Interactions of microwaves with ice and snow - from experiments to models for applications in remote sensing

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In this lecture the history of studies that led to our understanding of the interaction of microwave radiation with the natural snowcover, starting with lucky discoveries and disappointments, will be described. These were a motivation for robust investigations leading to the determination of the complex dielectric properties of ice and snow, to reflectivities and transmissivities of snow slabs from which we derived absorption and scattering coefficients. The relations of these parameters with snow temperature, density and correlation length (& liquid water content in case of wet snow) were used in the development of the Microwave Emission Model of Layered Snowpacks (MEMLS) for the frequency range from 5 to 100 GHz. Comparable relationships were obtained for a fully physical model using the improved Born Approximation and radiative transfer in a refractive medium. Recent extensions of MEMLS to L Band and to radar backscatter indicate the potential to estimate snow density and ground permittivity from SMOS / SMAP data and to simulate radar backscatter of snow-covered terrain, respectively.

Biography:
Christian Mätzler studied physics at the University of Bern, with minors in mathematics and geography, M.Sc. in 1970, and Ph.D. in solar radio astronomy in 1974. After postdoctoral research at the NASA Goddard Space Flight Center, Greenbelt, MD, and at the Swiss Federal Institute of Technology (ETH), Zürich, Switzerland, he became Research Group Leader for terrestrial and atmospheric radiometry and remote sensing at the Institute of Applied Physics, University of Bern in 1978 where he received the habilitation in applied physics in 1986 and the title of a Titular Professor in 1992. After retirement in July 2010, he started as a consultant for Gamma Remote Sensing. His studies have concentrated on microwave (1–100 GHz) signatures for active and passive remote sensing of the atmosphere, snow, ice, soil, and vegetation, as well as on the development of methods for dielectric and propagation measurements for such media. He is Editor of a book on thermal microwave emission with applications for remote sensing.