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Sub-Antarctic ice core records - potential sites for deep ice core drilling

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The sub-Antarctic is one of the most data-sparse regions on earth. Several glaciated Antarctic and sub-Antarctic islands appear suitable for deep ice core drilling; however, little is known about their glaciology or vulnerability to atmospheric warming. Here we present stable water isotope and geochemical records from four shallow ice (firn) cores (14 to 24m), drilled as part of the Antarctic Circumnavigation Expedition (ACE), together with complementary ground-penetrating radar (GPR). The cores were drilled at locations on Bouvet Island (54°25'19''S, 03°23'27''E) in the South Atlantic, Peter I Island (68°51'05''S, 90°30'35''W) in the Bellingshausen Sea, Mount Siple (73°43'S, 126°66'W) on the Amundsen Sea coast, West Antarctica, and Cape Hurley, on the eastern side of the Mertz Glacier (67°33'S, 145°18'E), East Antarctica. All cores have been annual layer counted and compared with reanalysis data and satellite observations. Despite evidence of surface melting, the records reliably capture local and regional changes in surface temperature, sea ice and atmospheric circulation over the past 20-30 years. The GPR profiles indicate uniform internal structure and, except for Bouvet Island, indicate ice thicknesses more than ~60 m. Thus, demonstrating the potential for future deep ice core drilling to retrieve centennial-scale climate reconstructions from these unique sites.

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