Rayleigh wave phase and group velocity

1. The velocity of a single-frequency wave, called 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,

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

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.