Infrasound Case Studies

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Case 1

- A magnitude 6.0 earthquake located near Wells NV USA at a distance of 422 Km. from IMS station PS47 caused 3 different infrasound arrivals at the NVIAR infrasound array colocated with PS47.
Infratool Detector Results

![Graph showing Infratool Detector Results with various parameters and data points.](image-url)
Wells Earthquake

Early infrasound arrival source

Intermediate arrival source

NVIAR Array

Early infrasound arrival source
Conclusions (Earthquake Infrasound)

- Through an iterative process of combining Rayleigh wave travel times with infrasound travel times and a known azimuth, it can be shown that one single earthquake can cause multiple infrasound sources in a region.
Case 2
Dispersed infrasound

- Dispersed infrasound signals were observed on November 19, 1997 at TXIAR and September 9-12, 2007 at FALN and NVIAR
- The source/receiver distance was 546 km for TXIAR, 157 km for FALN and 36 km for NVIAR
- The signals exhibited dispersion between 0.2-1 Hz (for TXIAR) and 1 – 2 Hz (for NVIAR and FALN)
Modeling

- We modeled the dispersed infrasound as low velocity waveguides
- Model composed of a low velocity layer overlain by a half space
- Boundary conditions: rigid boundary at surface of the earth; continuity of stresses (pressure) and displacements at the interface and the displacements must vanish in the half space, away from the interface
## Model

<table>
<thead>
<tr>
<th></th>
<th>TXIAR</th>
<th>NVIAR</th>
<th>FALN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Layer thickness</strong></td>
<td>600</td>
<td>80</td>
<td>120</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>0.2 – 1</td>
<td>1 - 2</td>
<td>1 - 2</td>
</tr>
<tr>
<td><strong>Velocity</strong></td>
<td>335.8 - 340</td>
<td>340 - 347</td>
<td>340 – 348</td>
</tr>
<tr>
<td><strong>Distance</strong></td>
<td>546</td>
<td>36</td>
<td>157</td>
</tr>
<tr>
<td><strong>Phase Velocity</strong></td>
<td>341</td>
<td>354</td>
<td>352</td>
</tr>
<tr>
<td><strong>Celerity</strong></td>
<td>339</td>
<td>348</td>
<td>345</td>
</tr>
</tbody>
</table>
Conclusions (Dispersion)

- We observed signals at TXIAR, NVIAR and FALN that traveled in boundary layer waveguides as well as later arrivals that were determined to be stratospheric returns. The trapped signals displayed obvious dispersion while the stratospheric returns did not. The later arrivals exhibited lower celerities and higher phase velocities than the dispersed signals.
Conclusions (Dispersion)

• Dispersed infrasound signals can be modeled successfully as acoustic energy propagating in a low velocity surface waveguide.
• The thickness of modeled waveguides are on the order of hundreds of meters.
• The observed dispersed infrasound signals have celerity values comparable to their phase velocities.