Near-continuous monitoring of Antarctic ice shelf and sub-ice shelf ocean temperatures

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During the Austral spring of 2011, two instrumented boreholes were completed through the McMurdo Ice Shelf (MIS) at Windless Bight to test rapid drilling and continuous monitoring methods. The boreholes were drilled using an approach combining ice coring for the upper portion of the borehole, with a new hot-point method for the final penetration through the iceocean interface. Each borehole was drilled through 190 m of ice to the ocean using two-person drilling team. The core drilling provided a 130mm diameter open borehole that remained dry through the drilling period. A hot point drill was used to penetrate into the ocean, and provided a 40 mm diameter borehole. The boreholes were instrumented with distributed temperature sensing (DTS) fiber-optic cables temperature measurements within the ~190m thick ice shelf and into the ocean below. The boreholes were also instrumented with traditional thermistors both in the ice shelf and in the ocean column and pressure transducers all attached to the armored DTS cables. Borehole BH1 is instrumented with fiber optic temperature sensing cable through the ice shelf and extending 30m into the ocean below. BH2, located 40 north of BH1, was used to test measurements to depths of 800m and also to demonstrate the potential for multiple independent installations through the same borehole. BH2 is completed with one DTS cable extending 600m below the ice/ocean interface, a logging pressure transducer and thermister located 450m below the ice/ocean interface and four additional logging thermistors. Temperature measurements are made every 1 meter along each optical fiber. The measurements are repeated hourly through the summer, and 4 times per day in winter months to conserve power. Data are transmitted off site via satellite link. After 3 months of operation (February 2012), there has been warming trend (~0.5^{o}C) in the upper ocean column that began in late December, consistent with previous measurements in the vicinity.