

Portable system for intermediate-depth ice-core drilling

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Abstract:

A lightweight, portable drilling system for coring up to 500 m depths has been developed and field-tested. The drilling system includes four major components: (1) an electromechanical (EM) dry-hole drill; (2) an ethanol thermal electric drill; (3) a drill set-up with a 500 m cable capacity; and (4) a controller unit. The system may be switched quickly from a dry-hole EM drill to an antifreeze thermal electric drill. This lightweight system makes ice-core drilling more cost-efficient, and creates a minimal environmental impact. The new EM drill, which recovers 100 mm diameter, 1 m long pieces of ice core, is 3.2 m long and weighs 35 kg. This drill and the drilling set-up were recently tested at the Raven (former Dye 2) site, southern Greenland, where a core was recovered to 122 m. The thermal drill is 2.9 m long and weighs 25 kg. It produces 100 mm diameter, 2.1 m long pieces of ice core, and was tested to 315 m in Franz Josef Land, Eurasian Arctic. The drilling set-up with a 250 m cable weighs about 100 kg (or 128 kg for 500 m of cable). After minor adjustments this drill system retrieved cores of better quality than those recovered by other drill systems under similar glaciological conditions. After adjustments to optimize its performance, the drill retrieved 5.25 m of core per hour over the depth range 0-21 m.