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High resolution in situ density profiling of snow-firn-ice sequences.

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Most of density quantification methods require a sample, its preparation and few measurements. Procedures are laborious, slow and time consuming. Due to vertical and horizontal density variations a single vertical density profile has significant uncertainty. Multiple profiling allows increase precision of mass balance measurements. Field and laboratory measurements show that melting-penetration rate of the HP is proportional to density of a porous or solid ice formations. Continuous and high depth resolution density profiling of snow-firn-ice sequences (SFIS) was conducted with a low power, non-coring thermal-electric drill - hot point (HP) and electronic interface that registered penetration rate. The penetration rate of the HP drill converts to density instantiations. Average rate of vertical profiling with the HP is above 10 m h⁻¹. Resolution of density measurements using HP is about 5% of its value and vertical resolution can be as high as a few millimeters. We present calorimetric method for fast, continuous, in situ density profiling of a SFIS and application results obtained in Polar Ural, Svalbard, Greenland and Elbrus glaciers.

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