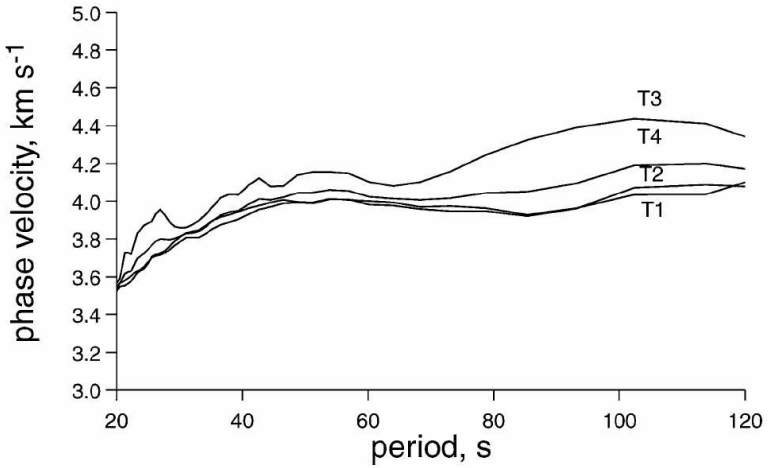
Rayleigh wave phase and group velocity

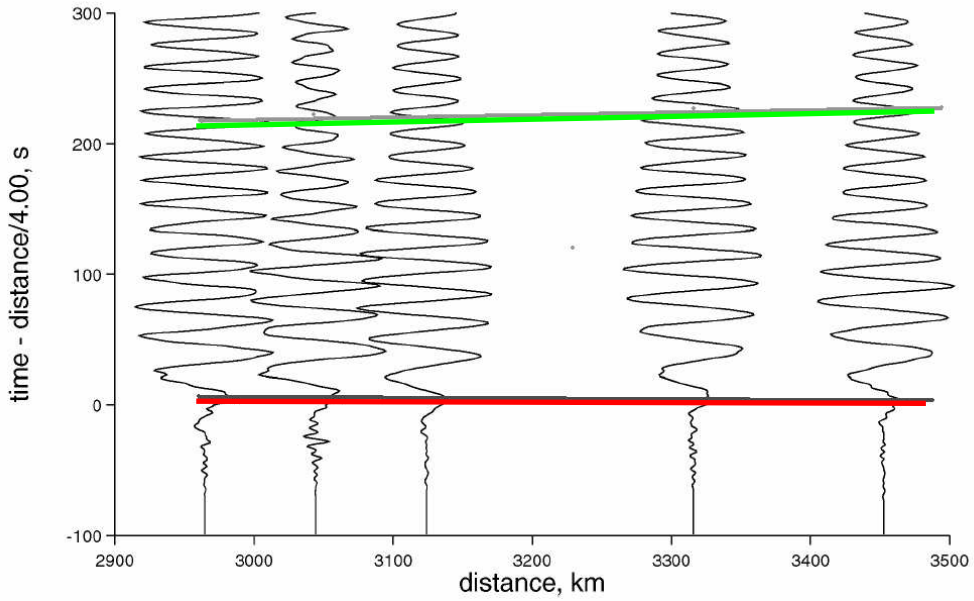
1. The velocity of a single-frequency wave, called the the phase velocity, v(w), varies with frequency, w (called dispersion)
2. A wavecrest (red and green lines, below) is an interference phenomenon. It does not move at the phase velocity, but rather at the group velocity,

$$u(w)=v(w)[1-(dv/dw)w/v(w)]^{-1}$$



Phase velocities computed from groups of three seismograms at the left

Rayleigh waves from mid-Atlantic Ridge earthquake observed along east coast of North America



3. In a uniform half-space, the Rayleigh wave is non-dispersive with a constant phase velocity of 92% of the shear velocity.
4. In the earth, in the 20-100 second period range, phase velocities typically increase from about 3.5 to 4.5 km/s, reflecting the increase in shear velocities from the crust to mantle.