

Problem set 1
Due next Thursday

- 1) Assume that we have a source located in the middle of a line of 6 geophones (a “split spread”). The spacing between geophones is 1 m and there is a 1 m distance (“offset”) between the shot and the nearest geophone on each side. The top layer consists of a 5 m thick dry sand ($V_p = 800$ m/s, $\rho = 1.8$ kg/m³) over a flat layer of wet sand ($V_p = 1500$, $\rho = 2.0$ kg/m³).
 - a. Calculate the reflection coefficient for the first reflection from the dry sand/wet sand interface.
 - b. Determine (i.e. derive equation and calculate or do graphically) the time of the first reflection at each geophone. The bounce point should be half-way between the source and the geophone. Each reflection should arrive slightly later at each geophone. The time shift is called the normal moveout.
 - c. Draw a shot gather (with time vertical downward) - draw the correct seismogram (“trace”) for each geophone showing the direct wave and the reflected wave. You may use whatever “wavelet” you like, but it should be consistent.

- 2) Now we will move the entire spread 1 m along and reshoot. We do this a total of 4 times.
 - a. Create a “stacking chart” to determine how many CDP’s we will get and which traces are in each CDP gather.
 - b. List all the CDP’s and the traces in each. Each trace can be represented by something like this: “S1G2” which refers to shot #1 recorded at geophone #2.
 - c. What is the fold at each trace?
 - d. Now draw the CDP gather for one of the CDP’s with maximum fold.

- 3) Using the normal moveout values from problem 1b, we now want to correct the CDP gather to mimic a zero offset section (or what we would see if the source and geophone were at the same position and the ray paths were vertical).
 - a. Calculate the time shift (which varies only with offset) for each trace in CDP drawn in problem 2 with respect to the expected time for a zero offset reflection.
 - b. “Apply” this offset and “mentally” stack the data and draw the resulting stacked section. How many traces are in it? Which traces should have the best data, i.e. best signal-to-noise ratio?

- 4) Suppose the layer of wet sand was dipping in one direction. How would you compensate? Would it be better to do this before stacking or after stacking?

- 5) Read the handout.