9.4 Problems for Physics 575, Chapter 9 "Ground Motion"

9.4.a
Seismometers SM3-KV were developed at the Earth Institute of the Russian Academy of Sciences (Moscow) for the purpose of worldwide nuclear blast monitoring. Assuming the seismic station is set near Semipalatinsk (Kazakhstan), estimate the amplitude of the seismic wave to be detected by SM-3KV due to a nuclear bomb explosion in Nevada (USA). When will the wave arrive?

9.4.b
The *ATL law* of diffusive ground motion estimates the mean squared ground displacement as $<dX^2>=A \times T \times L$ where A is a coefficient, T is time interval between measurements, L is distance between observation points. Derive Power Spectral Density (PSD) $P(\omega, k)$ of such motion.

9.4.c
The *Kolmogorov-Obukhov* law of developed turbulence states that velocity fluctuations v_λ over spatial distances λ scale as

$$v_\lambda \sim v_0 \, (\lambda/L)^{1/3} \quad ,$$

where v_0 is the average flow velocity over the largest scale L. Estimate the relative ground motion of two points of a Linear Collider tunnel 100 m apart due to air pressure fluctuations occurring on a typical windy day in Chicago.