

Geophysics 210 Fall 2008 Assignment 2 – Seismic methods

1. A P-wave is generated by a large earthquake and travels vertically downwards. Assume that the P-wave velocities in the mantle, outer core and inner core are 12, 9 and 10 km/s respectively. The wave has an initial amplitude $A=1$. Assume that density is constant throughout the Earth.

Compute the amplitude of:

- The seismic wave that travels through the centre of the Earth and reaches a seismic station on the far side.
- The seismic wave reflected from the core-mantle boundary (CMB) and recorded close to the epicentre.
- The seismic wave reflected from the inner-core to outer core boundary and recorded close to the epicentre.
- What other factors can also change the amplitude of a seismic wave? List **three**.

2. An earthquake with magnitude $M_S = 7$ occurs at a distance of 28° . What will be the amplitude of the surface waves with a period of 20 seconds?

3. An earthquake on a thrust fault has a moment magnitude of $M_w = 7.6$. The earthquake had a rupture length of 70 km which extended from the surface to a depth of 12 km. Shear modulus of the crust at this location 100 GPa.

What was the magnitude of the slip?

4. An interface separates two layers.

Above the interface $v_p = 4.0$ km/s and $v_s = 3.1$ km/s. Below the interface $v_p = 6.5$ km/s and $v_s = 4.1$ km/s. A seismic wave is incident on the interface with $\theta_i = 30^\circ$. Consider the case that the incident wave is

- P-wave
- S-wave, polarized parallel to interface (SH)
- S-wave, polarized in the vertical direction (SV)

For each case, what waves will be transmitted and reflected. Compute the angles of reflection and transmission. Assume that the density of both layers is the same.

5. Sketch the focal mechanism that would result from:

- Earthquake on a left-lateral strike-slip fault with strike of $N70^\circ E$
- Thrust fault with strike $N135^\circ E$ and dip 20°
- Underground nuclear explosion

6. Read sections 4.1 and 4.2 from the text book (pages 100-140)

This assignment will be due in class on **Tuesday November 4 2008**

Please contact Dr Currie after class, or the teaching assistant if you have questions. Office hours will be announced in class.