Modeling of Small-offset Survey



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Survey Layout and Source Model

Framework Cross-section Source Signal Observation Modeling Reflectors Point Eree Horizontal line • Computation Cable Interval Projected 790 Number : 790 ÷ Last : ÷ + Interval : 5 Eirst : 1 m - <u>R</u>eflector Surface Max angle : 45 deq Mode Omnidirectional ✓ Move with source 5 1800 0 Start : Þ Erom : $\mathbf{\nabla}$ ms 10 $\overline{\mathbf{v}}$ 1800 $\mathbf{\nabla}$ To: Stop : ms 2.5 \Leftrightarrow $\mathbf{\nabla}$ Interval : Sa<u>m</u>pling Rate: 1 Aperture : 1500 ms Snapshots Duty Snapshots Time **NCASK** 90 🗹 Every: 150 10 + 🔽 Start : ms 🔽 Sample : 20 Final Truncation ms



Receiver line: 10m length, symmetric,

- 5 receivers, interval 2.5m
- 790 shotpoints, interval 5m

Model: 4000m x 2500m

- Upper boundary: 2000m/s > 2500 m/s, uneven;
- Mid boundary: 2500m/s > 3500 m/s, steep (45deg) parts;
- Lower boundary: 3500 m/s > 5000 m/s, flat
- Included "diffracting elements" 50 m x 50 m

Modeling

Elastic wave approximation, 2D casse Modes:

- Free (reflecting) surface
- No surface waves from the source



- corresponding snapshots
- Red line on shotgather corresponds to snapshot time

"True" velocity model



Pre-stack Depth Migration(PSDM)

- Wide apertures (~2000m);
- 10m between traces

Left picture shows migration results after summation for few starting shotgathers





^{×1... 99% [}Step#3926] Partition 786 of 790. Elapsed Time 00:14:29 (00:05:42 for time calculation. 00:01:45 for trace summind)

"True" model velocity variations at PSDM processing



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52.65, Plane:1/1

X: 3246.721 m

T: 1098.381 ms

"Basic" model velocity variations at DPSKM processing



Summary

- Modeling for small offset survey is done on a simple schematic model for initial evaluation of such survey approach.
- It shows that in principle there is no difference with regular offset surveys in ability to image dipping boundaries.
- If you have some initial guess and/or apriory information about interval velocities you can use almost the same pre-processing and processing sequence as in regular seismic.
- Processing using Pre-stack Depth Migration (PSDM) in this case is preferable, and mostly because small offsets does not allow to obtain RMS velocities used in time-scale processing techniques.
- In practice, to achieve good enough reliability (in depth) of results, small offset survey data may require more work at fitting of interval (migration) velocity model using only a criteria of a better quality of resulting seismic image.
- Actually, if survey will consist from a number of such (parallel 2D) profiles, 3D processing may be applied in the same way.

