Update on DRDC Results, SW06 – 2008 Workshop

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Experimental area

- July 17 – August 2, 2006
- REA experiment
  - Propagation loss
  - FFCPt
- Scattering experiment
  - Backscatter (WBS)
  - Auralization
- WARBL
DRDC research at the SW06 at the “Mid Frequency Site”
Environment

Uncharacterized
Sensitive
Organic sediments
Clays
Silt mixtures
Sand mixtures
Sands
Gravelly sand

TL leg 1 (August 1)

TL leg 2 (August 1)
Propagation loss

- **Sources**
  - Towed projector (SL~200 dB @ 1m/Hz^{0.5})
    - LFM (200 Hz BW) & CWs centered @ 1.2 and 3.5 kHz.
  - WRC sources
    - 224 Hz, 400 Hz lines, 300 Hz, 500 Hz LFM
- **Receivers**
  - Moored UAT – 8 h/p between 22 m and 51 m depth – 24kHz sampling rate
  - SHRUs
Propagation loss results

Incoherent TL (3 depths) along slope – leg 1

Incoherent TL along and across slope (SHRUs)

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Environment (model)

- 500 simulations varying each of 9 parameters (SSP varied as a whole)
- PECan forward model

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Sensitivity measures

- Determine key parameters
  - Environment specific

Sensitivity of pressure field $P$ to perturbations of model/measurable $m$ (Gaussian with standard deviation $\sigma$).

Linear (two-point) measure:

$$\left( \frac{\delta P}{P} \right)_{ij \text{, 2 pt}} = \frac{1}{2} \left[ \frac{| \delta P_i^j (\delta m_j = +\sigma_j) |}{|P_i|} + \frac{| \delta P_i^j (\delta m_j = -\sigma_j) |}{|P_i|} \right].$$

Non-linear (Monte Carlo) measure:

$$\left( \frac{\delta P}{P} \right)_{ij \text{, MC}} = \left\{ \frac{< [\delta P_i^j]^2 >}{|P_i|} \right\}^{1/2}.$$  

Linearity determined by agreement between measures and linear increase of sensitivity w.r.t. $s$ for given parameter.
Sensitivity results

All parameters

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Model/data comparison

Model results based on environmental variability > data variability

Sensitivity based primarily on SSP at 52 m depth
Model/data comparison

Sensitivity at bottom based primarily on water depth
Model/data comparison

Look only at model variability wrt SSP variability: still >95% data points
### Propagation loss variability

<table>
<thead>
<tr>
<th>UAT h/p depth</th>
<th>Mean TL (dB)</th>
<th>St. dev. (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>300 Hz</td>
<td>500 Hz</td>
</tr>
<tr>
<td>22.1 m</td>
<td>67.9</td>
<td>75.7</td>
</tr>
<tr>
<td>24.3 m</td>
<td>66.1</td>
<td>73.8</td>
</tr>
<tr>
<td>30.6 m</td>
<td>64.2</td>
<td>72.3</td>
</tr>
<tr>
<td>34.8 m</td>
<td>64.5</td>
<td>72.7</td>
</tr>
<tr>
<td>39 m</td>
<td>66.1</td>
<td>73.1</td>
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<tr>
<td>43.3 m</td>
<td>65.8</td>
<td>72.2</td>
</tr>
<tr>
<td>47.5 m</td>
<td>65.7</td>
<td>71.7</td>
</tr>
<tr>
<td>51.7 m</td>
<td>65.6</td>
<td>72.9</td>
</tr>
</tbody>
</table>

300 Hz LFM – ping energy vs. time for varying receiver depth
Wide Band Sonar
You always overlook something!
Preliminary, backscatter vs. grazing

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Preliminary, backscatter vs. azimuth

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Bottom loss is the angle-fitted source level, calculated from direct arrival, minus received level minus theoretical transmission loss from a perfectly reflecting bottom (technique of Holland and Osler, 2000).

\[ BL = SL - RL - TL \]
Analysis Status

- Environmental data (done)
- Propagation loss (well advanced)
- Sensitivity (well advanced)
- Scattering (ramping up)
- SWATH (contracted, ramping up)
- Bottom loss (not started)
Questions?

King_Hines
and the Q players

Live on the Lido Deck, every Wednesday night.
$5 cover charge.
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