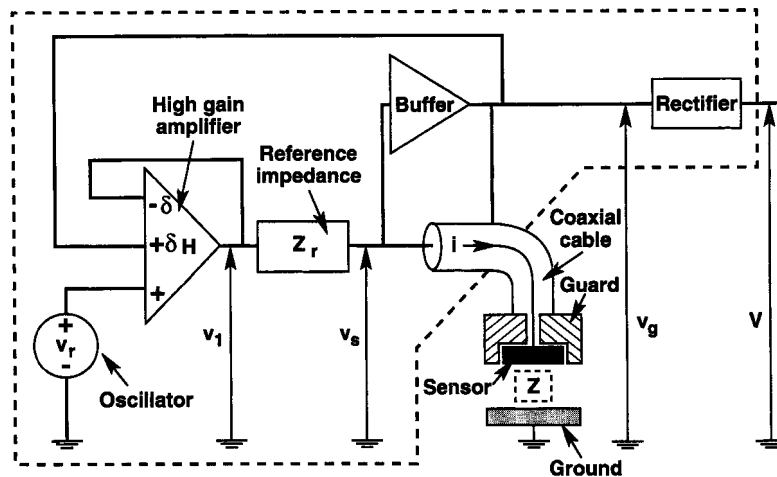


Louge M.Y., Foster R.L., Jensen N. and Patterson R.: "A Portable Capacitance Snow Sounding Instrument," *Cold Regions Science and Technology* **28**, 73-81 (1998).

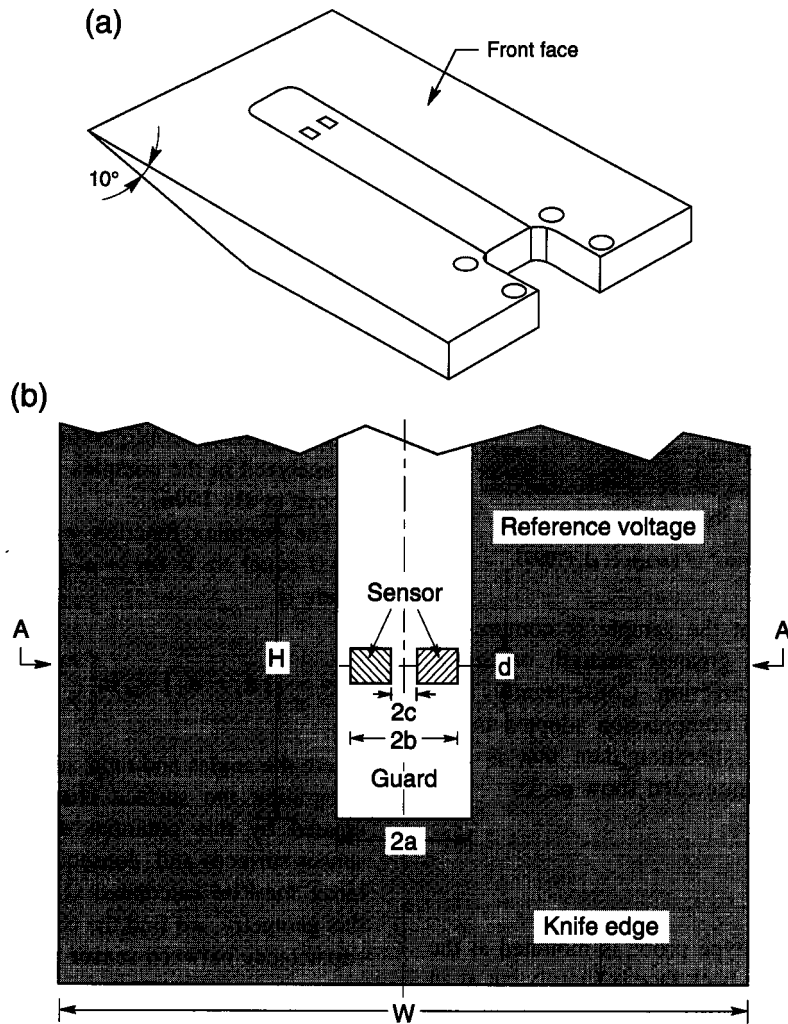
We describe a penetration field-portable capacitance instrument capable of recording profiles of dielectric permittivity through a relatively dry snow pack. It consists of a wedged capacitance tip mounted at the end of a penetration pole. By appropriate placement of its reference, guard and sensor conductive surfaces, the capacitor sheds horizontal electric field lines resolving horizontal snow layers of 2.5 mm thickness.

A prototype of the probe was tested at the mountain resort of Alta near Salt Lake City, Utah. There, it recorded the real and imaginary parts of the dielectric constant through a typical winter snow pack. Using independent calibrations, measurements of the dielectric modulus provided an accurate profile of density later confirmed by the excavation of a detailed snow cover profile.

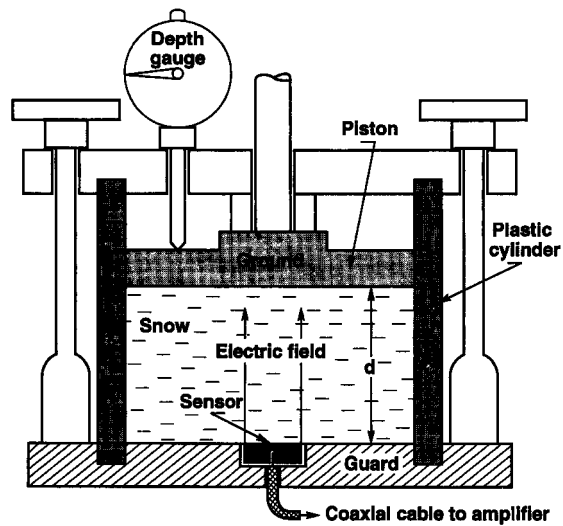
Figure excerpts



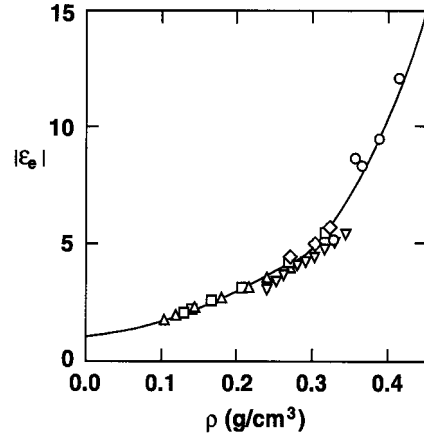
Schematic of the electronic system. The dashed lines represent the physical boundary of the processing circuits. Z is the impedance between sensor and ground.



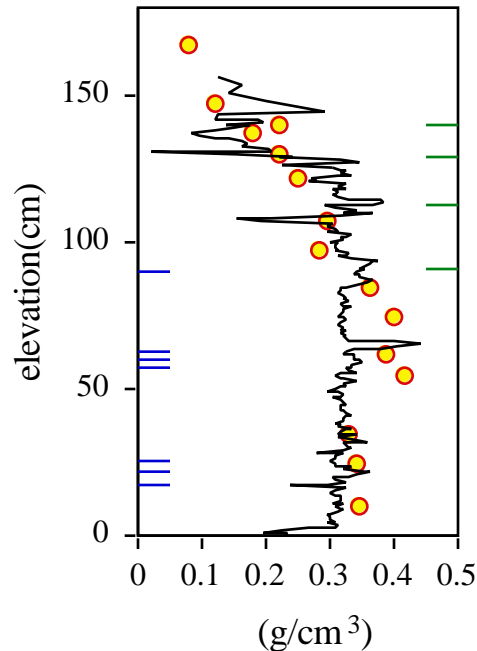
Tip of the penetration probe. (a) Perspective of the metal frame held at the reference voltage; (b) front view.



The "snow press" of Louge, et al (1997).



Variations of the modulus of the dielectric constant with snow density. The various symbols represent different samples at -4°C . The best empirical fits are $|\epsilon_e| = (\rho / \rho_0)^{1.5}$ for $\rho < 0.29 \text{ g/cm}^3$ and $|\epsilon_e| = (\rho / \rho_1)^{3.1}$ for $\rho > 0.29 \text{ g/cm}^3$, with $\rho_0 = 0.12 \text{ g/cm}^3$ and $\rho_1 = 0.19 \text{ g/cm}^3$.



Snow density versus elevation inferred from the sounding of Fig. 5 and the calibration of Fig. 6. The line is from the capacitance probe and the symbols represent direct density measurements from the excavation (Fig. 4). The dashed lines to the right of the graph mark elevations of the melt-freeze crusts recorded in Fig. 4. The horizontal lines to the left are peaks of the ram penetrometer profiles with $R > 600 \text{ N}$.