GEO369 – Introduction to Geophysics

9 December, 2004
Bevill 266

Class 26: Producing a synthetic seismogram from log data

Today we will be using the density and velocity logs from an 800.5 m deep borehole from offshore Papua New Guinea. The data have been cleaned up, removing spurious values, and re-sampled to a sample interval of 0.5 m. From the density and velocity logs you will calculate the reflection coefficient and then convolve this with the source signal to create a synthetic seismogram. The source signal was produced by flattening and then stacking the seafloor from a series of seismic lines recorded during a seismic survey in 1995. The source signal has been converted to depth and re-sampled to a sample interval of 0.5 m (with a length of 120 m). The resulting synthetic seismogram can be compared to seismic data in the region with the goal of refining depth conversions and identifying lithological boundaries.

1. Load the file cvdt_rhom.xls (in your unix home directory under GEO369/Class26) into Excel. This file contains three columns – depth, seismic velocity, and density.
2. In the fourth column, calculate the reflection coefficient.
3. Save the file as a text (tab delimited) file.
4. Start Matlab.
5. Load the text file into Matlab
    a. load z:*username*/GEO369/Class26/cvdt_rhom_rc.txt
        i. Replace *username* with your username.
        ii. Note that the drive letter may be different on your system – check this by looking in "My Computer".
6. Assign the fourth column of the new matrix to a variable named "rc".
    a. rc = *username*_GEO369_Class26_cvdt_rhom_rc(1:1602,4);
    b. 1602 is the number of rows in the matrix.
7. Plot rc.
    a. plot (rc)
    b. Check with me to make sure that your plot is OK.
8. Load the source signal (the waveform produced by the airgun array) into Matlab.
    a. load z:*username*/GEO369/Class26/source
9. Assign the second column of the matrix to a variable named "source".
    a. source = *username*_GEO369_Class26_source(1:241,4);
10. Plot the source signal.
11. You now have two matrices, one containing the source signal, and one containing the reflection signal. Convolve the source signal with the reflection coefficient sequence and plot the result. The result is a synthetic seismic trace.
12. Plot your result.