

Problems for Week 7: Resolution

- 1) How is the along-track resolution of ice penetrating radar dependent on
 - a. The radar system wavelength?
 - b. The radar system bandwidth?
 - c. The processing performed?
 - d. The target being observed?
- 2) Assume that an ice penetrating radar has a center frequency of 60 MHz, a bandwidth of 15 MHz, an antenna pattern with a 15 degree central lobe, and a survey height of 500m. Calculate the size of the following for the ice surface.
 - a. The beam limited footprint
 - b. The pulse limited footprint
 - c. The first Fresnel zone
 - d. The along-track resolution after coherently summing over 20 m
 - e. The along-track resolution after '1D' focusing with a 100 m aperture
 - f. The along-track resolution after '2D' focusing with a 2 km aperture
- 3) Assume that an ice penetrating radar has a center frequency of 60 MHz, a bandwidth of 15 MHz, an antenna pattern with a 15 degree central lobe, a survey height of 500m, and a 4 km ice depth. Calculate the size of the following at the bed.
 - a. The beam limited footprint
 - b. The pulse limited footprint
 - c. The first Fresnel zone
 - d. The along-track resolution after coherently summing over 20 m
 - e. The along-track resolution after '1D' focusing with a 100 m aperture
 - f. The along-track resolution after '2D' focusing with a 2 km aperture
- 4) Assume that you are trying to distinguish distinct types of regions on the ice surface using radar that had been coherently integrated across C pulses and then incoherently averaged across N. The regions have distinct surface morphologies at a resolution of 50 m or better and distinct radar reflectivity that produce returns differing by 3 dBm. If initial processing yields 20 m along track resolution and 4 dBm radiometric resolution, how could the same data be reprocessed to best allow the two region types to be distinguished?
- 5) Assume that you have an ice penetrating radar system with a center frequency C, a bandwidth B, a survey height of H, and an ice depth Z.
 - a. Under what conditions would the pulse limited footprint on the surface be larger than the first Fresnel zone on the surface?
 - b. Under what conditions would the first Fresnel zone on the bed be larger than the pulse limited footprint on the bed?
 - c. Under what conditions would the first Fresnel zone on the bed be larger than the first Fresnel zone on the surface?