

GROUND BASED SAR SURVEY OF BASAL INTERFACE AT NEEM DRILL SITE

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In August of 2008 a ground based radar survey was conducted at the NEEM deep ice core drill site. The purpose of the NEEM drilling project was to retrieve Eemian ice from the previous interglacial corresponding to 115,000 year ago. These ice core samples will help us to understand the dynamics of a past climate that was similar to a future warming climate.[1]

The ground based radar contained an eight element receiver with effectively two separate transmitter locations. A 30 MHz bandwidth centered at 150 MHz was used, providing a depth resolution of around 8.5 meters. This radar was an improved version over that previously used, with both an increased sensitivity and higher gain antennas. In addition to improved hardware more advanced processing techniques have also been implemented. On top of the basic pulse compression, synthetic aperture radar (SAR) processing using f-k migration was applied. To maximize the gain from combining 16 effective channels an adaptive calibration and channel equalization was performed based off a strong specular internal layer. For depth sounding echogram generation, a wiener filter was applied to help preserve resolution and reduce speckle. Finally a statistical detrending of the data was performed to enhance the weak deeper internal layers' contrast with the strong bed return. These improvements in hardware and software have provided more than 15 dB of SNR gain, enhancing deeper internal layers and bed return from both nadir and off nadir. A processed echogram can be seen below in figure 1.

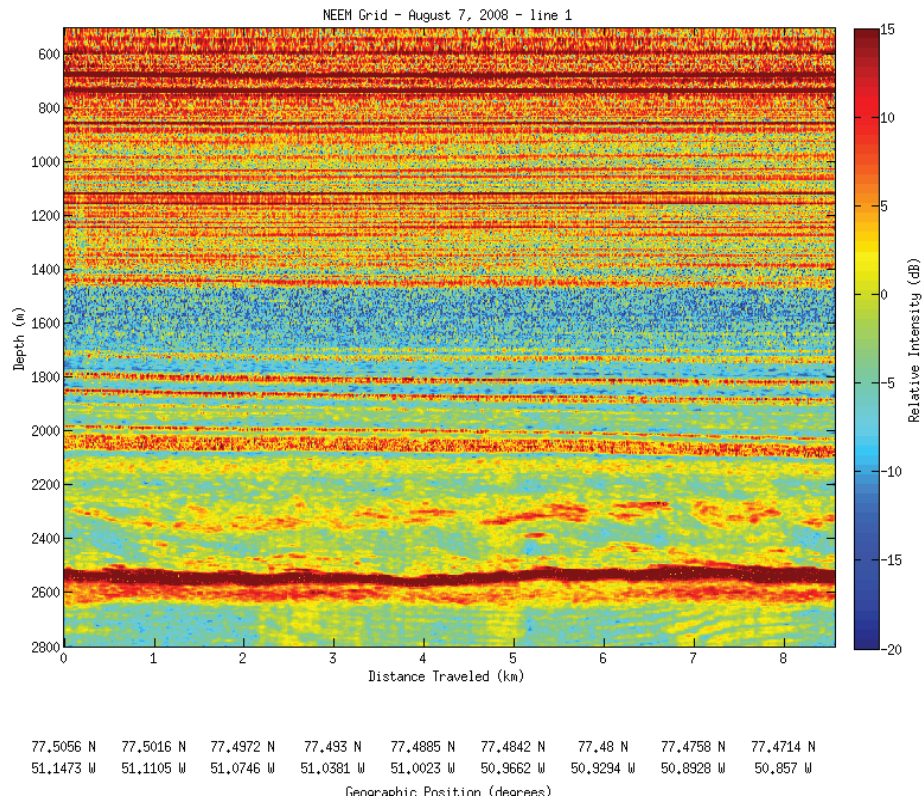


Figure 1: Processed echogram

The improved radar and processing techniques have allowed for internal layers as close as 50 meters from the bed to be seen. The strong bed return allows for a preliminary coarse resolution, in along track, digital elevation map (DEM) to be generated. Using this coarse DEM, side looking SAR images of the base of the ice, some of the first of its kind will be presented. Additionally due to two transmitters located at different locations interferometric SAR (InSAR) images can also be generated. These images will be the first fine resolution three dimensional images through the ice sheet of the base of the ice with resolutions on the order of 15 meters by 15 meters. Both the side looking SAR and InSAR images will be presented as well as interpretations of the results. The images will confirm whether or not there is indeed undisturbed Eemian ice at the NEEM drill site as well as provide the first fine resolution three dimensional basal map at and around the site.

References

[1] "About NEEM – Kobenhavns Universitet". http://neem.ku.dk/about_neem/. Accessed January 2, 2009.