Acquisition and analysis of 3C land streamer data

Gabriela M. Suarez and Robert R. Stewart

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Outline

- The land streamer idea
- Geophysics Field school data 2007
- CREWES land streamer
- Future work and conclusions
The land streamer idea:
Is this the last geophone you will ever plant?

“A land streamer is an array of geophones designed to be towed along the ground”
Land Streamer equipment

- Receivers
- Sources
- Streamer
Advantages

- Acquisition geometries

**Variable receiver spacing for reflection and refraction survey acquisition** (Modified from Nitsche, F. O., Delouis, B. and Green, A.G. (Institute of Geophysics, ETH Zürich))

**Montana Tech and PFM Manufacturing**

**3D land streamer design**
## Advantages

- **Field effort and recording time**

<table>
<thead>
<tr>
<th>Seismic source</th>
<th>Traditional approach</th>
<th>Towed land streamer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crew size</td>
<td>Recording time (hours)</td>
</tr>
<tr>
<td>Sledgehammer</td>
<td>5</td>
<td>23</td>
</tr>
<tr>
<td>Pipegun</td>
<td>6</td>
<td>43</td>
</tr>
</tbody>
</table>

Example taken from Van der Veen et al (2001)

- All terrain tool
- No special instrumentation is needed
- 2D and 3D
Several innovators have been exploring the use of land streamers:

- Alan Green, ETH Switzerland
- Carsten Ploug, COWI, Denmark
- Andre Pugin, Illinois Geological Survey
- Rick Miller, Kansas Geological Survey
- Jorgen Ringgaard, Ramboll, Denmark
- John Clark, Bay Geophysical, Traverse City Michigan
- Mats Svensson, Tyréns Infrakonsult AB, Sweden

**Marvin Speece, Curtis Link, Pat Miller and Jack Kruppenbach, Montana Tech and PFM Manufacturing**
Acquired at the Rothney Astrophysical Observatory (RAO), located near Priddis (Alberta), about 30km southwest of the Calgary city center.
CREWES Land Streamer

- 3C geophones
- Top and base metallic plates
- Anti-rotation wing
- Tow webbing
CREWES land streamer

- Single streamer: 20 3C geophones every 1m, sources every 5 m
- 38 shots, 211 stations - Total streamer length = 210 m
Land Streamer data examples

- Raw 3-C shots
Amplitude spectrum for FFID 1798
Vertical component filtered shots
Inline component filtered shots
Filtered stack sections

Vertical

Integrated
Comparison P-PS stack sections

Suggest $V_P/V_S$ ratio $\approx 3$
VSP vs. land streamer data

VSP corridor stack

Vertical component stack
Section (1st 100 ms)
Refraction modelling

Statics values

First breaks fitting
Refraction modelling

Velocity

Modeled Layer Velocities

X-COORDINATE

920 m/s

330 m/s

≈ 2 m

≈ 1 m

≈ 2 m

≈ 5 m
Conclusions and future work

- Strong reflection observed around 30 ms, corroborated with VSP corridor stack
- $V_p/V_s$ ratio of 3 for this area
- 2 layer refraction model with velocities of around 300 m/s and 900 m/s
- Used of vibroseis as seismic source
- Variable geophone spacing
- Acquire conventional 3C data to compare land streamer data
- Find an area with a specific problem to solve to test land streamer
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