

AIRBORNE 3D BASAL DEM AND ICE THICKNESS MAP OF PINE ISLAND GLACIER

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1. INTRODUCTION

From October 20th, 2009 to November 5th, 2009 five airborne flights were flown over Pine Island Glacier (PIG) a floating extension of the West Antarctic Ice Sheet (WAIS). These DC-8 flights were part of NASA's Operation Ice Bridge. The Center for Remote Sensing of Ice Sheets (CRISIS) at the University of Kansas operated a radar depth sounder referred to as the multi-channel coherent radar depth sounder (MCoRDS). PIG is an area of high concern because of how rapidly it could respond to further retreating. [1] PIG may be part of a “plug” that if it breaks up as much as a third of the ice stored in WAIS could be released leading to global sea level rise of more than a meter [2][3]. One theory is that the parts of PIG that are below sea level leading to sea water getting below the ice and causing a positive feedback loop that is disintegrating the ice shelf, thus causing a speed up of the ice flow [1]. Our preliminary results show that much of PIG is below sea level consistent with [4][5].

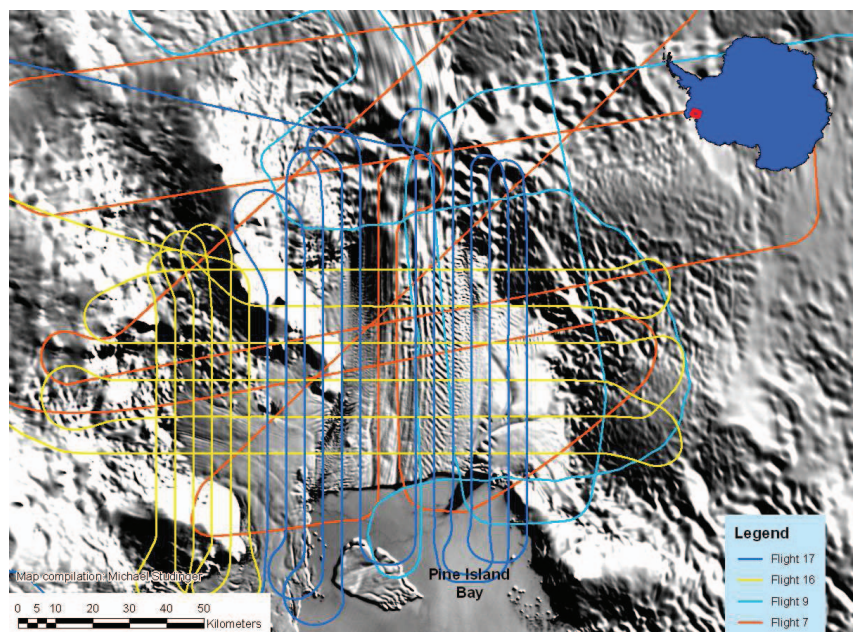


Figure 1: Flight lines over PIG

Ice thickness and bed elevation maps have been created before [5] however these were on a more coarse scale. Since a grid of many flight lines was flown (Figure 1) a fine resolution 3D map of both the basal topography and elevation can be created for the first time in this region. In the paper echograms showing areas of interest that are below sea level as well as a DEM and ice thickness map will be presented for interpretation by the glaciological community, providing necessary and valuable data for modeling.

2. DISCUSSION

These preliminary results require refinement before being paper ready but these have proven to have both an adequate signal to noise and signal to clutter ratio (SNR/SCR) to provide ice depth measurements. An example echogram is shown in Figure 2. The surface location in this echogram is around 12 μs (not seen in this waveform), therefore the bed being located at around 35 μs as seen on the left side of the image leads to an ice thickness of 23 μs (two way time) or ~ 1950 m. As shown in [4] the

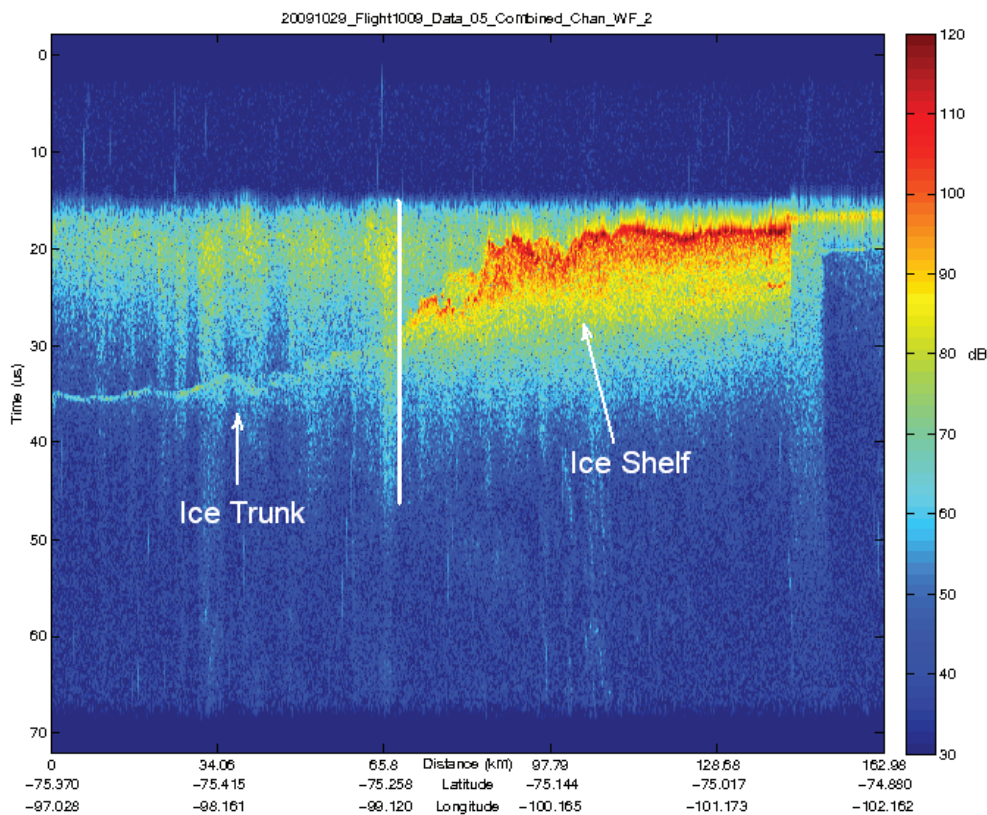


Figure 2: Example Echogram of Pine Island data

surface elevation over the ice tongue is ~750 m MSL. This leads us to a depth of 1200 m below sea level for the base of the ice trunk, again consistent with [4].

3. CONCLUSIONS

A high SNR/SCR deep sounding data set was collected over PIG. These data will allow for a fine resolution DEM to be created showing the areas, if not all, of PIG that are below sea level helping to refine the models of how these could respond rapidly to the further retreat of PIG.

4. REFERENCES

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