P6317 Assignment III

Due, Wednesday, April 19, 2017

1) [5] Your are calibrating a circular piston source of radius 20 cm over the frequency range from 5 kHz to 50 kHz. How far away from the source should the test hydrophone be placed in order to avoid near-field effects?

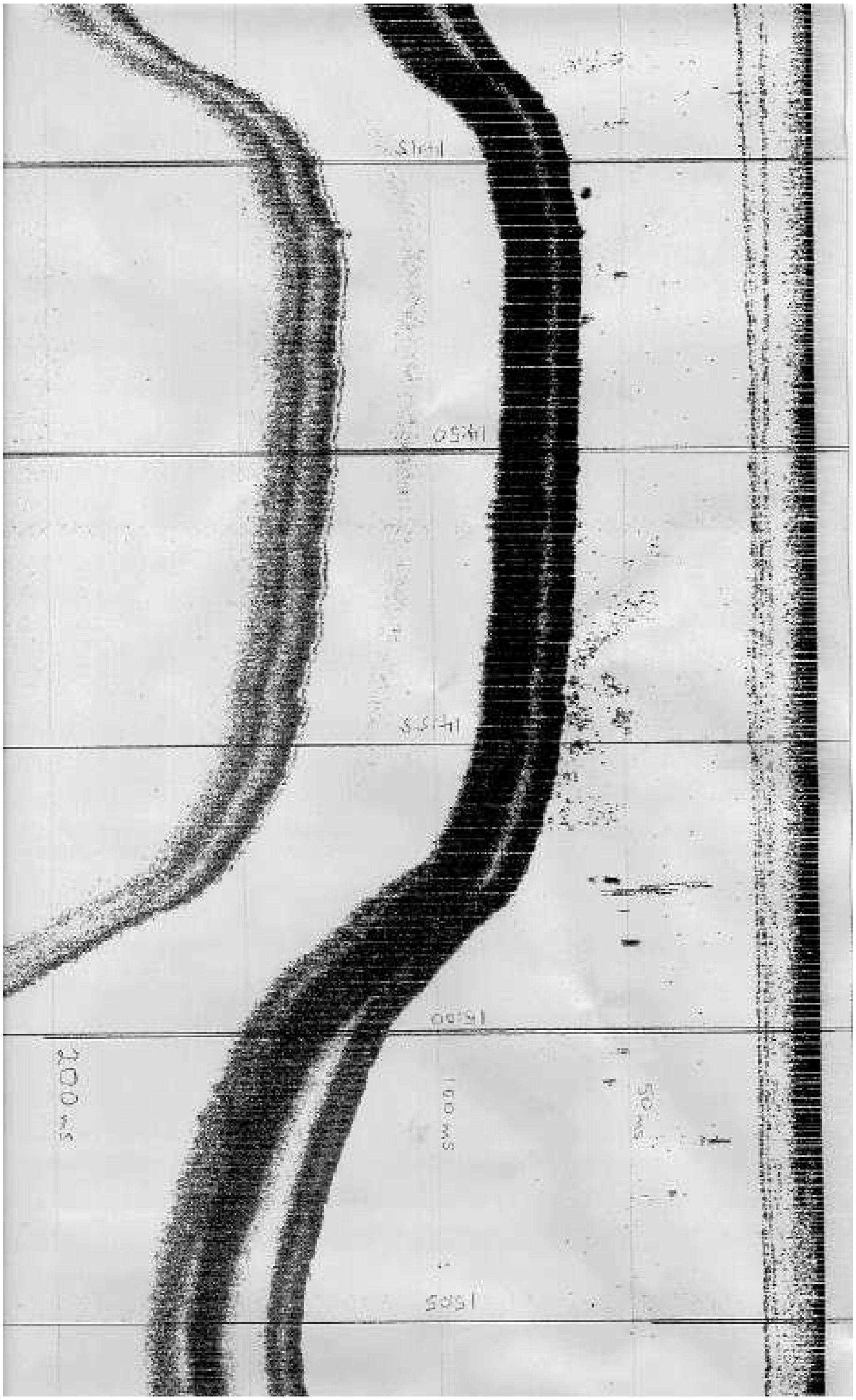
2) [5] A typical hydrophone has a sensitivity of about S = -170 dB (re 1 V/μPa). You paid $2000 for the preamplifier and it has a noise level of 20 nV (that means that if a signal is bigger than 20 nV you can see it). At what maximum range can you expect to detect a 100 dB (re 1 μPa), 10 kHz source? (assume spherical spreading and use an absorption value of 0.001 dB/m).

3a) [8] For the 200 kHz echosounding record shown on the following figure, label the bottom, the surface, the location of fish schools and individual fish. If the sound speed is 1475 m/s, what is the minimum depth shown in the echosounding. Explain the cause of the "multiple" bottom expressing where you would expect it in apparent distance (or time) compared to the real bottom. Comment on the accuracy of the depth given that the sound speed has been fixed at an arbitrary value. For a reasonable range of sound speeds, what uncertainty should be assigned to any given depth?

3b) [2] If the vessel making the echosounding is traveling at 3 m/s, what is the maximum bottom slope in this area. How does this slope compare with the apparent slope of the bottom in the echosounding?

4) [10] In the matlab data file *p6317.mat* located on the ftp site brigus.physics.mun.ca in directory, /pub/zedel/p6317 is data from a 300 kHz ADCP deployed looking upward from a 150 m depth. The data was collected in a protected inlet: Smith Sound (NL). The instrument was configured to collect 75 1.2 m bins. I have sampled this data so that there is one sample per hour for the first month of 2005. In the file you will find variables: V1_s, V2_s, V3_s, and V4_s which represent the velocities (in mm/s) observed for the four instrument beams (positive velocity is toward the instrument). Take this data and using the instrument heading information (variable Hdg_s which indicates the compass heading of beam 3) convert it into east and north component velocities. You can cheat to see if you got the right answer because there is also Ve_s and Vn_s as computed by the instrument itself (exact agreement will be imposible because of the way I averaged the data). Also of possible interest are the backscatter intensities, I1_s, I2_s, I3_s, and I4_s. The compass direction identifies the +Y direction of the instrument. The beams 1, 2, 3, and 4 are directed in the +X, -X, +Y, -Y directions respectively. The beams are tilted at 20° to the vertical.

Please submit your code along with your results.


1445
1450
1455
1500
1505
200 ms
100 ms
50 ms