Updates on NN Estimation

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Whenever something follows a rectilinear motion or fields have plane boundaries, then you get an exponential cut-off in the form:

$$\exp(-2\cdot\pi\cdot f\cdot x/c)$$

Examples: sound and seismic waves, advected fields, moving objects, flowing water
Water flow and waves are both too slow for (1) – (3) to matter (exponential cutoff at very low frequencies), even if the water flows closely to the test mass.

Perturbation produced by vortices and other structures included in (4) – (6) in the NN band are supported by small water volumes and associated NN is very likely insignificant, but one should look at this more carefully.
Rayleigh NN

1. Vertical surface displacement

2. Soil/rock compression

3. Horizontal displacement of cavity walls

A Rayleigh NN model requires:
1) Spectrum of vertical surface displacement
2) Dispersion curve
3) Density estimates for near surface soil and rock around the cavern
Length Scales

1) Depth

2) Reduced wavelengths
   a) $1/k$  
      (reduced Rayleigh wavelength)
   b) $(1/k^2 - 1/k_p^2)^{1/2}$  
      (inh. vertical compressional wavelength)
   c) $(1/k^2 - 1/k_s^2)^{1/2}$  
      (inh. vertical shear wavelength)

$\exp(-\kappa \cdot d)$
NN Suppression with Depth

Faster Rayleigh waves

Slower Rayleigh waves

Rayleigh dispersion model:
1.8km/s @ 1Hz, 750m/s @ 5Hz,
450m/s @ 10Hz

Rayleigh dispersion model:
1.5km/s @ 1Hz, 500m/s @ 5Hz,
350m/s @ 10Hz
Suggested explanation:
1) When oceanic microseisms are strong, then the sources are relatively close and Rayleigh waves dominate
2) If microseisms are near the low-noise model, then many distant sources contribute and body waves dominate
ET: Seismic NN

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- Seismic models:
  Body wave: 3x – 12x LNM, Surface: 50x – 1000x LNM
- Includes all three contributions from slide 4