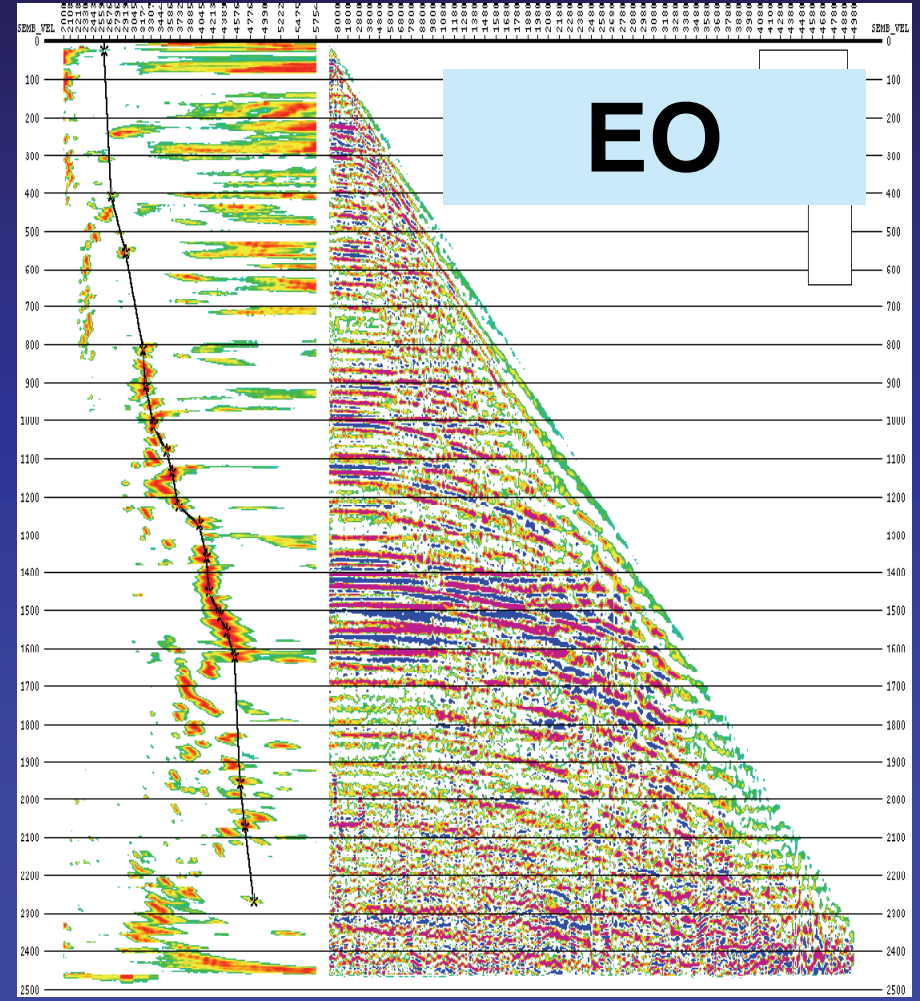
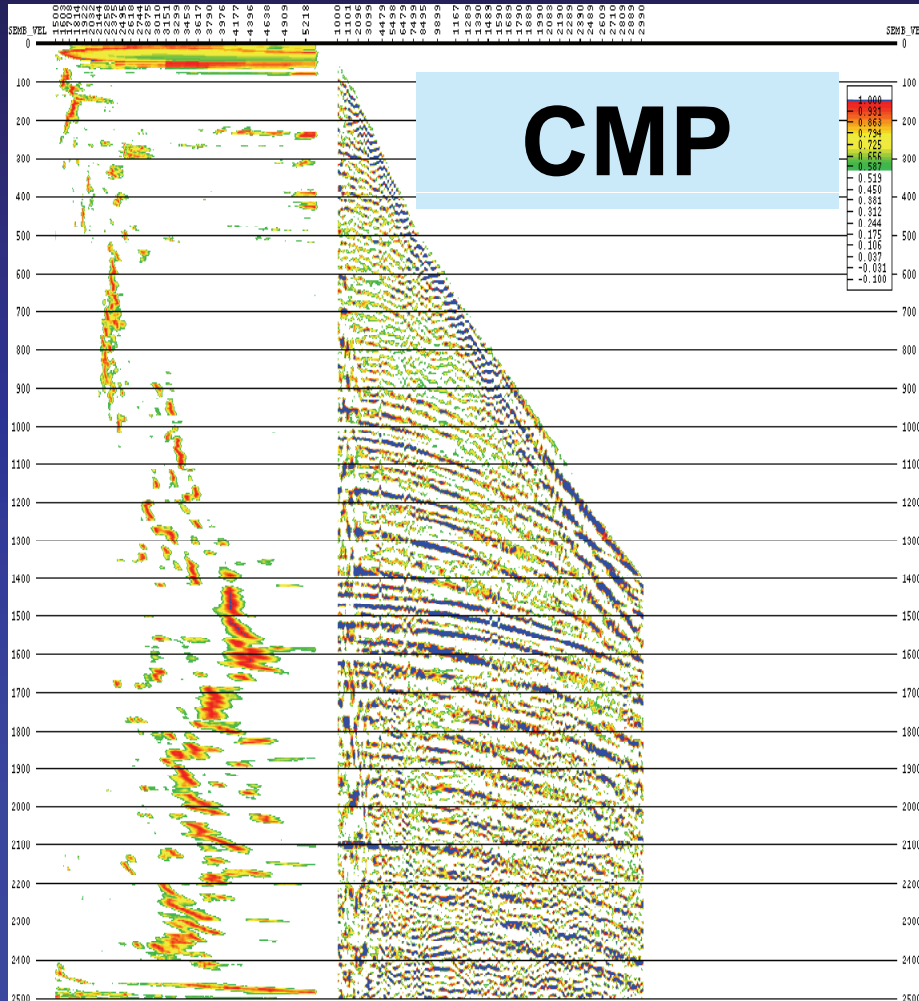
Hyperbolic MO

Longer offsets

Accurate velocities

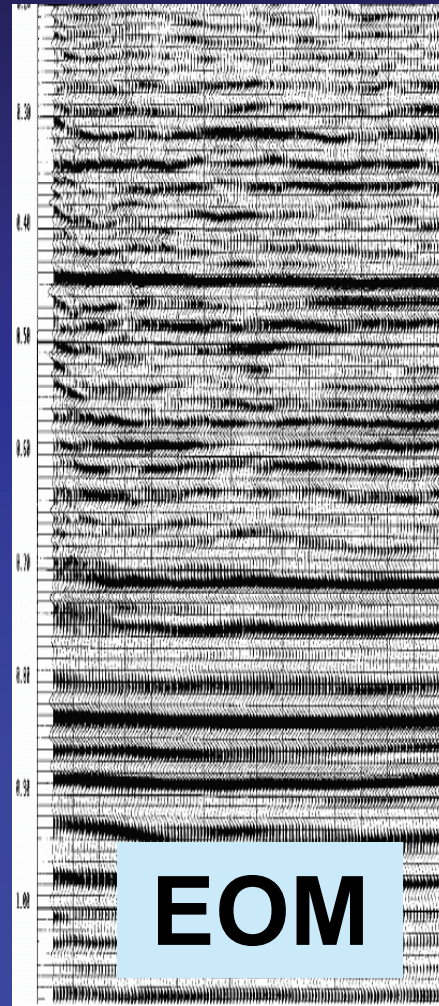
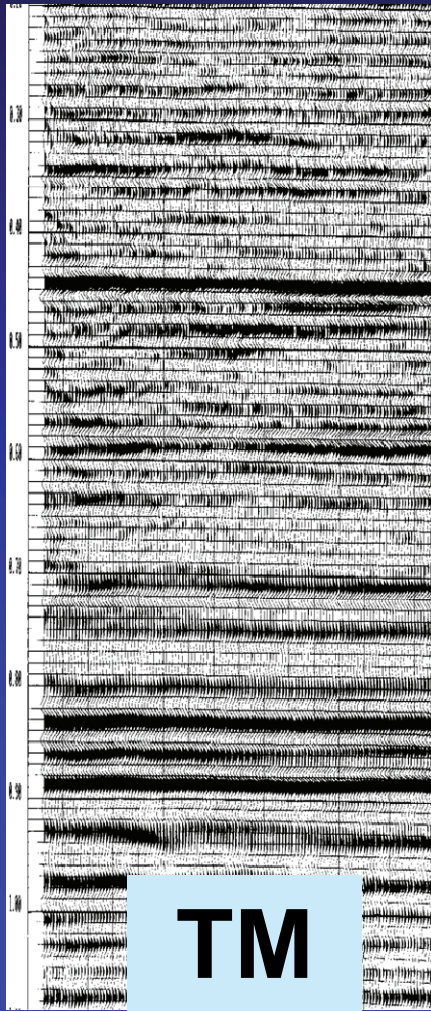
What is EOM?

Accurate velocities



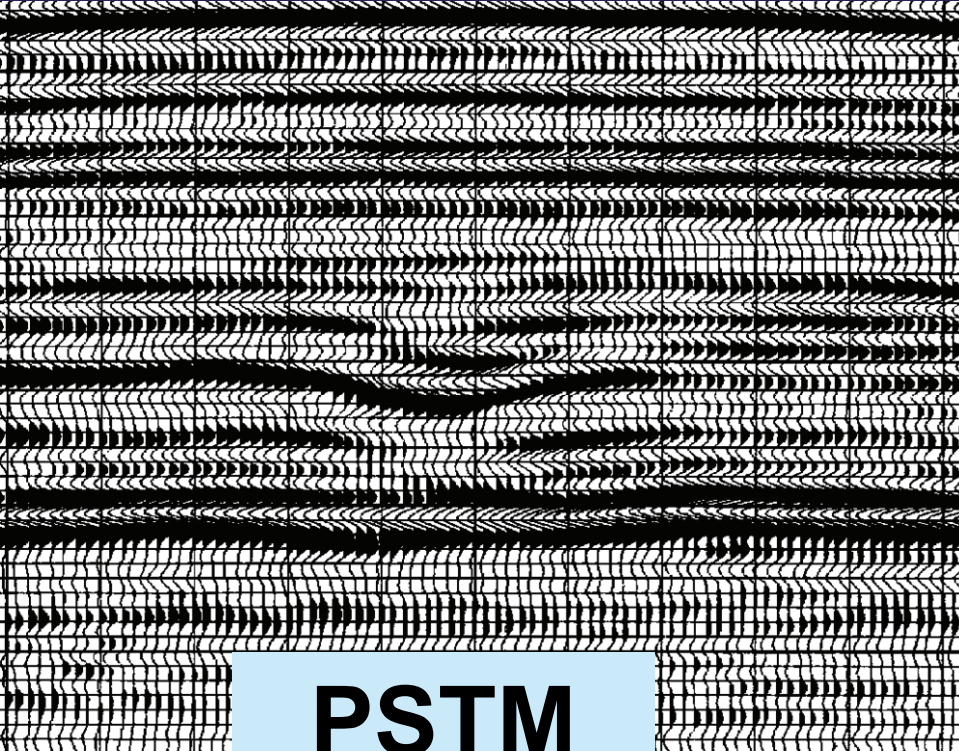
What is EOM?

Horizontal media

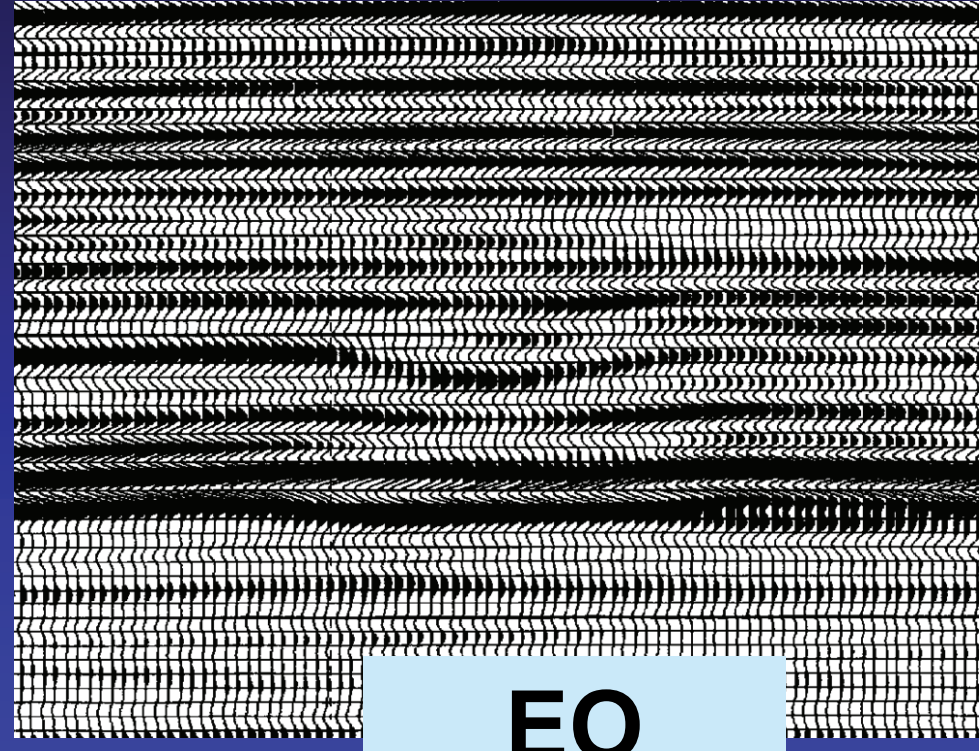


What is EOM?

Structure ???



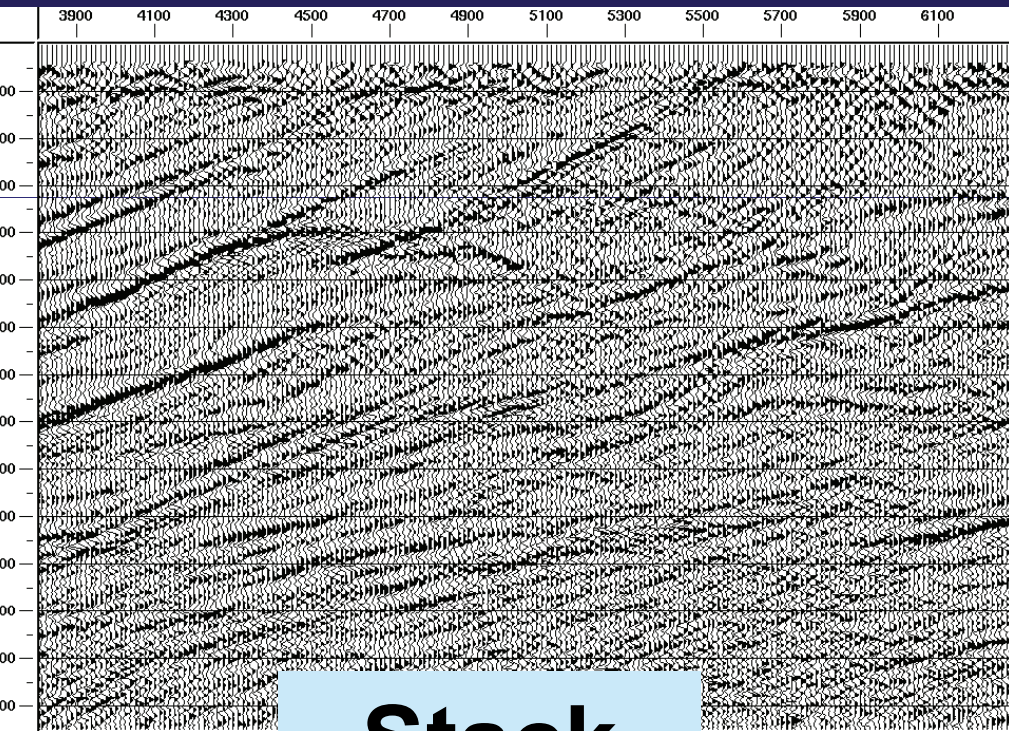
PSTM



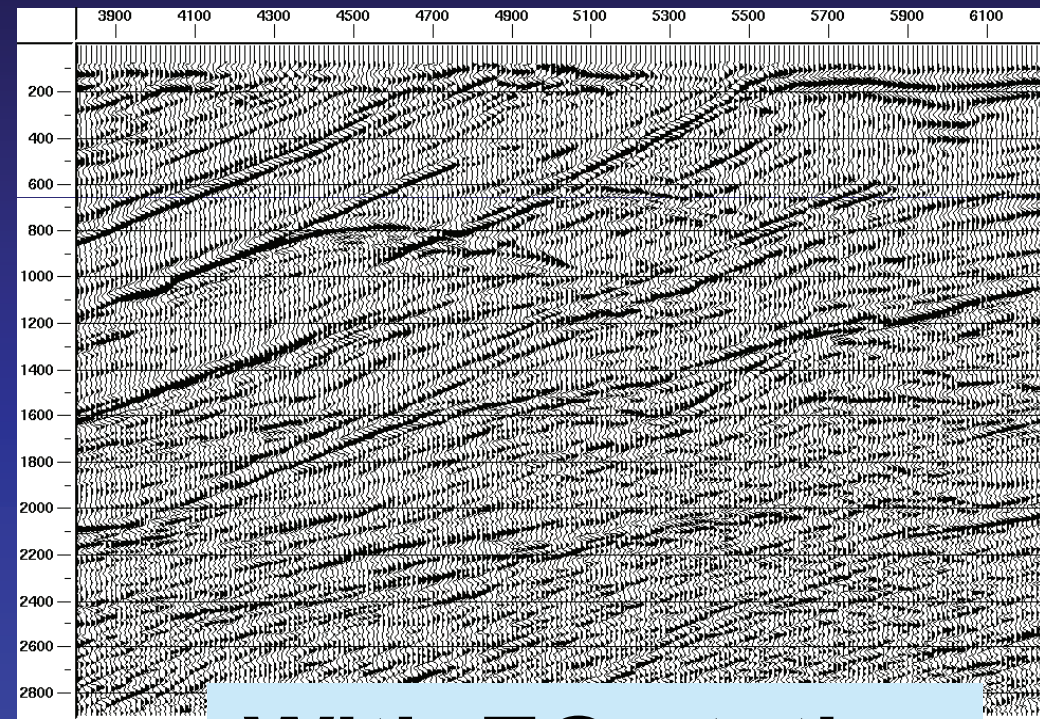
EO

What is EOM?

Statics, Marmousi data ± 20 ms



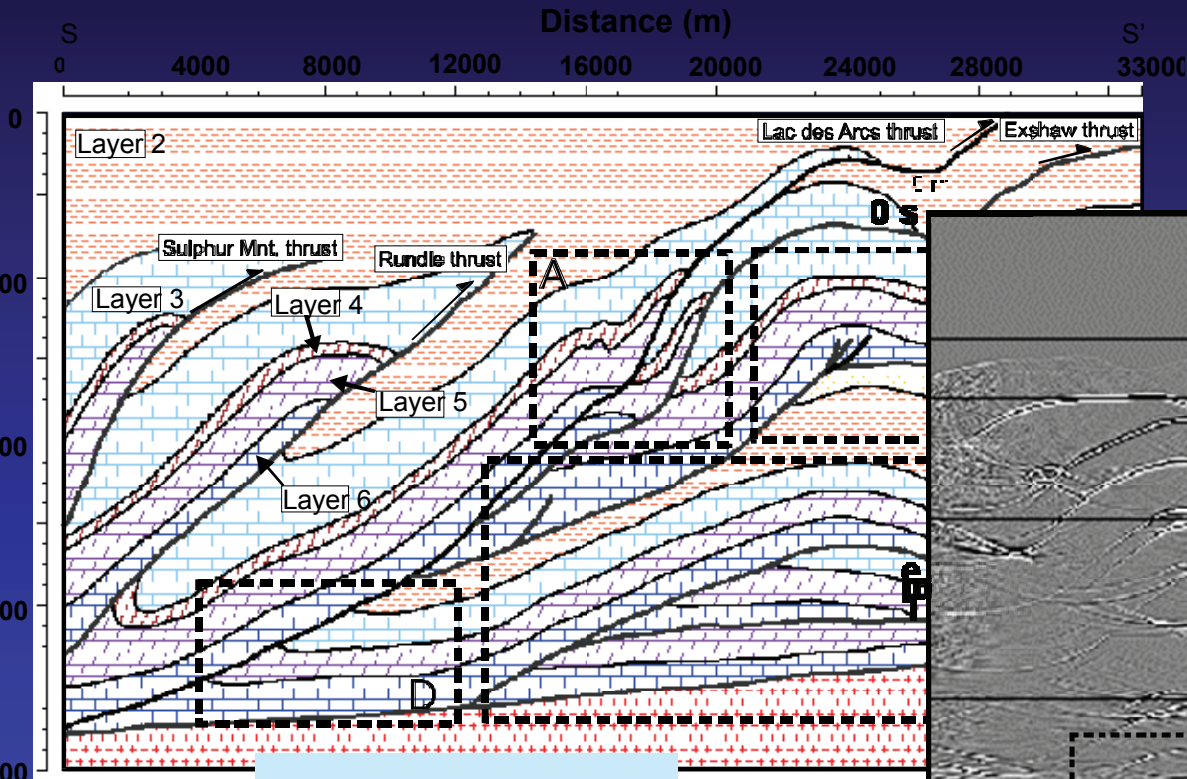
Stack



With EO statics

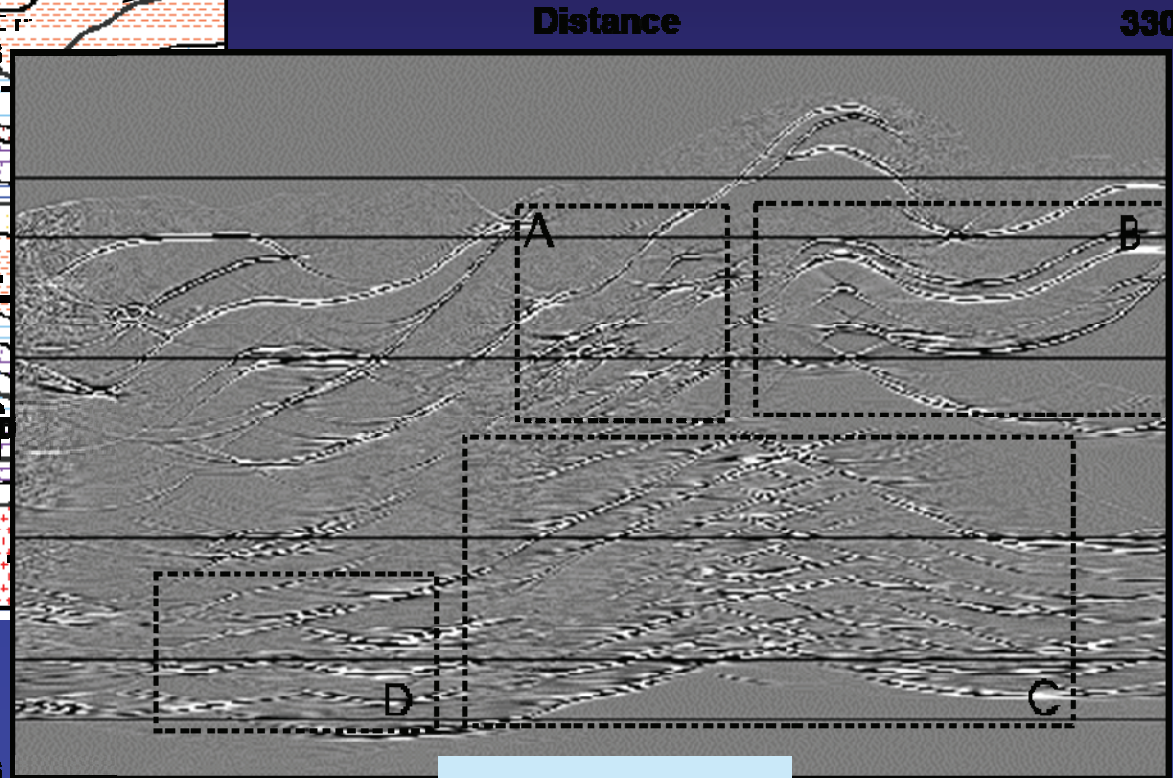
What is EOM?

Structured data



Model

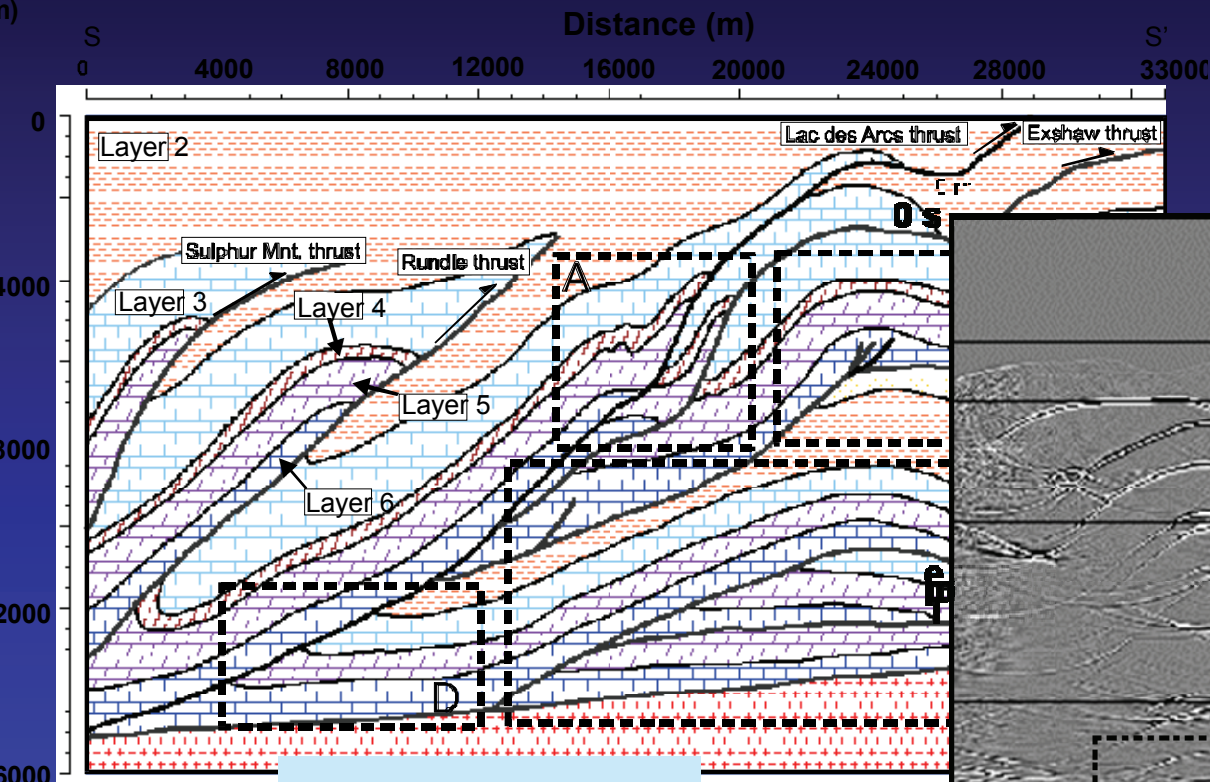
6 s



EOM

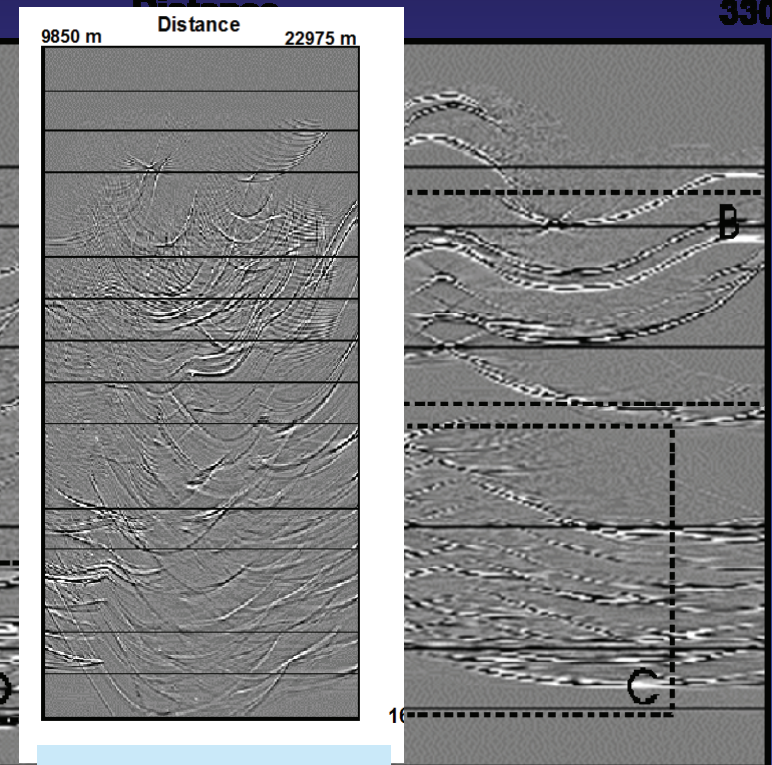
What is EOM?

Structured data



Model

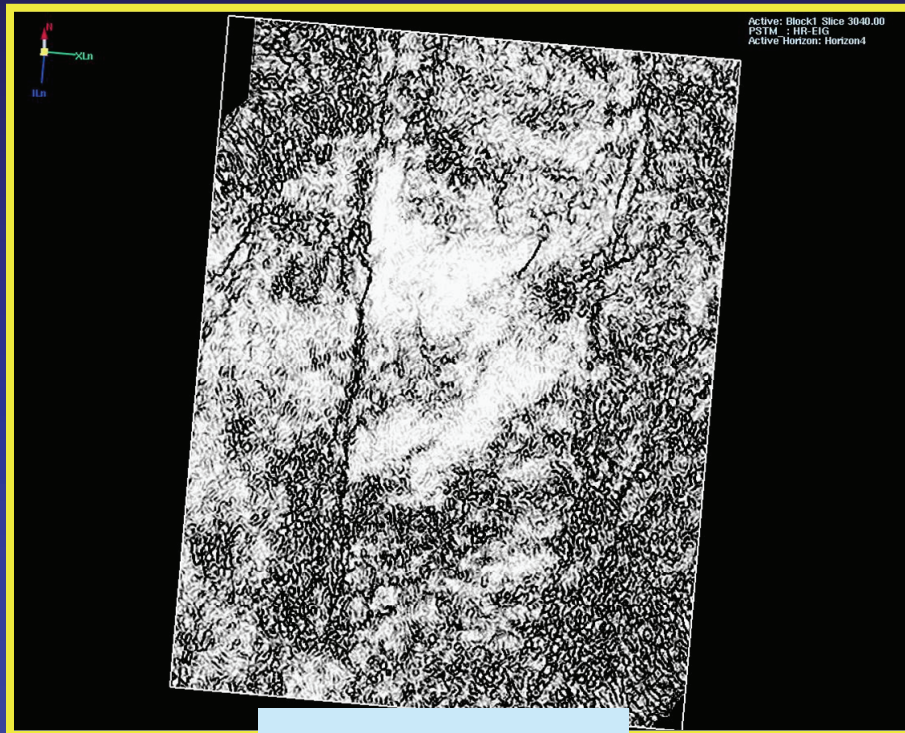
6 s



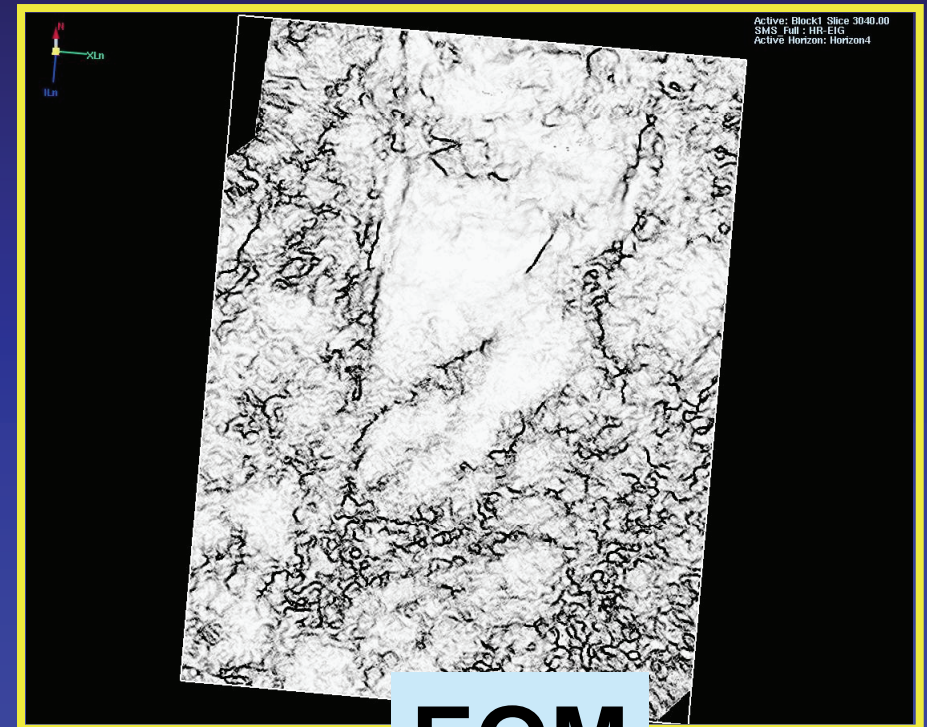
EOM

What is EOM?

Coherency examples (2009)



PSTM



EOM

MATLAB EOM

Text file

SEG Y I/O

Forms EO gathers

2D and 3D

```
%% EOMtextFile1.m
InputSGYFile AAA-JCB-matlab-files\EOMdata\thrust1_rd.sgy % Inp
VelSGYfile AAA-JCB-matlab-files\EOMdata\rmsvel.sgy % Inp
CspgSGY AAA-JCB-matlab-files\EOMdata\CSPgathers29July2010.sgy
Velocity 1 % SEG Y file only
FirstCSP 250 480 0 % First CSP: CMP location, X, Y
LastCSP 350 1480 0 % Last CSP: CMP location, X, Y
NumCSPs 0 % Number of CSPs to compute (Inc. might not be 1)
Bins 201 15.0 % Number of bins and increment in a CSP gather
TmaxCSP 2.0 % Maximum time (seconds) for CSP gathers and sta
EOMethod 1 1 % Gathers: [ Type : Sides ] Sides = 1, 2, or n = 3
TincType3 0.040 % Time increment for Itype 3
Dim2D3D 2 % Dimension, 2D or 3D, = 2 or 3. [2]
FoldGather 1 % Use of CSP gather fold counter. 0 = No, 1 = Yes
DipLim 60 80 % Dip limits in degrees for moveout (stretch limit)
NMO 1 % Normal moveout to CSP gathers: 0 = no, 1 = yes
StackOpt 1 % Stack CSP gathers to stack: 0 = no, 1 = yes
RhoFilter 1 % Apply rho filter to SEG Y file, 0 = no, 1 = yes
SaveCSPg 0 % Save CSP gathers to SEG Y file, 0 = no, 1 = yes
Idebug 2 % Debug level: 0 = Minimal,
End % Nothing read after first "End"
```

Requires additional processing software

eg. Promax or Vista

MATLAB EOM

Features

Velocities,

SEG Y, constant, linear

Various EOM methods

Display EO gathers, stack

Output options

Large data sets

```
CspgSGY AAA-JCB-matlab-1
Velocity 1 % SEG Y file
FirstCSP 250 480 0 % Fir
```

```
TmaxCSP 2.0 % Maximum CI
EOMethod 1 1 % Gathers: [ T
TimeType3 0 0 0 % Time incre
```

```
StackOpt 1 % Stack CSP gathers
RhoFilter 1 % Apply rho filter
SaveCSPg 0 % Save CSP gathers
Idebug 2 % Debug level: 0 =
End % Nothing read after
```

MATLAB EOM

Coming soon

Converted wave

Two-sided gathers

Tilt

Statics

Velocity analysis

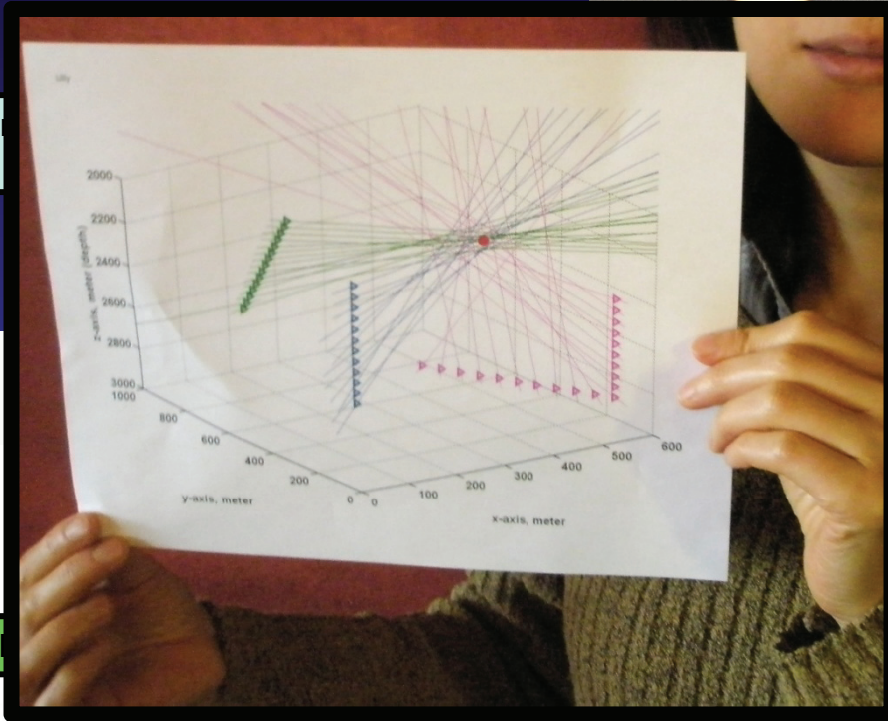
Anisotropy



And now some commercials



Transition zones



Converted waves



Aliasing

Converted wave EOM

V_p and V_s velocities

V_c converted wave velocities

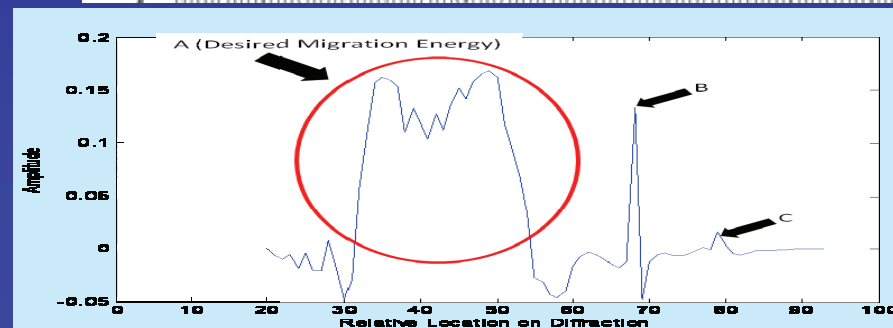
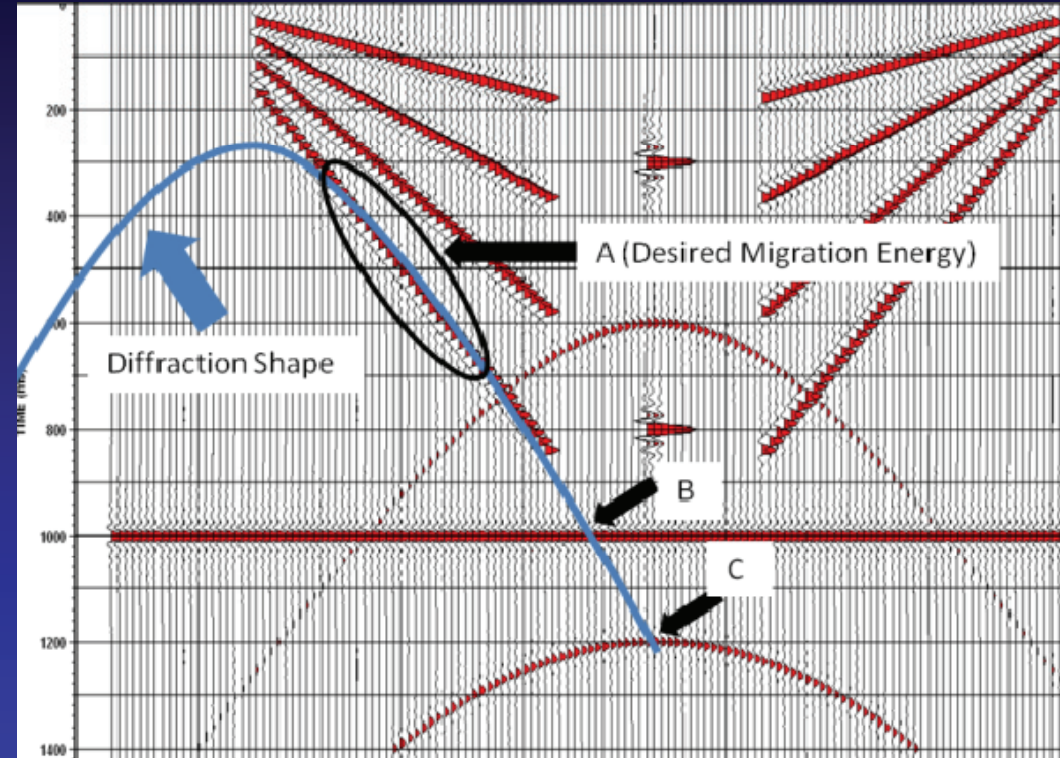
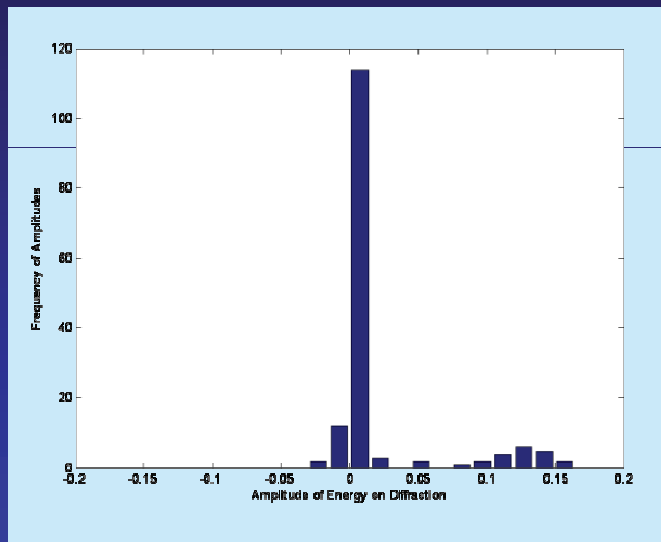
Process data with one V_c ???

See poster and paper by
Thais Guririgay



Kirchhoff aliasing

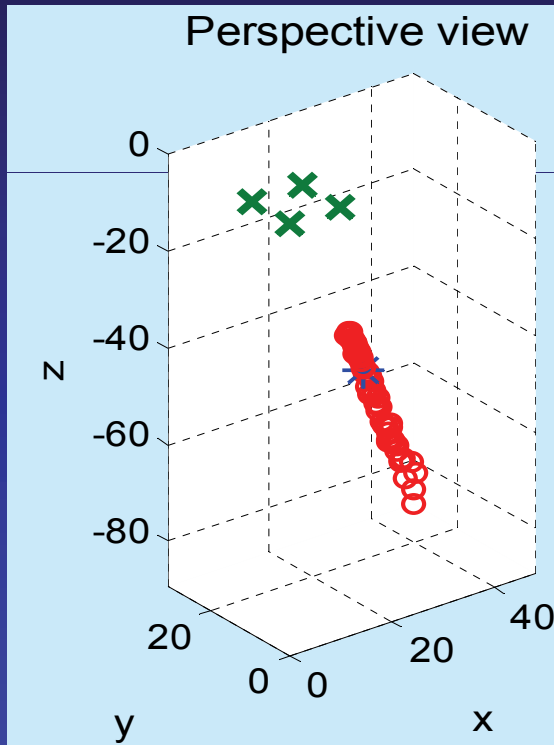
Data driven



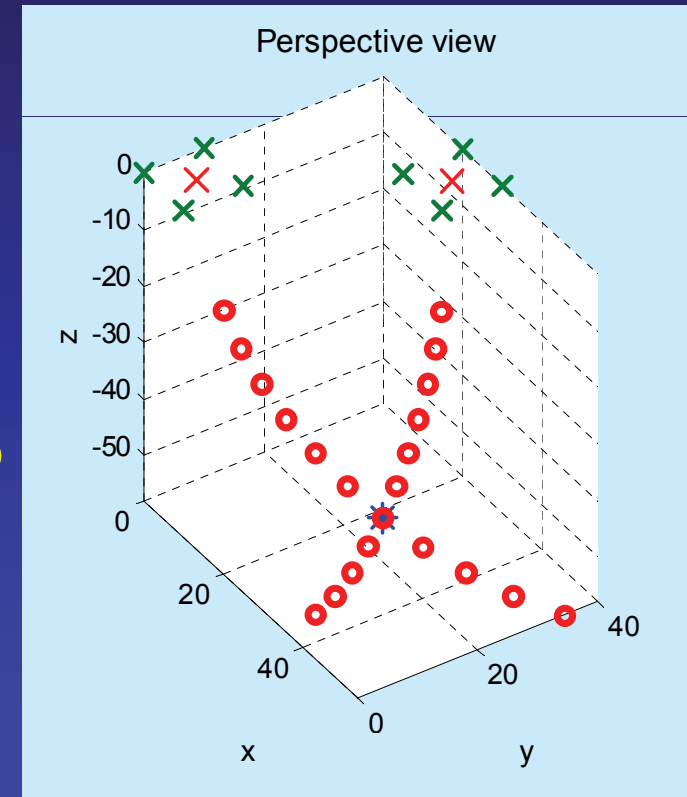
Microseismic

Sensitivity for location, travelttime, and velocity

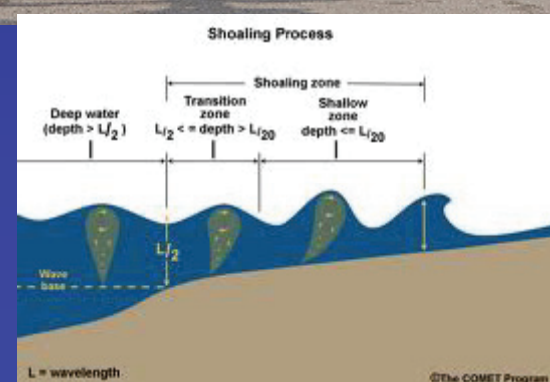
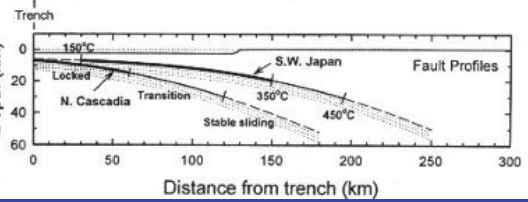
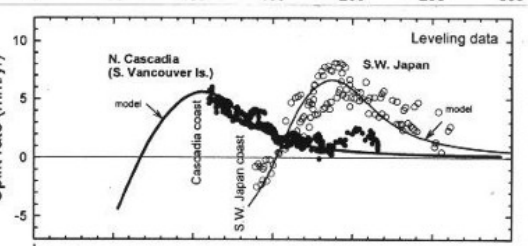
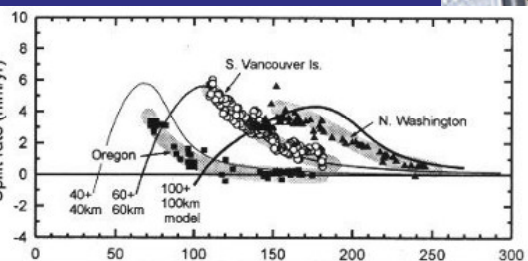
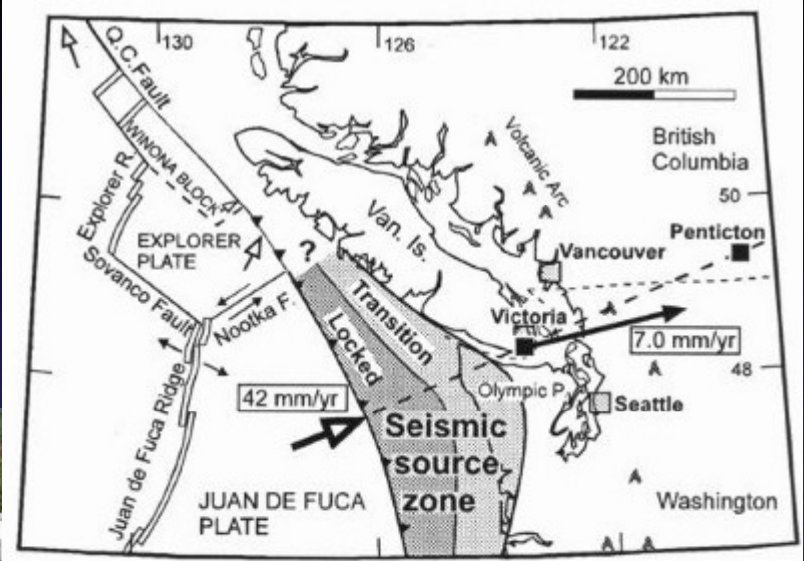
Receiver
(x, y)
H = 10m
 $\delta = 0.1$ m



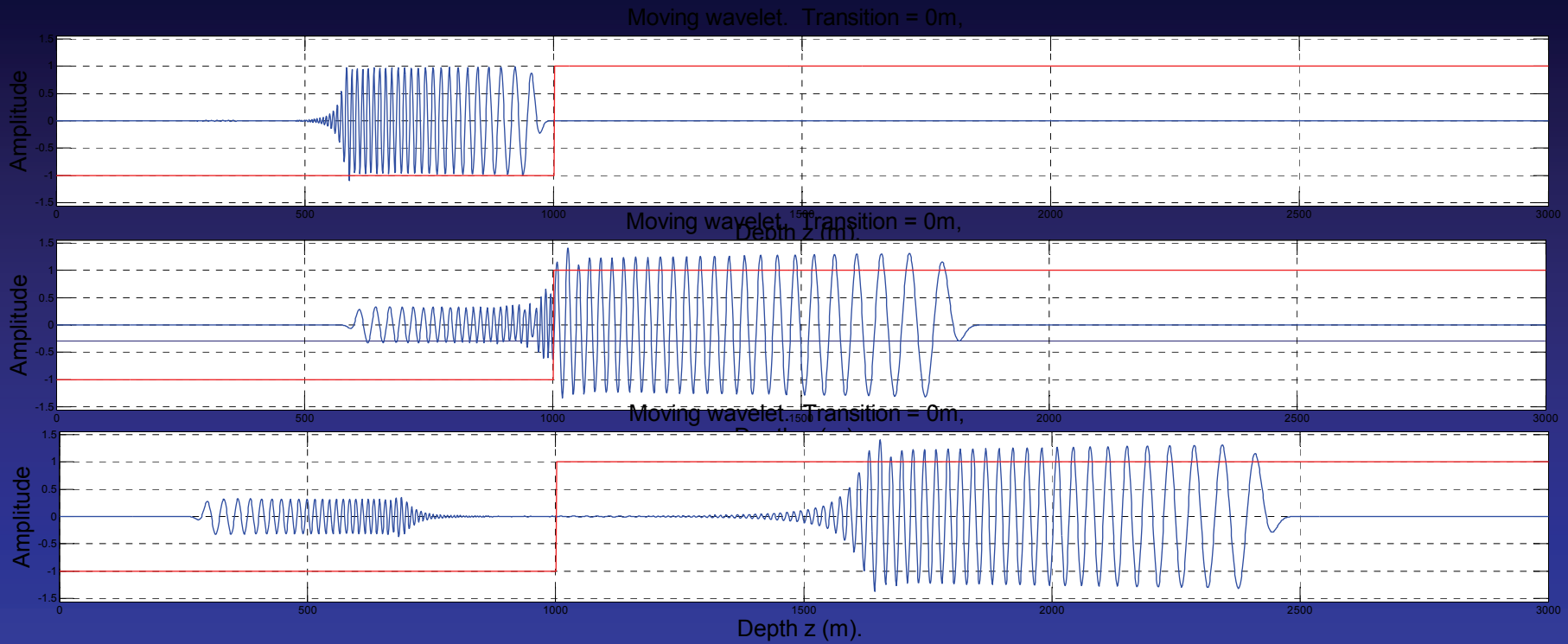
Velocity
60% to 120%



Transition zones



Transition zones



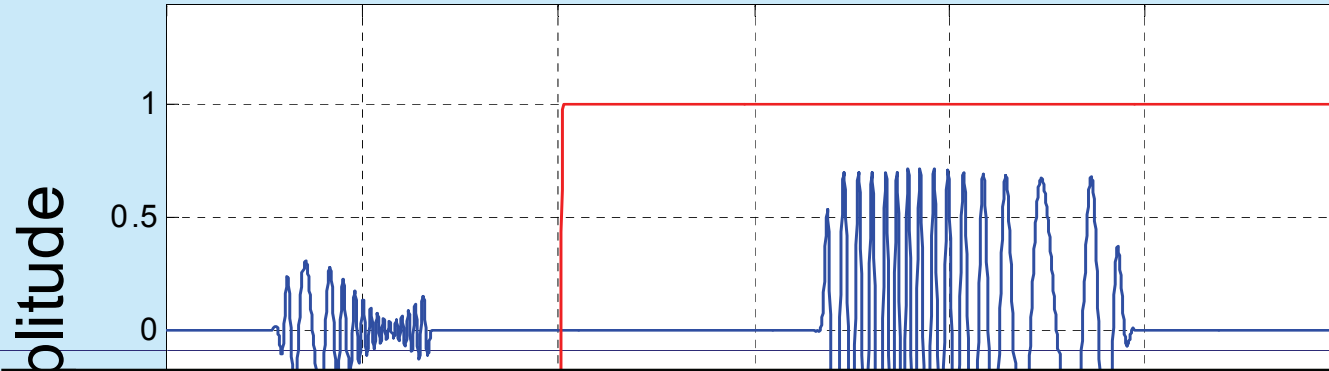
Smooth transition zones

**Modulated
wavelet**

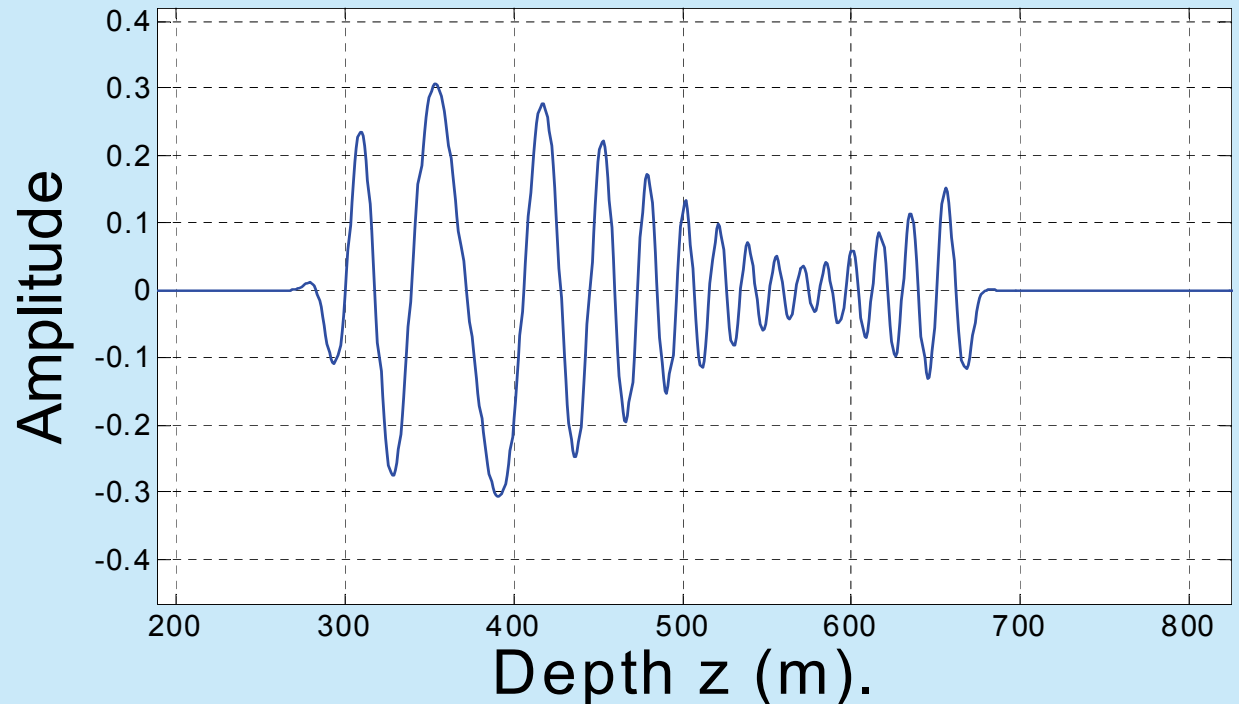
**Excite reservoir
fluids?**

**Low frequency
reflections?**

Moving wavelet. Transition = 15m,



Moving wavelet. Transition = 15m,



Coming soon

To a screen near you

*Improved velocity analysis in structured areas
using EOM*



Thanks for your attention

