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A temperature logger for dry boreholes

Content

Polar firn and shallow ice record the temperature history above an ice sheet. Monitoring the temperature in dry boreholes provides access to the recent temperature evolution in remote areas like East Antarctica where AWS are sparse. There, where the accumulation is low boreholes can be kept accessible over decades. We measured the borehole temperature using high precision NTCs but tested also a temperature logger used by oceanographers to measure water temperature (Seabird, SBE 56). Its advantage is that it is cheap, light (<200 g), records the temperature in any temporal resolution needed and works down to temperature below -50°C. The experience with the SBE56 is positive - in principle. A problem is the power supply. Li-batteries even rated to -60°C may switch off at temperatures below about -43°C and need to be certified before used since their functioning can not be controlled at the surface. Developed to record water temperatures a more severe problem is the long thermal response time in a dry borehole (up a few hours). To log a 200 m deep borehole then can last up to several days if measured in 5 m depth resolution. We developed a temperature logger overcoming these problems. A first prototype will be tested at EGRIP in summer 2022. Borehole temperatures from Kohnen Station (EPICA DML drill site; uppermost 200 m) and NEEM using NTC and the SBE56 are presented. The Kohnen data indicate a recent and ongoing warming because the temperature minimum moves slowly deeper.

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