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Lake Amundsen-Scott, South Pole, Antarctica

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Radio-echo sounding and satellite altimetry observations have been used to identify a catalog of well over one hundred subglacial lakes beneath the Antarctic Ice Sheet. These lakes provide a unique laboratory for studying life in extreme environments, and may also contain paleoclimate records and ecological records that may date back as far as ~ 35 million years, when the Antarctic continent was ice-free. One of these lakes, which is near the South Pole (and is hereafter referred to as Lake Amundsen-Scott), is typical of many subglacial lakes in its radar signature and subglacial morphology. However, both temperature modeling and radar reflection strength modeling have cast doubts on the presence of free water at the base of the ice sheet near the South Pole. We set out to reconcile these contradictions with a set of seismic and radar experiments. Here we present the results of those experiments, along with temperature modeling of the ice column. In the 2006–2007 Antarctic field season, we collected ~ 9 km of seismic reflection and refraction data, as well as ~ 15 km of ice-penetrating radar profiles, in order to characterize the firn, the local ice column, and the subglacial environment. Kinematic GPS measurements were also made to determine if basal conditions are reflected in the surface expression of the region. Our temperature modeling supports the potential for liquid water at the bed, suggesting that the base of the ice sheet is at the pressure melting point here. Both the field experiments as well as the numerical modeling results suggest that Lake Amundsen-Scott truly exists, and we present the properties of this lake.