

Introduction to Earthquake Seismology

Assignment 11a

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Multilayered Crustal Model - Source Depth

Goals:

- Compute first arrival times for a multilayered crust with the source at any depth

Background:

The computation of a buried source in a multilayered medium is a challenge of the source is not in the top layer. It is necessary to compute the direct arrival and then all possible refracted arrivals and then to select the one with the shortest travel time.

This is best done by breaking the problem into several parts:

1. Compute the direct arrival
 - a) Is the source in the first layer?
 - b) Is the source in a deeper layer?
2. Compute all possible refracted arrivals

I have found that the simplest way to do this is to insert a layer into the model at the source depth, e.g., by carefully splitting a layer apart. This will keep the logic simpler. Also if the source is in the halfspace, this additional layer will create a layer beneath the source depth. In splitting a layer, the velocities and densities do not change.

Before writing any code, write down the equations for the following problems:

- a) uniform halfspace
- b) single layer over a halfspace
- c) two layers over a halfspace

By doing this you will see patterns that will guide the writing of your code.

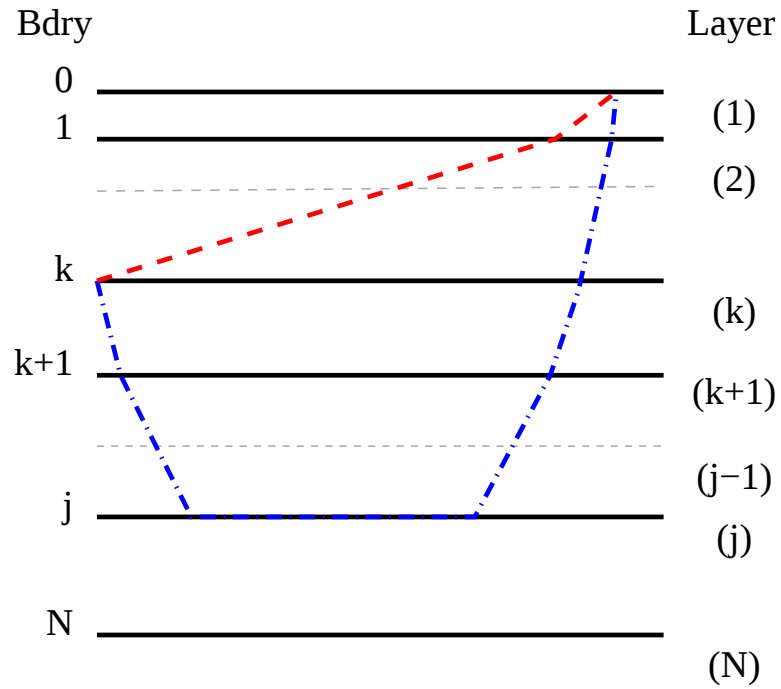


Fig.1. Multilayered medium showing the direct arrival, equations (4) and (5) (red-dashed) and refracted arrival, equation (6) (blue- dot-dashed) paths