Radar Results from the Geophysics Site Characterization of Subglacial Lake Whillans, West Antarctica

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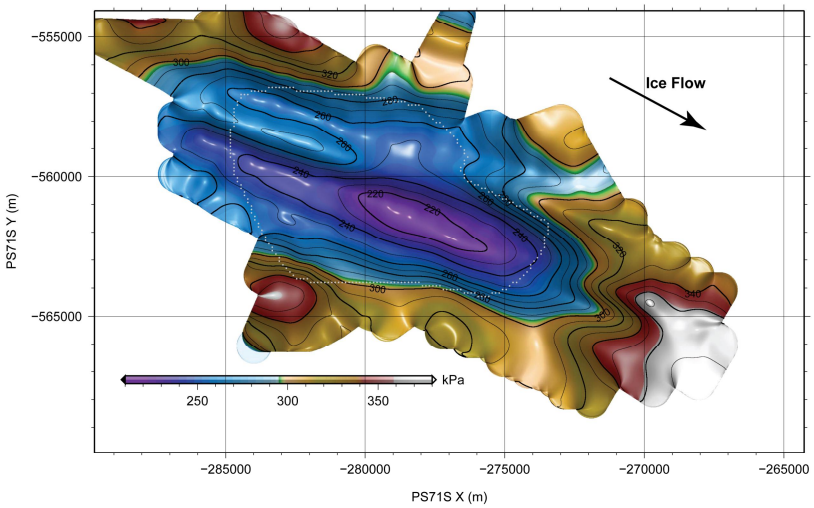
We present results from radar and GPS measurements over subglacial Lake Whillans undertaken as part of the WISSARD surface geophysics site characterization completed during the 2010-2011 field season. Over 400 km of radar data at 5 MHz were acquired on a 20 x 6 km grid of profiles spaced at either 500 m or 1 km. Waveforms were stacked 800 fold and recorded every ~3 m of surface travel together with GPS measurements of the surface position and elevation. This high-density gridded data set reveals details of bed and surface topography which define the lake basin as well as reflection characteristics of the bed. Because of the generally low surface slopes on the Whillans Ice Plain, the lake area is controlled by a combination of steep bed and broad surface features. For example, a bed lineation approximately 10 m in height provides a confining boundary for the lake to the north, sharply separating areas of high and low basal reflectivity. The lineation merges with a system of shallow troughs in the downflow direction, with no evident exit channel. While the lake was near-empty during the time of the survey, sharp differences in bed reflectivity indicate areas that are wet as well as dry margins. Based on the hydropotential map, water appears to both enter and exit primarily at the upstream end of the lake, with some influx over a ridge from the south. The radar also displays details of ice internal stratigraphy showing patterns of deformation that depict details of the ice strain history. A strong contrast from south to north across the lake reveals much larger strains on the south side, though their relation to the lake is unclear.



Subglacial Lake Whillans hydropotential (South Polar Stereographic) showing the pre-survey lake outline from Fricker et al. based on ICESat elevation changes and surface slopes. Hydropotential barriers in the downflow direction and limits based on the measured surface uplift restrict the primary water inflow and outflow path to the up-glacier direction where contours are low.