

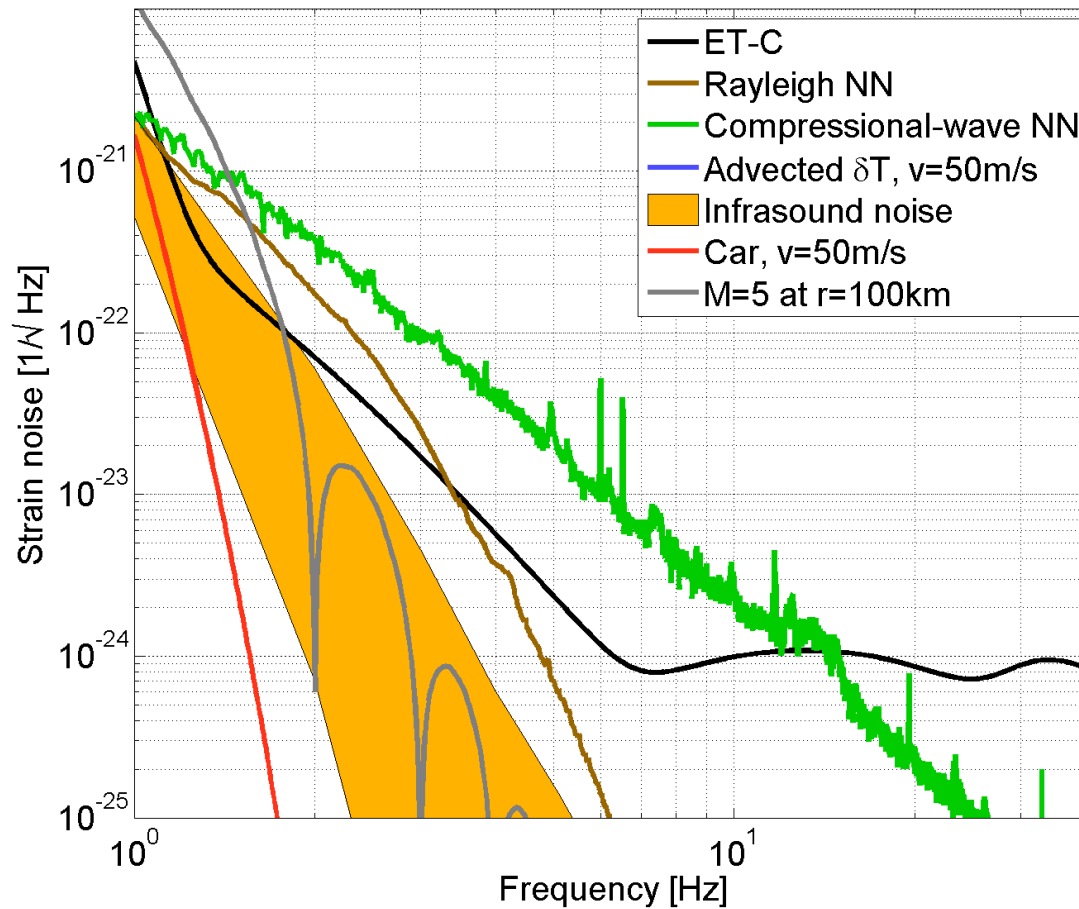
# Newtonian noise models for the Einstein Telescope

INFN, Sezione di Firenze

Jan Harms

# ET Terrestrial Gravity

ET at 200m depth

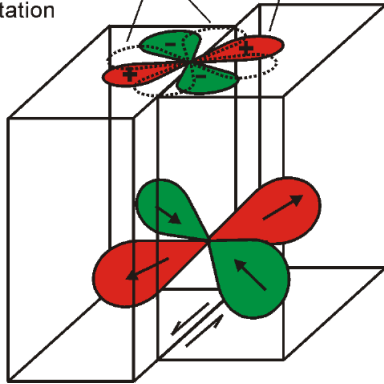


# Sources of Terrestrial Gravity Perturbations

Earthquake (strike-slip)

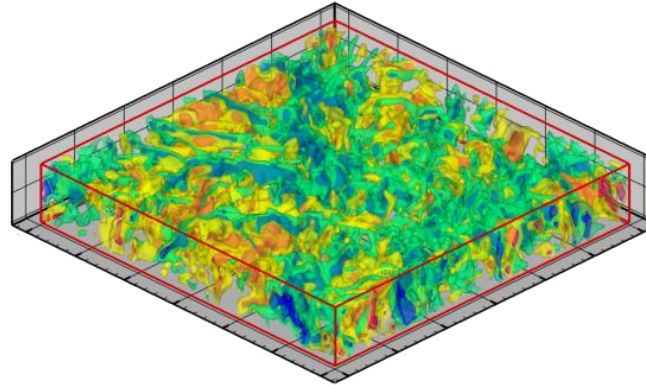
SH- & Love-waves P- & Rayleigh-waves

+ Compression  
- Dilatation



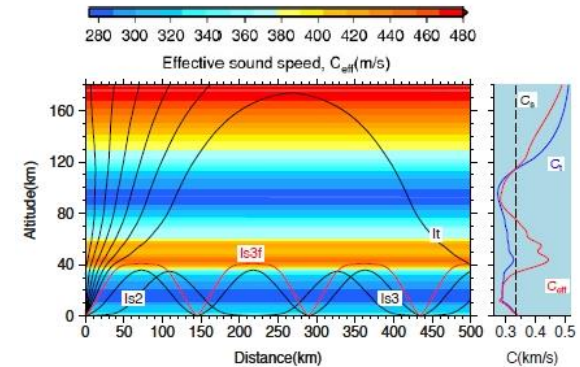
$$\frac{1}{r^5} \frac{M(f)}{f^4}$$

Objects moving at constant speed



$$\frac{e^{-\frac{2\pi f r}{v}}}{f^{3/2}}$$

Infrasound

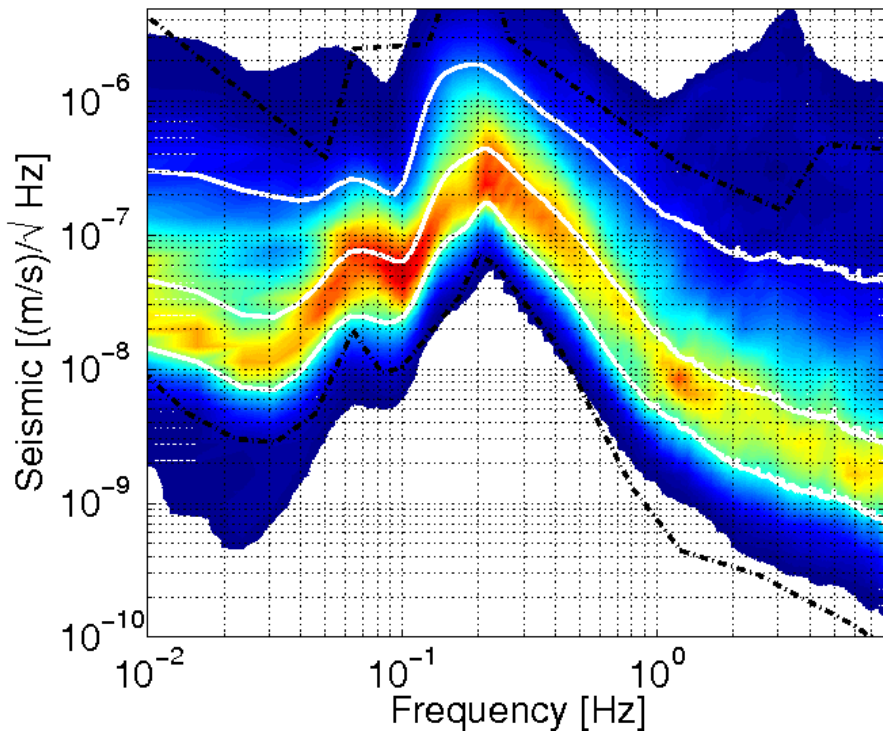


$$\frac{p(f) e^{-\frac{2\pi d f}{c_{hor}}}}{f^3}$$

# Environment

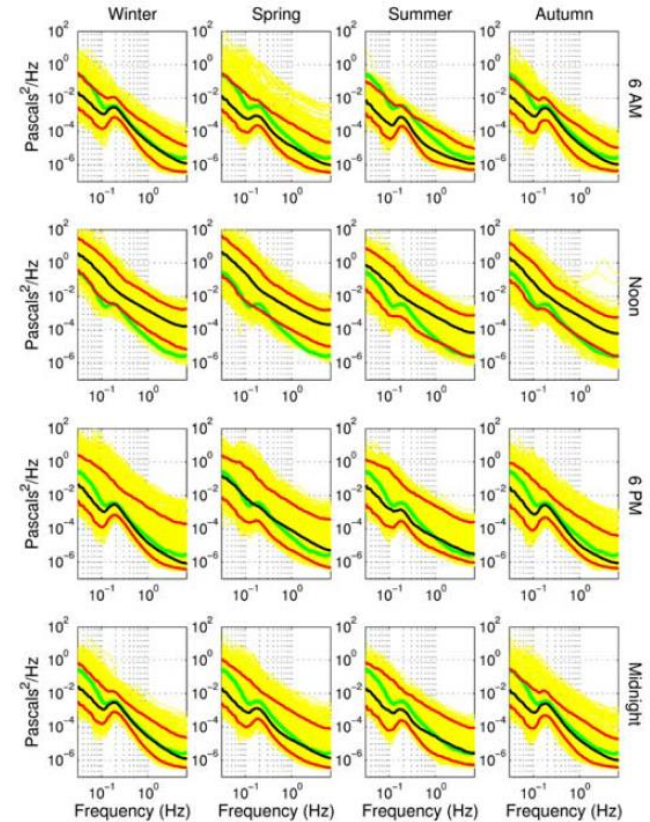
## Seismic

Histogram over 3 years and 300 seismic stations in Europe



## Infrasound

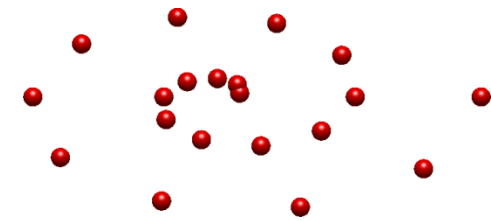
Histograms from La Paz



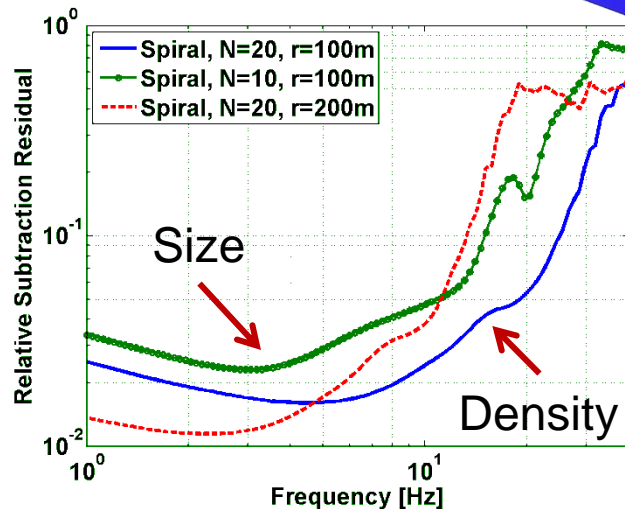
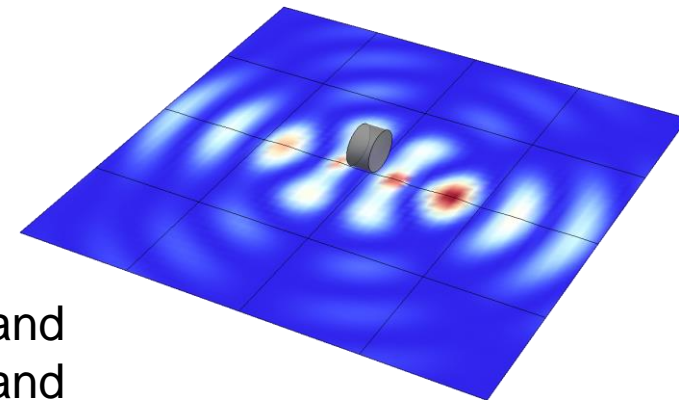
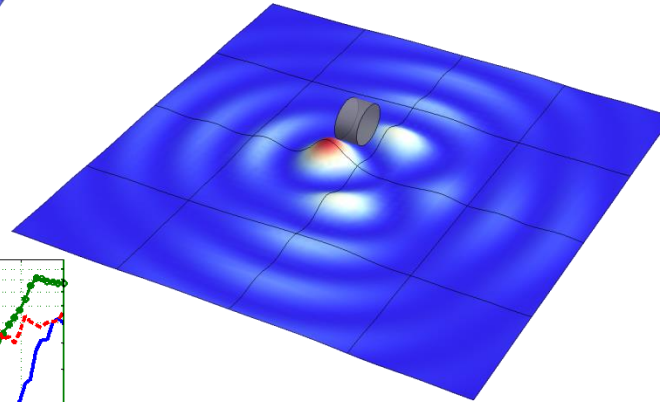
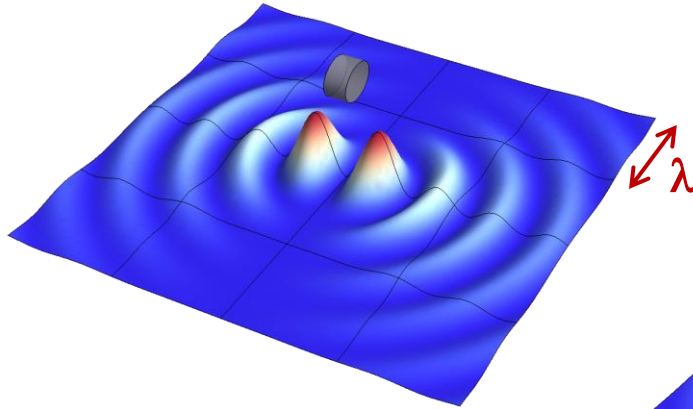
Geophys Res Lett, 32/L0980 (2005)

# Rayleigh-Wave Subtraction

Subtraction has to be done using vertical displacement since horizontal displacement has contributions from shear waves.

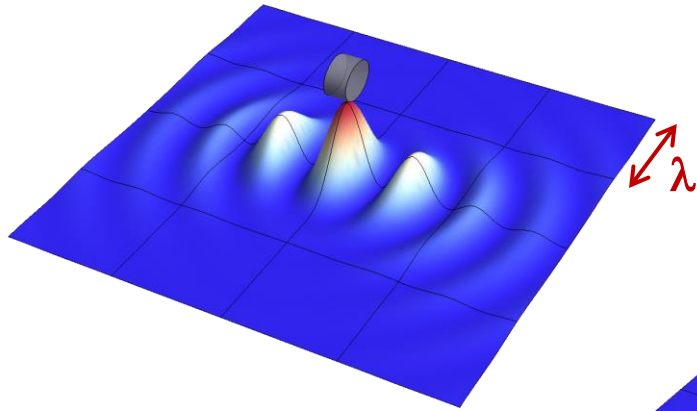


For this reason seismometer array has more complicated configuration.

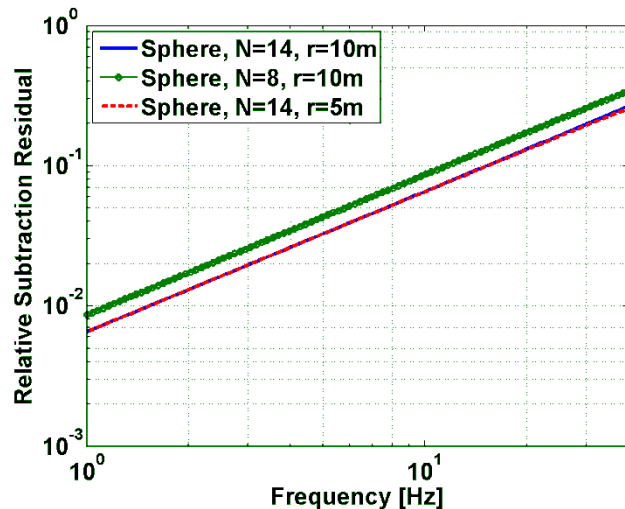
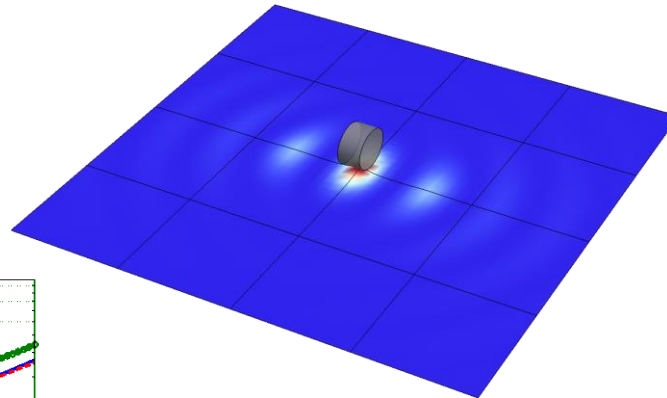


Subtraction residuals determined by number and SNR of seismometers, and array shape.

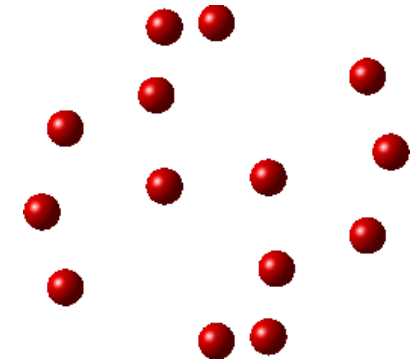
# Compressional-Wave Subtraction



Ideally (if there were no scattering and shear waves) all seismometers should be placed as close as possible to the test mass.



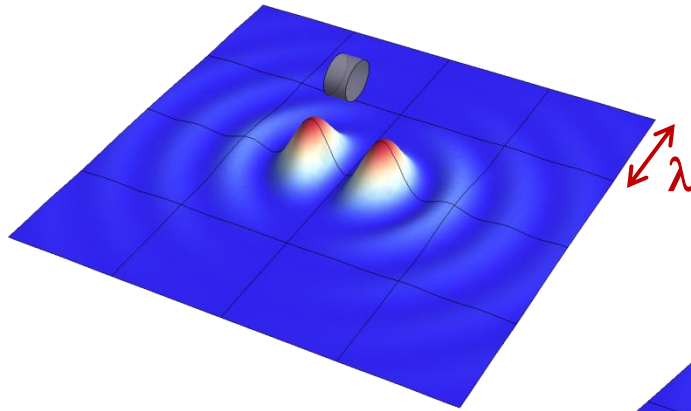
Subtraction residuals determined by number and SNR of seismometers.



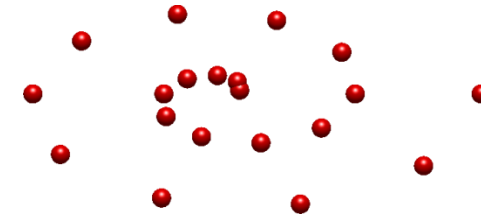
Seismometers could be deployed around the cavern.



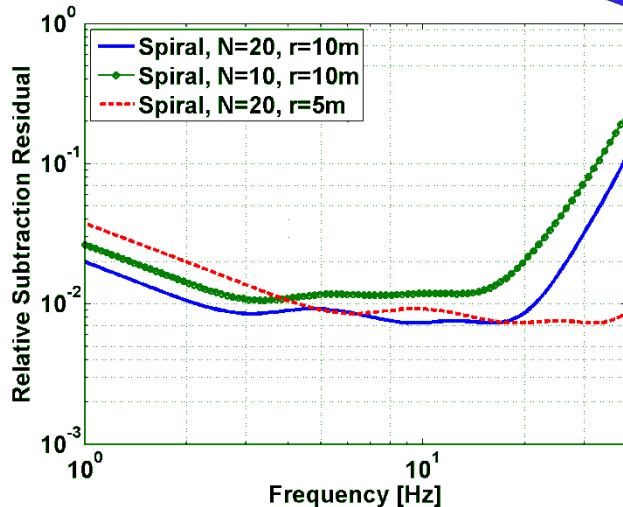
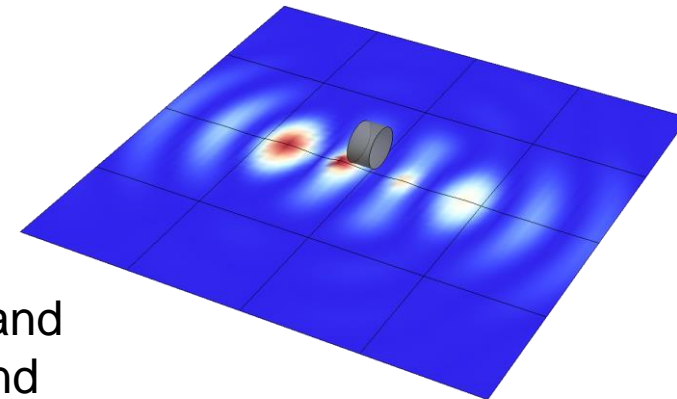
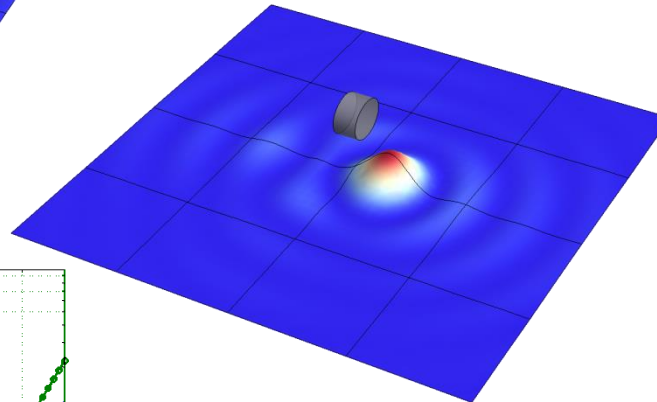
# Infrasound Subtraction



Individual microphones do not provide directional information.



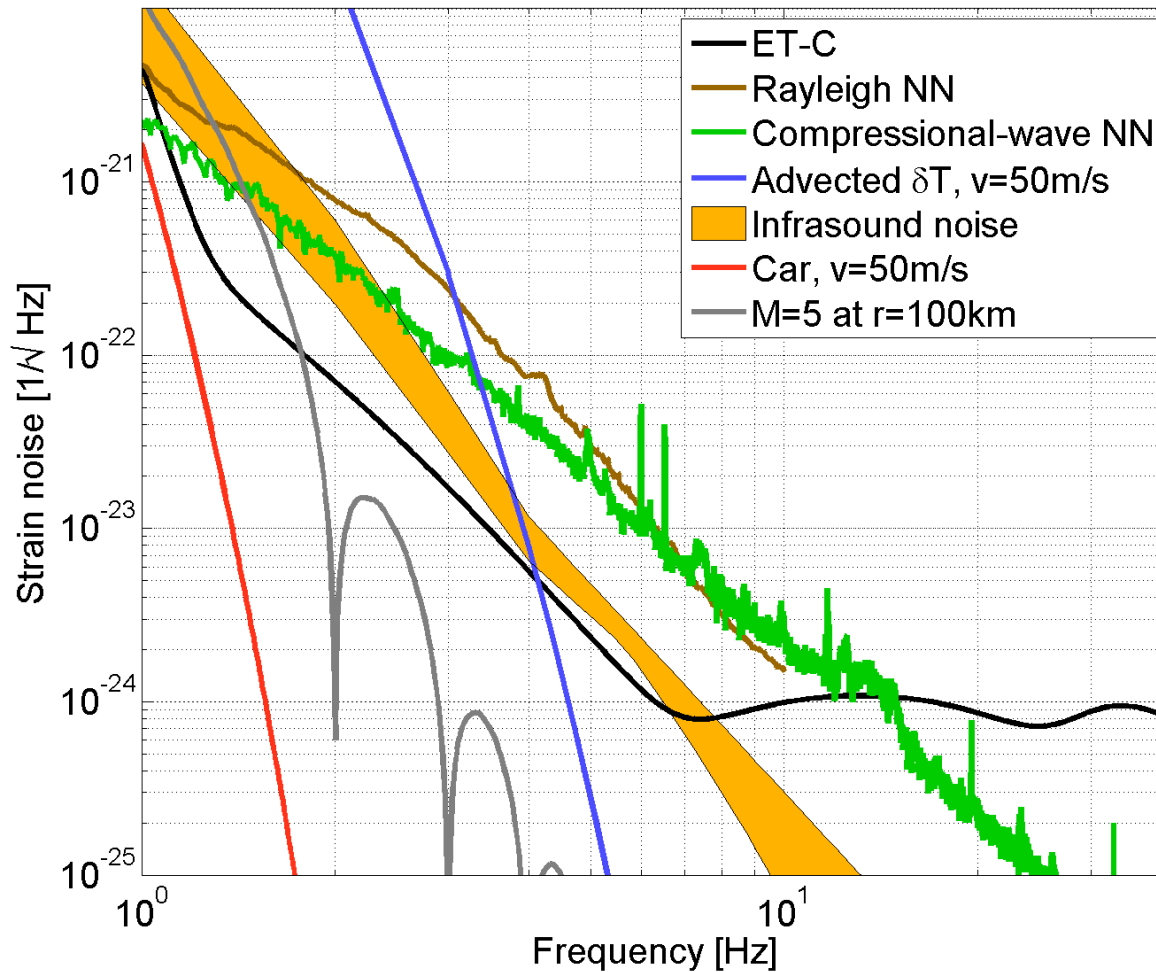
For this reason microphone array has more complicated configuration.



Subtraction residuals determined by number and SNR of microphones, and array shape.

# ET Terrestrial Gravity

ET at surface





# ET Terrestrial Gravity

ET at surface

