



A coaxial cell setup for measuring the dielectric permittivity of ice

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When investigated by radio echo sounding (RES) polar ice sheets exhibit internal reflection horizons which stem from variations in the dielectric properties of the ice. These are caused by enhanced conductivity, density fluctuations and changes in crystal orientation fabric. The envisaged application of an inverse method to the RES data as to reconstruct profiles of physical properties, e.g. conductivity, independently of ice cores is hampered by insufficient knowledge of the frequency dependence of the complex dielectric permittivity of ice in the MHz-range, where RES typically operates. The well established method of dielectrical profiling (DEP) is usually deployed up to 1 MHz only.

Here we present an adapted device for dielectric measurements, originally developed for measuring soil samples between between 1 MHz and 3 GHz with a coaxial cell. This includes the preparation of the laboratory ice to fit the coaxial geometry as well as the acquisition of the scattering parameters with a network analyser. The dielectric permittivity is inferred by a genetic optimisation algorithm adjusting a debye model to fit the scattering data. Furthermore we outline the potential of the setup to process natural ice and to provide results for the complex dielectric permittivity in the MHz-range.