Intermediate Seismology
ESCI 7402
Homework #4
Due: Monday, April 2, 2012
NCAA Cagniard-deHoopsters!
SsPmp Tournament

Figure 6 of the attached paper shows the geometry of 3 different rays that contribute to the response of intermediate depth regional earthquakes.

Examine the kinematics and dynamics of the response of these 3 generalized rays.

1) Assume the layer-over-halfspace model in Table 2. The Cagniard contour can be generally written as

$$t = px + \sum_{n=1}^{m} l_i \, Th_i \;\; \eta_{v_i}$$

where,

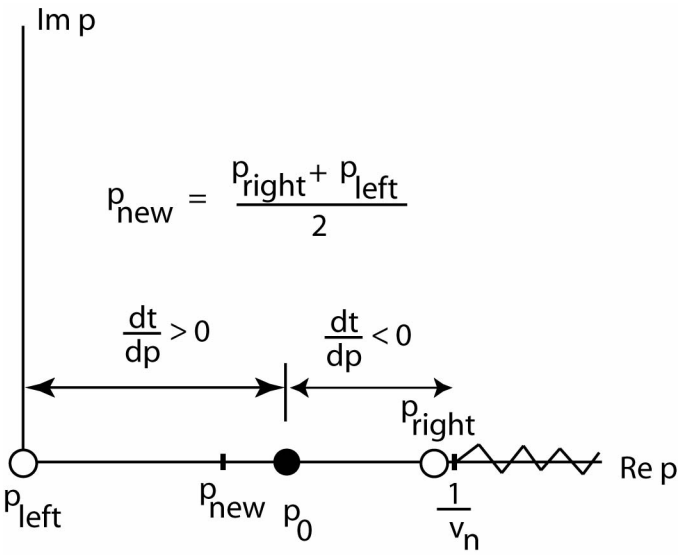
t = time
p = complex ray parameter
x = horizontal distance
Th_i = thickness of the ith layer
$\eta_{v_i} = \left(\frac{1}{v_i^2} - p^2 \right)^{1/2}$
l_i = number of times the ray traverses the layer

Write out the Cagniard contour for each ray.

2) The ray parameter of the geometrical ray, p_0, can be found iteratively by examining the behavior of $\frac{dt}{dp}$:

$$\frac{dt}{dp} = x - p \sum_{i=1}^{m} \frac{Th_i \, l_i}{\eta_{v_i}}$$

One way to find p_0 is to successively halve the interval between a trial p_{left} and p_{right} to produce a p_{new} as shown on the figure. Decide what side p_{new} is on and then use it to replace p_{left} or p_{right}. Repeat the process until you reach p_0 within some small tolerance (say 10^{-5}).



Using this or some other numerical technique, calculate *t*-*x* and p_0-*x* curves for the 3 generalized rays. Assume a source depth of 110 km and a range between 0 to 700 km.

3) For a distance past critical distance for all 3 rays, analyze each ray for head wave contributions and sketch these ray paths.